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Dynamics of Land Use and Land Cover Change in Jammu & Kashmir

Altaf Hussain Padder[1], B Mathavan[2]
[1]*PhD. Research Scholar, Department of Economics, Annamalai University – Chidambaram, Tamil Nadu, India*
[2]*Professor & Co-ordinator, Economics Wing DDE, Annamalai University – Chidambaram, Tamil Nadu, India*

Abstract: ***Agriculture is the main occupation for the people of Jammu & Kashmir. About 65 per cent of the people are directly or indirectly dependent on agriculture and allied activities for their livelihood. Agriculture and its allied activities are the predominant sectors of the economy of Jammu & Kashmir. The cropping land use in the state also underwent drastic changes which led to a decrease in area under food crops and an increase in area under cash crops/plantation agriculture. The study of this shifting land use was necessary for the sustainable agriculture of the state. Knowledge of cropping land use helps in maximization of productivity and conservation of land. The study tried to assess the cropping pattern of land use and land change dynamics, the land use and land cover change among different land-use classes and to study the extent of productive and unproductive land-use patterns in Jammu & Kashmir. The study has revealed a major shift of land from the desirable to undesirable land-use classes. The area under the three major food crops (Paddy, Maize and wheat) grown in the state has decreased at the state level though with regional variations, it has increased in some districts as well. But the area under paddy recorded a decline in all the districts and the area under orchards has registered highly positive growth in all the districts of Jammu & Kashmir.***

Keywords: Agriculture, Land Use, Land Cover Change, Cropping Pattern, Jammu & Kashmir.

I. INTRODUCTION

Human activities have modified the environment for thousands of years. Significant population increase, migration, and accelerated socio-economic activities have intensified these environmental changes over the last several centuries. The climate impacts of these changes have been found in local, regional, and global trends in modern atmospheric temperature records and other relevant climatic indicators. An important human influence on atmospheric temperature trends is extensive land use and land cover change (LULCC) and its climate forcing.

The land is a complex and dynamic combination of factors: geology, topography, hydrology, soils, microclimates, and communities of plants and animals that are continually interacting under the influence of climate and people's activities (Hudson 1995; Aynekulu et al, 2006). It is the basic natural resource, which provides space and raw materials for various developmental and other activities and it can be classified into various categories. According to James R. Anderson et al (1976), land use can be generally classified into Urban or built-up Land, Agricultural Land, Range Land, Forest Land, Water, Wetland, Barren Land, Tundra and Perennial Snow or Ice. These can also be classified into further sub-classifications. Then, it is possible to use the land for various activities and purposes at different times and it is under continuous change and dynamics. There is complex and dynamic land use land cover change at various scales, which has global environmental implications. Therefore, due to the dynamism and continuing nature of the LULCC problems, detailed and continuous study at all scales is needed. Land use and land cover change (LULCC) is a key driver of global environmental change and has important implications for many national and international policy issues (Nunes and Auge 2001). The impact of land use and land cover change are critical to many government programs like documenting the rates, driving forces, and consequences of change. In particular, LULCC in lowland tropical regions are a major concern due to the widespread and rapid changes in the distribution and characteristics of tropical forests. FAO (2001) indicates that there are roughly 39 million km^2 (29 per cent) of the world's land surface is under forest cover. However, the World Resources Institute (WRI, 1997) estimates that only one-fifth of the world's original forest cover remains.

According to Moore (1986), deforestation is one of the major causes of land cover change and it is the most pervasive concern in developing countries, especially in tropical moist forests, which cover some 550 million ha of the globe, with an annual harvesting rate of over 2 per cent. So that the forest cover of the world is declining continuously and has global environmental implications. Moore (1986), indicated the worldwide consequences of deforestation as - change in the way of life of local people, extinction of species, loss of undefined reservoir of genetic resources, increased erosion from wind and water, increased desertification; increased runoff to rivers, resulting in flooding and future erosion; reduced transpiration from vegetation and thus less precipitation, and change in the regional Aledo.

Local land use and land cover changes are fundamental agents of global climate change at all scales and are significant forces that impact biodiversity, water and radiation budgets, and trace gas emissions (Riebsame et al., 1994 in Thomas R. Loveland

1999). At local and regional scales, land cover change can have profound impacts on aquatic systems due to new land-use practices that adversely affect water quality and sedimentation (Thomas R. Loveland, 1999). Such changes also modify the composition of plant communities through fragmentation, removal and introduction of species, alteration of nutrient and water pathways, and alteration of disturbance cycles. Since environmental change is ubiquitous throughout the world, identifying and diagnosing symptoms of emerging environmental criticality in the overall noise of environmental change at local levels is essential. Most current attention in discussions of global environmental change focuses on rapid land-cover change especially deforestation, global climate change and loss of biodiversity (Jeanne X. Kasperson et al 2001).

