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Spatio-temporal analysis of land use pattern in a sectoral context: A case study of Gorakhpur district, Uttar Pradesh

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Abstract
Land constitutes a fundamental natural asset, serving as a foundation for the development of various resources, thus underscoring the significance of studying its utilization. A significant portion of Gorakhpur district's land is agriculturally productive due to its fertile soil. The economic development of the district goes along the lines of optimum land utilization. Land use and its management continually evolve according to socio-economic needs. This study, spanning two decades from 2000-01 to 2020-21, highlights patterns and trends of land use prevalent in the district and accentuates the factors viz. land degradation, recurrent floods and climatic changes, and other land uses affected by anthropogenic factors; attributing the changes in the land use pattern relating to the agricultural and non-agricultural sectors. Emphasizing various aspects of land use, this study aims to underscore its optimal utilization. Data collection from secondary sources has been employed to facilitate informed decision-making regarding land use, thereby fostering sustainable development in the district in the coming years.

Keywords: Land use, optimum land utilisation, land degradation, Sustainable Development

Introduction

Land, being a finite natural asset, serves as the foundation for all socio-economic endeavors. Monitoring its utilization has long been essential for effective planning and regional development strategies. The complexity of land use stems from a dynamic interplay of agrarian relations, economic development, infrastructure, and institutional factors. It represents a synthesis of both natural processes - physical, chemical, and biological - and human activities (Kuriakose & Iyer, 2011) [10].

Land use patterns are shaped by the interactions between cultural backgrounds, societal needs, and the inherent characteristics of the land (Karwariya & Goyal, 2011) [9]. The significance of studying land use was underscored by L.D. Stamp (1948) [13] in his seminal work "The Land of Britain, Its Use and Misuse," which focused on land utilization in Britain.

Land use encompasses "the activities of humans and the various purposes to which land is put" (Clawson and Steward, 1965) [3]. Land use denotes the utilization of both developed and undeveloped land within a specific spatial and temporal context (Mandal, 1982) [11].

Land use management constitutes a critical practice in efficiently allocating finite land resources across diverse potential applications. It necessitates a continuous interplay between available environmental resources and ever-evolving human demands. This process is demonstrably influenced by human interventions, highlighting the crucial role humans play in shaping and adapting their physical surroundings. Effective land use management is, therefore, essential for human survival.

A comprehensive understanding of land use, informed by scientific knowledge, is imperative for addressing the associated challenges. The overall land use patterns within a region represent the culmination of interacting physical, economic, and social factors. These factors, encompassing physiography, climate, soil characteristics, population dynamics, irrigation networks, urbanization, industrial development, and transportation infrastructure, exert a profound influence on how land is ultimately utilized. The resulting land use patterns serve as a reflection of the complex interplay between human activities and the prevailing environmental conditions.

Consequently, ensuring the sustainable utilization of this progressively diminishing resource has become paramount. This has led to the systematic examination of land use patterns, intending to evaluate a specific region's land potential for various applications.

Study Area

Situated in the northeastern region of Uttar Pradesh, Gorakhpur district lies within the mid-northern part of the Middle Ganga plains. Geographically, the district spans from approximately 26º13'N to 27º29'N in latitude and from 83º05'E to 83º 56'E in longitude. The terrain of this area is primarily formed by sediment deposition from the Ghaghra, Rapti, Ami rivers, and their tributaries. The district includes a substantial area to the north of the Ghaghra River, which acts as its southern boundary with Azamgarh. Additionally, the formation of Maharajganj tahsil as a separate district delineates the district's northeastern boundary. To the west, it borders Sant Kabir Nagar district, while to the east, it is adjacent to Deoria and Kushinagar districts. Gorakhpur district comprises 7 Tehsils - Sadar, Bansgaon, Campierganj, Chaurichaura, Khajani, Sahjanwa, and Gola - along with 20 blocks, namely Bhathat, Khorabar, Pipraich, Sahjanva, Pali, Khajani, Belghat, Brahmpur, Piprauli, Bansgaon, Kauriram, Gagaha, Charganva, Campierganj, Jangal Kodia, Sardarnagar, Gola Badhalganj, Uruwa, and Bharohiya. The district has a population of approximately 4,440,895 individuals with a literacy rate of 75.4%. Its total geographical area spans about 3321 square kilometers.