Thomas R. Loveland (1999), explained the relation between different scale land cover changes that land use and land cover changes occur at all scales, and changes at local scales can have dramatic, cumulative impacts at broader scales. He also discussed that land use and land cover changes are not just of concern at local and regional levels because of their impacts on land management practices, economic health and sustainability, and social processes, but globally as well.

As we know Land is the basic natural resource that provides habitat and sustenance for living organisms and is a major source of economic activities. Based on the utility of the land, it can be classified into two classes i.e., "Land use" and "Land cover". Land use is the total of all arrangements, activities and inputs that people undertake in a certain land cover type. It involves both the order in which the biophysical attributes of the land are manipulated and the purpose for which the land is used. In contrast, the Land cover is the observed physical and biological cover of the earth's land as vegetation, rocks, water body or man-made features. It deals with, for example, the quantity and type of surface vegetation, water, and earth materials

II. OBJECTIVES OF THE STUDY

The present study will be carried out to fulfil the following objectives:

A. To assess the cropping pattern of land use and land change dynamics in Jammu & Kashmir.
B. To assess the land use and land cover change among different land-use classes in Jammu & Kashmir.
C. To study the extent of productive and unproductive land-use patterns In Jammu & Kashmir.

III. DATABASE AND METHODOLOGY

The method and materials involved in the study are different for different parameters but guided to solve the main problem. Thus, the methodology has been divided into various steps based on the techniques employed and the data used. The study is based on secondary data obtained from various issues of Digest of Statistics and other publications of the Directorate of Economics and Statistics, Government of Jammu and Kashmir.

For the analysis of land use and land cover change among different land-use classes of the study area. The secondary data has been generated from "Land use Statistics, Ministry of Agriculture, Government of India and Digest of Statistics, Government of Jammu & Kashmir.

The absolute change in land use and land cover of the two dates (1990 to 2018) was obtained by the difference of the values of different dates of the same category by the following method;

$$\text{Absolute change} = st_1 - st_2$$

Where st_1 = status at time t_1 and St_2 = status at time t_2

For depicting the Spatial-temporal change in the cropping land use, the data sets of the major crop's wheat, paddy, maize and orchards were generated from the digest of statistics Government of Jammu & Kashmir 2018. The temporal change has been calculated by using the following formula;

$$\text{Change (V1)} = \frac{St1 - St2}{St1} * 100$$

Where, V1 = Change in any variable, St1= Status at time t1, and St2 = Status at time t2

To study the extent of productive and unproductive land utilisation in Jammu & Kashmir various types of land use data were generated from "Digest of statistics Government of Jammu & Kashmir.

In the productive land utilization study following data sets were generated;

- Total reported area (TRA)

- Net Area Sown (NAS)

- Irrigated area (IA)

- Average size of holding (ha)

The Net area sown as a per cent of the total reported area and irrigated area as a per cent of the total reported area from 1990-91 to 2018-19 were calculated in the study to see the extent of the total percentage of productive land utilization during different periods.

To study the extent of untapped or unproductive land utilization following data sets was generated;

- Total reported area (TRA)
- Area not available for cultivation (Barren-uncultivable land and culturable wasteland)
- Fallow land (Fallow land other than current Fallow and Current Fallow)

The area not available for cultivation as a per cent of the total reported area and Fallow land as a per cent of the total reported area from 1990 to 2018 has been calculated in the study to see the extent of the total percentage of unproductive or untapped land in the study area.