The district primarily consists of low-lying areas prone to annual flooding, resulting in significant loss of life. The region experiences an average annual rainfall of 1100 mm, with summer temperatures reaching up to 43.50ºC and winter temperatures dropping to 6.1ºC. The soil composition comprises sandy loam, clayey loam, and loam. The cropping intensity in the district is 166.57%, with the predominant cropping system being Rice-Wheat, covering approximately 80% of the area. Major crops cultivated include rice, wheat, pulses, oilseeds, and sugarcane. Given the ample availability of natural resources conducive to agriculture, there is significant potential for enhancing crop productivity in the district. To achieve higher crop yields and sustainability, the adoption of new agricultural technologies and farming techniques is imperative in the region.

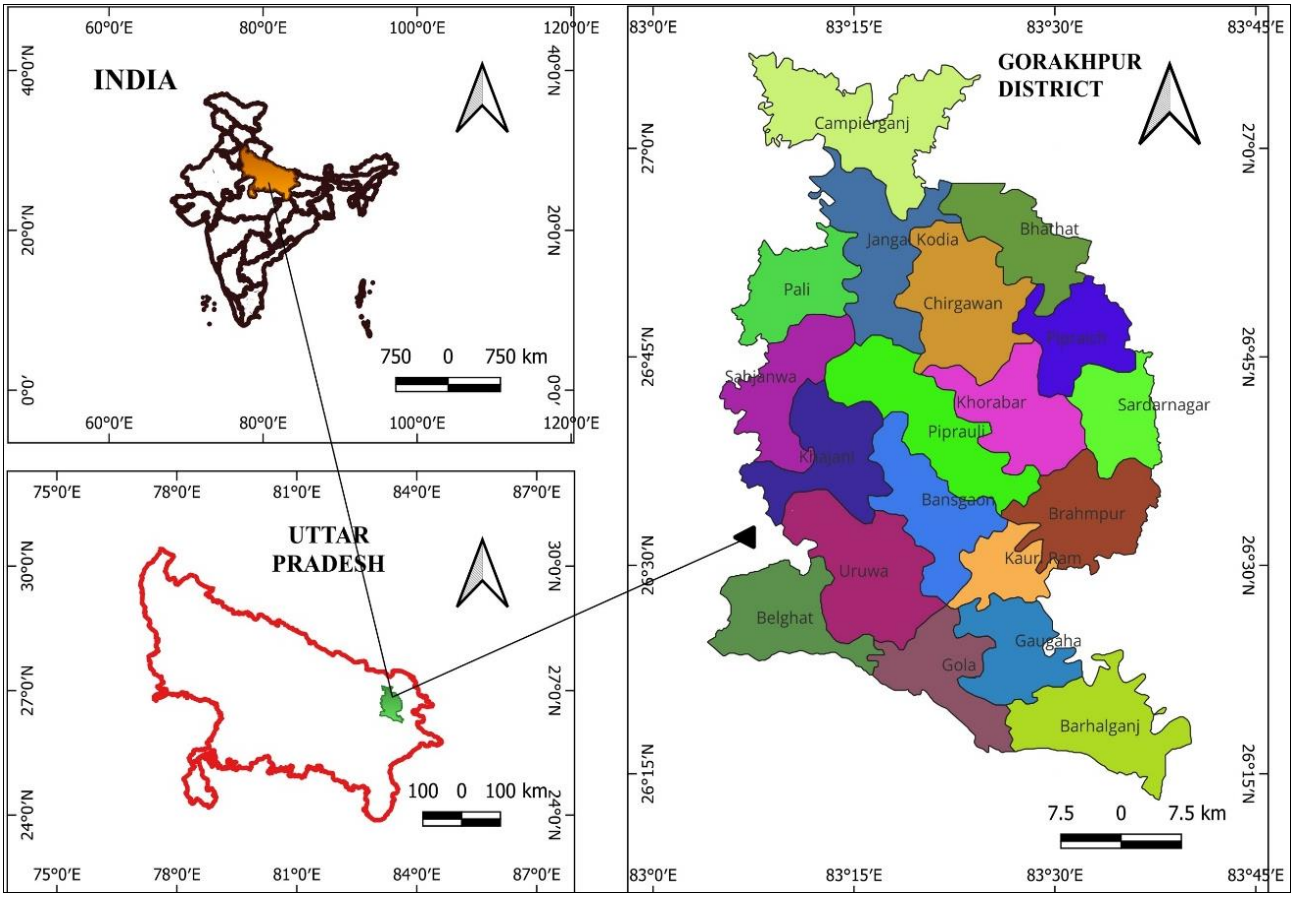

Fig 1: Location Map of the Study Area

Objectives of the Study

1. To present a spatio-temporal analysis of land use pattern in the study area in a sectoral context.
2. To highlight the factors affecting the changes in land use pattern in the study area and suggest way forward.