IV. CROPPING PATTERN LAND USE DYNAMICS IN JAMMU AND KASHMIR

Land use is the human use of land and it involves the management and modification of the natural environment into a built environment such as fields, pastures, and settlements (FAO, 1997a; FAO/UNEP, 1999). Land use is a synthesis of physical, chemical and biological systems and processes on the one hand and human/societal processes and behaviour on the other. One of the first land-use patterns that geographers studied is the pattern of crops across an agricultural landscape. Different crops represent different agricultural land uses (Bednarz, 2005). A cropping pattern refers to the proportion of the area under different crops at a point in time. It also reveals the rotation of crops and the area under double cropping etc. in any state or country (Siddhartha and Mukherjee, 2007). Cropping land use is a highly dynamic process and the farmer's choice of cropping pattern is determined by various factors, viz; physical factors such as soil, climate, technological factors like irrigation, improved varieties of seeds, availability of fertilizers and plant protection chemicals; Institutional factors like land reform, consolidation of holdings, credit facilities, price structure, procurement policies and storage facilities and other factors like the rate of return, agro-climatic conditions, farm programmes, conservation programmes, and environmental regulations (Duffy, 1996; Shafi, 2000; Das, 2004; Adihikariet al., 2005). These factors are not watertight but inter-related. For instance, the adoption of crop technologies is influenced not only by resource-related factors but also by institutional and infrastructural factors. Economic factors play a relatively stronger role in influencing the crop pattern in areas with better irrigation and infrastructure potential. In such areas, commercialization and market networks co-evolve to make the farmers more dynamic and highly responsive to economic impulses.

According to Bhalla and Singh (2001), the cropping system of any locality is the cumulative results of the past and present decisions by individuals, communities or governments and it keeps on changing in consonance with changes in prices of goods, Govt. policies and other related factors (Gupta & Singh, 1979). The interacting driving forces of population increase, income growth, urbanization and globalization on food production, markets and consumption have changed the food and agricultural system worldwide (Braun, 2007). The relative importance of crops, crop yields and farm size lead to a change in the cropping pattern of an area. The introduction of new agricultural technology, especially during the period of the green revolution in the late sixties and early seventies, resulted in a widespread change in cropping land use patterns in India especially from cereals to non-cereals (Hazra, 2006).

Agriculture is the main occupation for the people of Jammu & Kashmir. About 65 per cent of the people are directly or indirectly dependent on agriculture and allied activities for their livelihood (Padder, 2021). Agriculture and its allied activities are the predominant sectors of the economy of Jammu & Kashmir and this sector contributed more than 31.29 per cent of Gross Domestic Production (GDP) in 2007 (Digest of Statistics, 2007-08). The cropping land use in the state also underwent drastic changes which led to a decrease in area under food crops and an increase in area under cash crops/plantation agriculture. The study of this shifting land use was necessary for the sustainable agriculture of the state. Knowledge of cropping land use helps in maximization of productivity and conservation of land (ICAR, 1980). The spatial-temporal change in the area under different food crops like Paddy, Wheat, Maize and area under orchards from 1990 to 2018.

V. LAND USE AND LAND COVER CHANGE IN JAMMU AND KASHMIR, 1990- 2018

Land use and Land cover change that occurred among different land-use classes of Jammu and Kashmir between the periods of 28 years from 1990 to 2018 is shown in table 3.1. The area under Forests has declined from a total area of 671 (000ha) in 1990 to 658 (000ha) in 28 years with a declining annual rate of -0.52 (000ha). This decline in forest area can be attributed to deforestation and a wide gap between rates of forestation and deforestation. These trends are likely to cause severe ecological imbalances, including adverse agro-climatic change and acute shortage in meeting the rising demands of fuel, fodder and timber in the state.

Table 3.1 Land Use and Land Cover Change of Jammu & Kashmir, (1990-2018)

Land use classes	**Area in 000ha(%age) 1990**	**Area in 000ha(%age) 2018**	**Change in Area (%age)**
Area under Forest	671 (27.75)	658 (27.23)	-13 (-0.52)
Land put To Non-Agriculture Uses	276 (11.41)	293 (12.21)	17 (0.71)
Barren & Uncultivable Land	271 (11.20)	289 (11.96)	18 (0.76)
Permanent Pastures & other Grazing lands	125 (5.16)	125 (5.16)	No change
Land underMiscellaneous Tree crops	121 (5.004)	72 (2.98)	-49 (-2.024)
Culturable Wasteland	146 (6.03)	141 (5.83)	-5 (-0.2)
Fellow Land other than Current Fallow	15 (0.62)	13 (0.53)	-2 (-0.09)
Current Fallow	118 (4.88)	73 (3.02)	-45 (-1.86
Net sown Area	675 (27.91)	752 (31.12)	77 (3.21)

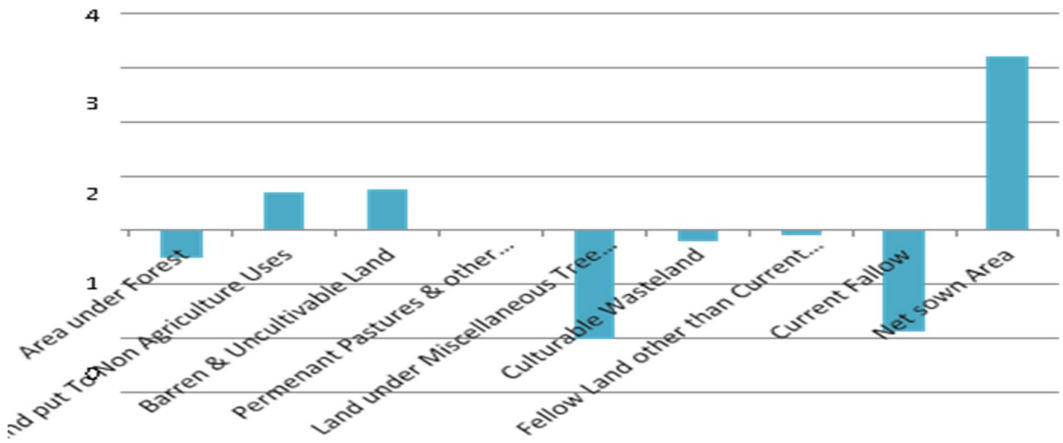
Source: Land use statistics, Ministry of agriculture, the government of India.

Forests occupied 27.75 per cent of the study area in 1990 which has come down to a total of 27.23 per cent in 2018 showing a net decrease of 0.52 per cent. Land put to non-agriculture uses is witnessing an increasing trend as the total area under it during the year 1990 was 276 thousand hectares and by 2018 it has increased up to 293 thousand hectares with a total growth of 0.76 per cent. Barren and uncultivable land being one of the dominant land use categories in the study area recorded a net increase of 18 thousand hectares with an average increase of 0.39 thousand hectares. The total area under Barren and uncultivable land in 1990 was 271 thousand hectares which have increased up to 289 thousand in 2018 and has recorded a total increase of 0.76 thousand hectares during the 28 years.

The area under permanent pastures and other grazing lands has remained stagnant at 125 thousand hectares over the years which is a cause of concern to planners due to the increasing demand for grasses and fodders for livestock. In the study area, the land under Miscellaneous tree crops not included in the area sown has decreased from 121 thousand hectares in 1990 to 72 thousand hectares in 2018, with an average decrease of 1.06 thousand hectares. Cultural Wastelands have also decreased from 146 thousand hectares to 141 thousand hectares from 1990 to 2018. The decline in these land-use classes is the cause of the increase in the area under cultivation and Barren and Uncultivable land.

Permanent Pastures spreads throughout- the whole state of Jammu and Kashmir, occupying an area of 125 (000ha) with a total percentage of 5.17 of the total reported area. Land under Miscellaneous tree crops covers the least area of 72 (000ha) with a total percentage of 2.98 of the total reported area. Cultural Waste Lands constitute about 141 (000ha) with a total percentage of 5.83. Current Fellow dominates 73 (000ha) which is 3.02 per cent of the total reported area, Fallowed by Fellow Land other than Current Fallow that occupies 13 (000ha) which is 0.53 per cent.

Fig 3.1 Land use and Land cover change statistics-1966-2010



Fellow land other than Current Fellow shows a decrease in their catchment area between the periods of 28 years. The area under Fellow land other than Current Fellow during the year 1990 was 15 thousand hectares and has decreased up to 13 thousand hectares during 2018 with an average annual decrease of 0.043 thousand hectares.

A net decrease of 45 thousand hectares has occurred in a current fellow. The current fellow has decreased from 118 thousand hectares in 1990 to 73 thousand hectares in 2018, with an average annual decrease of 0.98 thousand hectares. The Values Shown in table 3.1 ravels that the net sown area also witnessing an increasing trend as the total area under it in 1990 was 675 thousand hectares and by 2018 it has increased up to 752 thousand hectares registering a net increase of 3.21 per cent with an average annual increase of 0.69 thousand hectares.