Database and Methodology

The present study utilizes time-series data obtained from the District Statistical Handbook (Zila Sankhyiki Patrika) of Gorakhpur District of the years 2002 and 2022 (for the land use statistics of 2000-01 and 2020-21, respectively), published by the Economics and Statistical Division of the Government of Uttar Pradesh. This dataset serves as the basis for evaluating shifts in land utilization patterns within the district. Furthermore, relevant government and non-governmental reports, books as well as research papers, have been cited for this analysis. Statistical and graphical methods have been applied to examine the trends in land use within the district from 2000-01 to 2020-21.

Analysis of land use patterns in the district for the years 2000-01 and 2020-21 has been conducted across nine categories. The cumulative area covered by these categories represents the total reporting area.

where, R = Total Reported Area, F = Area under Forests, PP = Permanent Pastures, Mt = Land under miscellaneous tree crops and groves, B = Barren and Unculturable Land, NA= Area under Non- Agricultural use, CW = Culturable Wasteland, F_c = Current Fallows, F_o = Fallow Land other than Current Fallows, NSA= Net Sown Area

The approach outlined by Pandey and Tiwari (1987) [12] for sectoral analysis of land use patterns has been adopted. The total area reported for nine categories of land use classes has been categorized into three sectors: ecological (E), agricultural (A), and non-agricultural (NA). This categorization follows the equation

$$\Delta R = \Delta E + \Delta A + \Delta NA.$$

The alterations within the ecological sector (ΔE) can be further delineated into two distinct sub-sectors:

- Enviable/Desirable Ecological Sector: ΔEE = Area under forests (ΔF) + Permanent pastures (ΔPP) + Land under Miscellaneous tree crops and groves (ΔMt).
  This category encompasses changes in areas such as forests, permanent pastures, and miscellaneous tree crops and groves, which are regarded as beneficial for the ecology.

- Unenviable/Undesirable Ecological Sector: ΔUE = Barren and unculturable lands (ΔB). This division pertains to alterations in barren and unculturable lands, which are considered detrimental to the ecology.

The study suggests that alterations in land use can have environmental ramifications. Converting land from less favorable to more favorable ecological conditions is seen as advantageous, whereas the opposite may yield adverse effects. Even transitions within favorable ecological conditions can impact the environment. For instance, converting land from pastures or tree crops to forests is viewed positively, while converting forests into pastures may have negative implications (Fazal *et al*., 2022) [7].

The net fluctuations within the agricultural sector (ΔA) encompass various classifications:

ΔA = Culturable wastelands (ΔCW) + Current fallows (Δ F_c) + Fallow Land other than Current Fallows (Δ F_o) + Net sown area (ΔNSA)

The agricultural sector comprises four subcategories of land use: culturable wasteland, current fallow land, other fallow land, and net sown area. Positive developments in this sector often involve the utilization of land from the ecological sector, which includes forests, permanent pastures, and areas with miscellaneous trees. Conversely, adverse changes may result in shifts in land use towards either ecological or non-agricultural sectors. Such transitions towards less favorable ecological conditions could detrimentally affect agricultural activities. Changes within the agricultural sector, particularly an increase in net sown area, are generally advantageous. Even in instances of an overall negative trend, a positive expansion in net sown area indicates an augmentation in cultivated land, which is deemed beneficial. However, a reduction in net sown area due to shifts towards fallow land or wasteland negatively impacts agriculture, necessitating substantial efforts for land reclamation (Fazal *et al*., 2022) [7].

The net variations within the non-agricultural sector (ΔNA) are summarized as follows:

ΔN = Area under non-agricultural use (ΔNA)

The third classification, the non-agricultural sector, encompasses land designated for purposes other than agriculture. This sector holds significant importance in comprehending alterations in land utilization. Expansion of non-agricultural land can occur through three avenues: acquiring land from either the ecological sector, the agricultural sector, or both simultaneously. Converting land from the favorable ecological sector to non-agricultural use can result in adverse environmental impacts. Hence, it is recommended that optimal utilization is achieved when the non-agricultural sector utilizes land from less favorable ecological areas. Conversely, augmenting the non-agricultural sector by converting agricultural land is regarded as detrimental, potentially leading to food shortages (Fazal *et al*., 2022) [7].