VI. ANALYSIS OF CROPPING PATTERN OF MAJOR CROPS IN JAMMU & KASHMIR

A. Net Sown Area

Net sown area refers to the total area sown in an agricultural year. The net sown area has increased overall in the state by 3.36 per cent (715306 ha in 1990-91 to 739319 ha in 2018-19) as portrayed in Table 3.2. It has increased fairly well in the districts of Jammu province except for Kathua district (-3.56 per cent), while it has decreased in three out of six districts in Kashmir province. The net sown area increased in Jammu province on account of efficient land reclamation and increased use of technology, while the same process could not be repeated in Kashmir valley at that scale because of the paucity of land which could be brought under cultivation. In the two districts of Ladakh namely Leh and Kargil, the net sown area has increased, because ample land is available for purposes other than agriculture and secondly, efforts are put to bring more land under cultivation.

Table 3.2, Cropping Pattern of Major Crops in Jammu and Kashmir During 1990-91 to 2018-19

District	Net Sown Area	Area Under Paddy	Area Under Maize	Area Under Wheat	Area Under Orchards
	Change (%)	Change (%)	Change (%)	Change (%)	Change (%)
Srinagar	30.13	-48.95	-4.59	-72.22	106.82
Budgam	-20.27	-41.6	16.3	9.26	54.68
Baramulla	1.14	-29.67	10.83	13.24	17.22
Kupwara	1.39	-23.63	7.83	7.67	49
Pulwama	-8.9	-44.88	-9.44	80.43	1533.21
Anantnag	5.58	-26.27	-6.52	-48.72	64.62
Jammu	19.73	-13.3	-14	-15.5	24.53
Kathua	-3.56	-22.59	-25.5	-29.28	300.94
Doda	17.12	-15.35	-15.48	-23.66	178.85
Poonch	6.67	-27.26	-13.41	-16.4	389.47

Rajouri	16.3	-24.23	-28.78	24.26	735.29
Udhampur	7.16	-46.64	-28.78	-43.46	364.86
Leh	5.81			1.52	416.44
Kargil	15.28			15.67	84.25
Total	3.36	-29.92	-13.68	-21.47	176.39

Source: Own Elaboration

Srinagar district lost the maximum net sown area (8088 ha) on account of developmental activities and urbanization, while district Jammu has received a considerable increase in it (95166 to 113941 ha) on account of efficient land reclamation and enhanced irrigation facilities. Four districts (Srinagar, Budgam, Pulwama and Kathua) have received negative growth in the net sown area. The highest increase in net sown area is recorded by Jammu, Doda, Rajouri and Kargil, while it has slowly increased in Kupwara and Baramulla districts.

B. Area Under Paddy

Paddy is one of the dominant crops grown in the state of Jammu and Kashmir as its staple food for more than sixty per cent of the population of the state. It is a tropical crop and requires high temperature and moisture conditions (24°C to 35°C and 150-250 cm). Paddy cultivation is an age-old practice in the state, but with changing times the area under this crop has decreased in all the districts.

Table 3.2 depicts that Srinagar and Udhampur districts lost the maximum area under paddy during these twenty-eight years (48.95 and 46.64 per cent respectively), while as Jammu district has lost the least area (13.30 per cent). The cultivation of this crop is not possible in the Ladakh division of the state because of the very cold climate and short growing season. On average in absolute values, the state has lost 82321 hectares of land under paddy cultivation. In the state, almost one-third of the land under paddy (- 29.92 per cent) has been lost during these twenty-eight years through regional variations. The maximum land loss under this crop is observed in district Srinagar (-48.95 per cent) followed by Udhampur (-46.64 per cent), Pulwama (-44.88 per cent) and Budgam (-41.60 per cent), while at least loss is recorded in district Jammu (-13.30 per cent) and Doda (-15.35 per cent). Four out of the twelve districts have recorded a higher decrease than the state average.

C. Area Under Maize

Maize is also one of the prime crops grown in the state of Jammu & Kashmir as it is a staple food of the Gujjars and Bakerwlas living in and around the Pir-Panjal range consisting of more than ten to fifteen per cent of the population of the state. It is a grain and requires moderate temperature and less water (10°C to 25°C and 50-120 cm, respectively). Though maize is cultivated in all the districts of the state, it is a dominant crop in the hilly districts having more low-lying mountainous areas (Kandi belt) than the districts which have relatively more plain areas as shown in table 3.2.

The area under maize has overall increased in Kashmir province. Budgam, Baramulla and upward show an increase in their area under maize with 16.30, 10.83 and 7.83 per cent, respectively. While it decreased in three of its districts namely Pulwama, Anantnag and Srinagar by 9.44, 6.52 and 4.59 per cent respectively. Jammu province has recorded a decline in the area under this crop, the maximum decline is observed in Rajouri and Udhampur (28.78 per cent each) and minimum in Poonch (13.41 per cent). The crop is not cultivated in the Ladakh division because of the unfavourable geographical conditions. The highest decrease is observed in districts Udhampur and Rajouri (-28.78 per cent each) and Kathua (-25.50 per cent), while the lowest decrease is evident in district Srinagar (-4.59 per cent). All the districts of Jammu province have recorded negative growth in the area under maize cultivation.

D. Area Under Wheat

Wheat is also one of the important crops grown in the state of Jammu and Kashmir as it is a staple food for the people of Jammu & Ladakh province consisting of more than forty per cent of the population of the state. This is a rabbi crop in the state; i.e., it is grown in October-November and harvested in March-April and requires moderate temperature and less water (150C to 250C and 50-120 cm).

This crop is mainly cultivated in Jammu and Ladakh divisions and less area is under this crop in the districts of the Kashmir division (Table 3.2). In Kashmir valley wheat is grown in the upper reaches and not in plain areas. In the two districts of Ladakh, the area under this crop has increased by 342 hectares. The maximum area under wheat is in Jammu district (31564 ha), followed by Kathua (16023 ha), while as very least area under it is in Srinagar district (5 ha). The overall growth of the crop shows a declining trend. In Kashmir province, it has overall increased though it decreased in two of its districts (Srinagar and Anantnag); while in Jammu province the crop has recorded a decline, The maximum decline in Jammu province is observed in Udhampur district (43.46 per cent) followed by Kathua (-29.28 per cent) and minimum in Jammu district (15.50 per cent).

E. Area Under Orchard

Orchard cultivation or horticulture is an old economic activity of the people of the state, especially Kashmir. Kalhana, the great Kashmiri historian mentioned fruit culture in Kashmir in his famous book 'Rajtarangini' during the reign of king Nara as back as 1000 B.C. It was, however, during the period of Lalitaditya (900 A.D) that horticulture in the state received considerable patronage. The valley of Kashmir, parts of Doda, Kathua, Udhampur, Rajouri and Poonch district fall in a temperate zone which is conducive for the cultivation of fruits, thus occupying substantial area under orchards. Table 3.2 shows the area under orchids in the state and the total change in the area. The area under orchards has increased in all the districts of the state from the year 1990-91 to 2018-19. The maximum area has increased in district Pulwama (16482 hectares), while in district Poonch very least area has been brought under orchard cultivation (74 hectares in 28 years). Though the maximum area in absolute values has increased in districts of Kashmir valley, the intensity of expansion during the period is observed highest in Pulwama (1533.21 per cent) followed by Rajouri (735.29), Leh (416.66) and Poonch (389.47), and is much higher than the state average of 176.39 per cent. The districts with the least intensity of expansion are; Baramulla, Jammu, Kupwara and Anantnag.

VII. PRODUCTIVE AND UNPRODUCTIVE LAND-USE PATTERNS IN JAMMU & KASHMIR

A. Productive Land Utilization

The net area sown and irrigated area in a year is taken as the productive land use in this study. It has been observed that the area available for cultivation had increased from 675 thousand hectares to 752 thousand hectares during 1975-76 to 2010-11 and a slight decrease between 2010-11 to 2015-16. The net area sown as per cent of the total reported area in the state has also shown an increase, from about 27.91 per cent to 31 per cent during this period (Table 3.3). The net irrigated area had increased from 280 thousand hectares to 320 thousand hectares, but in percentage terms, the irrigated area of net area sown has remained more or less stagnant over this period.

Table 3.3, Productive utilization of land in Jammu & Kashmir

Year	Total reported area (TRA)	Net area sowed (NAS)	Net area is sown per cent of TRA	Irrigated area	Irrigated area as per cent of NAS
			(Area in 000ha)		
1975-76	2418	675	27.91	280	41.68
1980-81	2415	688	24.49	295	42.88
1985-86	2414	715	29.62	304	42.52
1990-91	2415	732	30.31	309	42.3
1995-96	2416	731	30.26	298	40.78
2000-01	2416	734	30.38	307	41.77
2005-06	2416	748	30.96	311	41.56
2010-11	2416	752	31.12	311	41.34
2015-16	2418	731	30.23	320	43.77

Source: Digest of Statistics (various issues), Government of J&K

B. Unproductive Land Utilization

The productivity can be improved by tapping uncultivated land, including wasteland and fallow land. The magnitude of untapped agricultural land in the state has remained stagnant for the past few decades, though some inter-sect oral fluctuations have been observed (Table 3.4). The two broad classes of untapped land, viz. Area not available for cultivation, and fallow land have depicted opposite trends over the years. Area not available for cultivation has increased from 417 thousand hectares in 1975-76 to 431 thousand hectares in 2005-06 and has shown a little decrease from 2005-06 to 2015-16, whereas the fallow land including current fallows has decreased during this period from 133 thousand hectares to 94 thousand hectares.