Sectoral Analysis of Land Use Pattern of Gorakhpur District

The land utilization trends in Gorakhpur district during the periods 2000-01 and 2020-21 are illustrated in Table 1. Furthermore, a comprehensive breakdown of land use across various categories at the block level within the district for the years 2000-01 and 2020-21 is presented in Tables 2 and 3 respectively.

Table 1: Land Use pattern in Gorakhpur District (From 2000-01 to 2020-21)

Land Use Classes	Area (in Hectares)		Change in Area (%)
	2000-01	2020-21	
Total Reported Area	335223	335217	-0.002
	100%	100%	
Area under Forests	5754	5842	1.53
	1.72%	1.74%	
Culturable Wasteland	3464	6124	76.79
	1.03%	1.83%	
Current Fallows	7963	11792	48.08
	2.38%	3.52%	
Fallow Land other than Current Fallows	9381	12098	28.96
	2.80%	3.61%	
Barren and Unculturable Land	4047	4300	6.25
	1.21%	1.28%	
Area under Non- Agricultural use	41848	53147	27.00
	12.48%	15.85%	
Permanent Pastures	168	313	86.31
	0.05%	0.09%	
Land under miscellaneous tree crops	1522	3357	120.57
	0.45%	1.00%	
Net Area Sown	261076	238244	-8.75
	77.88%	71.07%	

Source: Based on Zila Sankhyiki Patrika of Gorakhpur, 2002 and 2022

Table 2: Block-wise land use pattern of Gorakhpur district (2000-01)

S. No.	Name of Blocks\ Land use Classes	Total Reported Area (100 %)	Area under Forests (%)	Culturable Wasteland (%)	Current Fallows (%)	Fallow Land other than Current Fallows (%)
1	Pali	14128	0.52	1.02	5.17	0.66
2	Sahjanwa	15446	1.50	1.05	4.27	0.52
3	Piprauli	15168	0.01	0.68	3.06	1.67
4	Jungle Kaudia	21687	0.00	1.05	1.17	1.13

5	Chargawan	13556	2.96	0.79	3.82	1.23
6	Bhathat	15254	5.55	0.84	1.52	0.44
7	Pipraich	15686	0.08	0.43	1.79	1.83
8	Sardarnagar	13283	0.62	0.81	2.17	2.92
9	Khorabar	15825	1.38	2.83	3.75	5.68
10	Brahmpur	20273	0.32	0.38	2.20	5.60
11	Kauriram	17476	0.00	0.60	1.48	6.55
12	Bansgaon	15565	0.00	0.63	0.84	2.51
13	Uruwa	17673	2.86	0.62	2.22	4.39
14	Gagaha	15313	0.00	1.17	0.70	1.03
15	Khajni	16906	2.22	0.89	3.03	3.45
16	Belghat	19890	0.00	0.87	2.89	6.16
17	Gola	14027	1.82	0.81	0.68	2.42
18	Barhalganj	22182	2.84	0.62	2.19	1.92
19	Campierganj	25014	5.50	0.86	0.51	1.07

S. No.	Name of Blocks\ Land use Classes	Barren and Unculturable Land (%)	Area under non-agricultural use (%)	Permanent Pastures (%)	Land under miscellaneous tree crops (%)	Net Area Sown (%)
1	Pali	1.03	10.75	0.01	0.51	80.33
2	Sahjanwa	1.20	11.13	0.03	0.11	80.20
3	Piprauli	1.62	12.08	0.03	0.20	80.65
4	Jungle Kaudia	1.19	14.06	0.00	0.10	81.29
5	Chargawan	1.30	12.94	0.22	0.57	76.17
6	Bhathat	0.90	10.91	0.04	0.85	78.96
7	Pipraich	0.91	10.10	0.18	0.45	84.22
8	Sardarnagar	0.79	12.14	0.06	0.79	79.70
9	Khorabar	0.94	12.45	0.13	1.05	71.78
10	Brahmpur	0.68	6.70	0.14	0.42	83.54
11	Kauriram	0.93	9.65	0.05	0.77	79.98
12	Bansgaon	0.76	11.93	0.00	0.55	82.78
13	Uruwa	1.51	9.38	0.06	0.23	78.73
14	Gagaha	1.03	9.69	0.00	0.40	85.98
15	Khajni	0.91	9.61	0.05	0.38	79.45
16	Belghat	2.06	15.28	0.00	0.38	72.36
17	Gola	1.08	14.02	0.01	0.42	78.74
18	Barhalganj	1.11	13.40	0.00	0.43	77.48
19	Campierganj	1.11	12.12	0.01	0.36	78.46