Table 3.4, Untapped agricultural land in Jammu and Kashmir

Year	Area not available for cultivation					Fallow land				Total	
	Total Reported area	Barren & uncultivated	Culturable wasteland	Total		Fallow land other	current fallow land	Total		Area	% Of TRA
				Area	% Of TRA			Area	% Of		

		land				than current fallows			TRA		
1975-76	2418	271	146	417	17.2	15	118	133	5.5	550	22.7
1980-81	2415	244	155	399	16.5	8	105	113	4.6	512	21.2
1985-86	2414	231	147	378	15.6	8	94	102	4.22	480	19.8
1990-91	2415	259	164	423	17.5	7	86	93	3.85	516	21.37
1995-96	2416	295	137	432	17.8	6	97	103	4.26	535	22.0
2000-01	2416	291	141	432	17.8	7	96	103	4.26	535	22.0
2005-06	2416	291	140	431	17.84	8	82	92	3.8	523	21.64
2010-11	2416	289	141	430	17.8	15	73	88	3.63	518	21.44
2015-16	2418	292	136	428	17.7	26	68	94	3.89	522	21.59

Source: Digest of Statistics (various issues), Government of J&K

Agricultural production can be more or less doubled if this untapped land could be brought under cultivation. In this direction, land-use planners and government have a major role to play. Farmers should be provided training to use land on scientific lines. Incentives in the form of cheap credit, development subsidies, etc. may improve the financial status of the poor farmers, enabling them to invest in land improvement, and purchase technologies and critical inputs. In this way, they could shift unproductive land to productive use and transform agriculture towards commercialization. Soil and water conservation and other reclamation measures could help bring the untapped land under plough for productive uses.

VIII. CONCLUSION

In the present work the effects of land-use changes which have taken place in the last couple of decades, have been investigated in the state of Jammu & Kashmir. The study has revealed a major shift of land from the desirable to undesirable land-use classes. There has been an increase in the net area sown in Jammu and Kashmir on account of various land reclamation measures adopted till the early-1990s, but later this land-use class has shown an unfavourable decline towards 2018-19. Cropping intensity has been lower in Kashmir than in Jammu province due to unfavourable climatic conditions prevalent in the valley the analysis and interpretation of the data revealed that on average, the net sown area has slightly increased in the state of Jammu and Kashmir on account of reclamation of waste and barren lands. The net sown area has decreased in some districts because of urban expansion and developmental activities. The area under the three major food crops grown in the state (Paddy, Maize and wheat) has decreased at the state level though with regional variations, it has increased in some districts as well. But the area under paddy recorded a decline in all the districts and the area under orchards have registered high positive growth in all the districts. This increase is largely explained by the shifting of cropping land use from food crops to plantation agriculture (orchard cultivation).

There has been an increase in the net area sown in Jammu and Kashmir on account of various land reclamation measures adopted till the early-1990s, but later this land-use class has shown an unfavourable decline towards 2010-11. Cropping intensity has been lower in Kashmir than in Jammu province due to unfavourable climatic conditions prevalent in the valley. No significant association has been found between irrigated area and cropping intensity, indicating a lack of location-specific technological advancements and their respective channelization. It is required more so due to altitudinal variations that demand short duration varieties for increasing cropping intensity. The state largely comprises small and marginal farmers (about 94 %), and the per capita availability of cultivated land in the state is only 0.072 ha, which is a major constraint in agricultural development in the state. Therefore, a high priority needs to be accorded to exploring the potentialities of crop diversification in different agro-climatic zones of the state to maximize the returns per unit of land to the farmer. The unproductive utilized land in the state, though has decreased over the years, is still over 500 thousand hectares, which needs to be brought under cultivation through effective measures.

IX. SUGGESTIONS

A. The following policy options could be considered for the management of land resources of the state:
B. The declining trend in the reported area of the state needs to be checked by land surveys through remote sensing under GIS.
C. Since irrigation is an important determinant of agricultural growth, low gestation irrigation projects should be funded to expand irrigation capacities. Moreover, the existing irrigation structures should be made functional to improve the efficiency of the existing capital stock.
D. The desirable land-use pattern could be achieved through sectoral approach/plan linkages and there is a need to apply modern science and technology to enhance productivity on a sustainable basis.