Source: Based on Zila Sankhyiki Patrika of Gorakhpur, 2002

Table 3: Block-wise land use pattern of Gorakhpur district (2020-21)

S. No.	Name of Blocks\ Land use Classes	Total Reported Area (100%)	Area under Forests (%)	Culturable Wasteland (%)	Current Fallows (%)	Fallow Land other than Current Fallows (%)
1	Pali	17094	0.01	0.55	4.01	8.89
2	Sahjanwa	17000	0.02	1.06	3.85	5.56
3	Piprauli	16574	0.07	0.48	5.15	7.50
4	Jungle Kaudia	16236	0.02	1.46	4.07	4.64
5	Chargawan	14331	4.63	1.12	2.06	5.73
6	Bhathat	14967	5.67	0.99	1.07	1.99
7	Pipraich	14712	0.50	1.01	3.48	2.05
8	Sardarnagar	12884	0.68	1.47	3.59	1.78
9	Khorabar	14693	8.92	4.05	2.48	4.14
10	Brahmpur	16724	0.41	0.78	5.18	1.76
11	Kauriram	16511	0.01	0.18	2.13	4.08
12	Bansgaon	15438	0.01	1.55	3.87	1.34
13	Uruwa	17838	0.18	1.51	2.68	1.47
14	Gagaha	14836	0.02	1.61	2.76	1.45
15	Khajni	15988	1.05	1.64	4.66	1.03
16	Belghat	19746	0.02	0.88	3.52	3.58
17	Gola	14716	1.66	0.60	1.04	1.66
18	Barhalganj	22995	0.54	2.13	5.36	1.37
19	Campierganj	18746	5.06	1.73	3.09	2.65
20	Bharohiya	15642	3.10	1.11	2.55	1.86

S. No.	Name of Blocks\ Land use Classes	Barren and Unculturable Land (%)	Area under non-agricultural use (%)	Permanent Pastures (%)	Land under miscellaneous tree crops and groves (%)	Net Area Sown (%)
1	Pali	1.01	15.78	0.02	0.74	68.98
2	Sahjanwa	1.54	16.14	0.00	0.61	71.24
3	Piprauli	1.04	15.83	0.02	0.22	69.68
4	Jungle Kaudia	0.24	17.70	0.04	0.60	71.22
5	Chargawan	1.89	18.41	1.10	1.16	63.91
6	Bhathat	0.79	14.84	0.04	1.15	73.46
7	Pipraich	0.16	14.42	0.18	0.91	77.28
8	Sardarnagar	1.12	15.93	0.00	1.30	74.13
9	Khorabar	2.21	20.98	0.16	2.45	54.62
10	Brahmpur	0.67	12.36	0.20	1.57	77.07
11	Kauriram	0.42	13.24	0.00	0.39	79.56
12	Bansgaon	1.94	12.48	0.10	0.71	78.00
13	Uruwa	1.72	12.71	0.00	0.71	79.02
14	Gagaha	1.16	13.68	0.05	0.84	78.42
15	Khajni	1.55	12.83	0.03	0.94	76.27
16	Belghat	1.77	19.41	0.00	0.53	70.29
17	Gola	1.94	19.48	0.02	1.66	71.95
18	Barhalganj	0.58	17.11	0.05	0.96	71.90
19	Campierganj	3.02	17.65	0.02	2.11	64.67
20	Bharohiya	0.87	15.99	0.03	0.80	73.70

Source: Based on Zila Sankhyiki Patrika of Gorakhpur, 2022

Tables 1, 2, and 3 showcase the land use trends and distributions across various categories at both the district and block levels within Gorakhpur district. An examination of these patterns and transformations over a 20-year period (from 2000-01 to 2020-21) offers insights from a sectoral standpoint. The total reported area for the district has remained nearly unchanged during this timeframe, with figures of 335,223 hectares and 335,217 hectares for 2000-01 and 2020-21, respectively.