E. There is an immense requirement of preserving agricultural land. Land reform measures should be strictly implemented and the construction of residential buildings and other establishments on agricultural land should be banned.

F. Reform policies should be supported by strict laws and regulations.

G. Diversification of agriculture should be encouraged in the state because it not only enhances income and protects from risks, it also enhances soil properties and prevents degradation of land.

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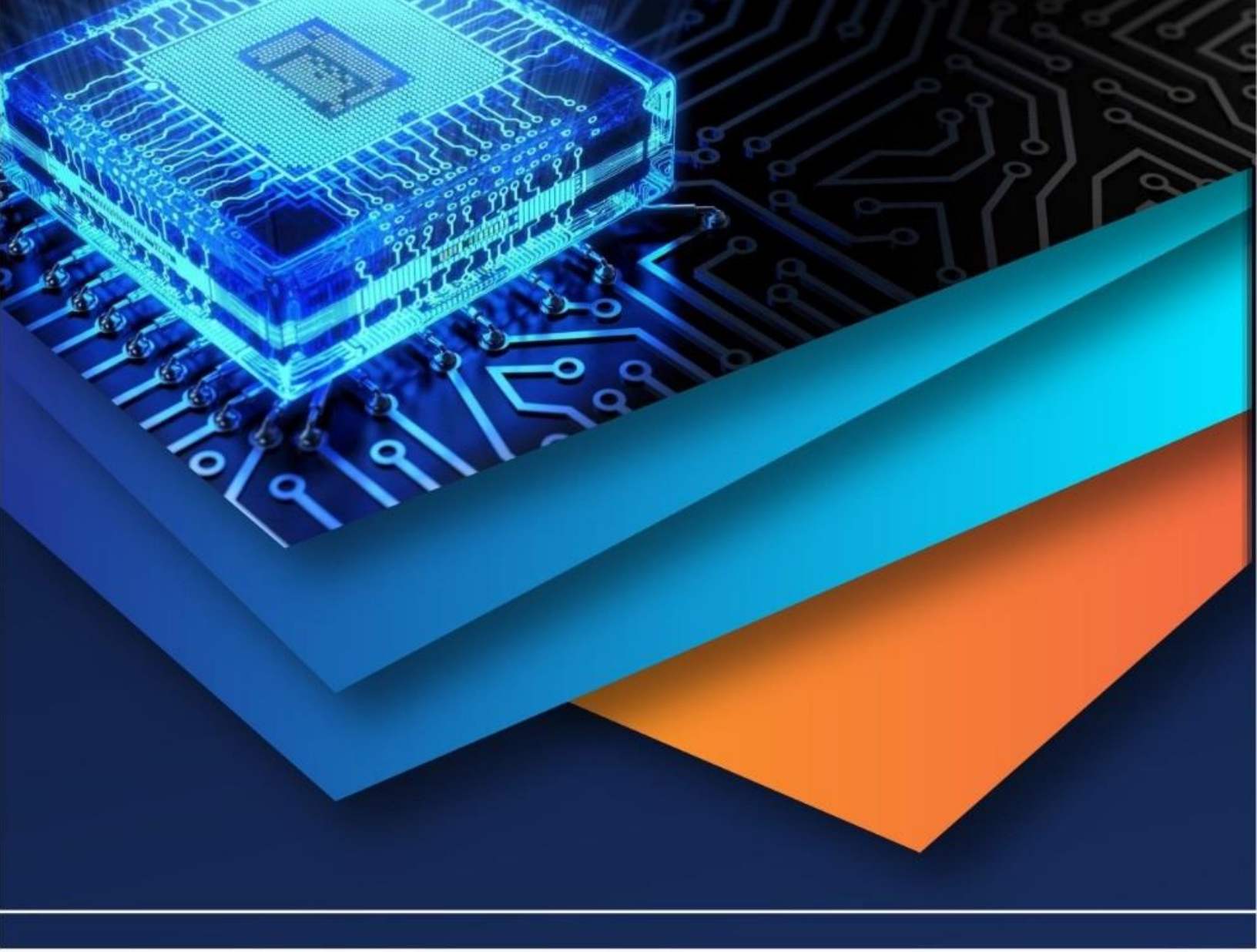

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