The Ecological Sector (ΔE)

a. Area under forests (ΔF)

It's noteworthy that the area classified as forest may differ from the actual forest cover. The former refers to land identified and demarcated by the government for forest growth, as reflected in land revenue records. Therefore, an increase in this category doesn't necessarily indicate a rise in actual forest cover.

The forest cover in the district has seen a slight uptick from 5754 hectares in 2000-01 to 5842 hectares in 2020-21, constituting approximately 1.74% of the total reporting area in the latter year. However, this figure falls significantly short of the national standard set by the National Forest Policy of 1988, which stipulates 33% forest cover in plain areas. At the block level, Khorabar block has witnessed a notable surge in forest cover, rising from 1.38% of the total reported area in 2000-01 to 8.92% in 2020-21.

b. Area under Permanent Pastures (ΔPP)

The predominant ownership structure for this land type features two primary stakeholders: village Panchayats and the government. Private ownership constitutes a minor portion of the total land area. Notably, Panchayat-controlled lands are designated as "Common Property Resources." These pastures play a critical role in sustaining the livelihoods of pastoral communities and other marginalized populations. By the year 2020-21, the total land area classified under this category had expanded to approximately 313 hectares, representing 0.09% of the total area, compared to 169 hectares (0.05% of the total area) in 2000-01. During 2000-01, all blocks reported less than 0.3% of the total area designated for this land use category, with the Chargawan block being the only one surpassing 1% of the total area under this classification**.**

c. Area under Miscellaneous tree crops and groves (ΔMt)

This category encompasses land dedicated to orchards and fruit trees, much of which is privately owned. It's evident from Table 1 that the area under this classification represented 0.45% of the total area in 2000-01, which has since increased to approximately 1.00% of the total area in 2020-21. During this period, the Khorabar block accounted for the highest percentage of land under this category, while Jungle Kaudia had the lowest.

d. Barren and Unculturable Land (ΔB)

This classification pertains to land categorized as wasteland, including barren hilly terrains, desert lands, ravines, saline soil (usara land), etc., which typically cannot be cultivated with current technology. The area under this category has risen from 4047 hectares (1.21% of total area) in 2000-01 to 4300 hectares (1.28% of total area) in 2020-21.

The Agricultural Sector (ΔA)

a. Culturable Wasteland (ΔCW)

This classification encompasses land that has remained fallow for more than five years but retains the potential for cultivation through appropriate improvement practices. Within the study area, culturable wasteland constituted 1.03% (3464 hectares) of the total reported area in 2000-01. This figure rose to 1.83% (6124 hectares) in 2020-21, indicating a noteworthy increase over two decades. Notably, Khorabar had the highest proportion of land to the total reported area, accounting for 2.83% and 4.05% in 2000-01

and 2020-21, respectively. Table 2 and 3 reveal that all blocks experienced an expansion in the area under culturable wasteland relative to the total area, except for Pali, Piprauli, Kauriam, and Gola blocks, that witnessed a decline in this land classification.

b. Current Fallows (Δ F_c)

This refers to land left uncultivated for one agricultural year or less, as a practice to allow the land to rest and regain fertility through natural processes. The area under current fallows in the district has increased by approximately 48.08%, from 7963 hectares in 2000-01 to 11792 hectares in 2020-21. During the same period, Pali block (5.17%) and Barhalganj block (5.36%) accounted for the highest proportion of land to the total area, while Campierganj (0.51%) and Gola block (1.04%) had the lowest percentage of total area, respectively.

c. Fallow Land other than Current Fallows (Δ F_o)

This classification encompasses arable land that has been left fallow for a period exceeding one year but remains suitable for cultivation within a timeframe of less than five years. The area under this land use category increased from 9381 hectares in 2000-01 to 12098 hectares in 2020-21 (a rise of 28.96%). Pali, Sahjanwa, and Piprauli blocks witnessed a significant increase in the percentage of land under this category relative to the total reported area during the given time period.

d. Net sown area (ΔNSA)

The net sown area refers to the physical extent of land allocated for crop cultivation and subsequent harvesting. Gorakhpur district predominantly relies on agriculture, with over 70% of the total reported area falling under this category. However, there has been a declining trend in the area allocated to this category, accounting for approximately 77.88% of the total reported area in 2000-01, decreasing to 71.07% in 2020-21, resulting in a reduction of about 22,832 hectares within this time frame. Every block in the district has experienced a notable decrease in the area of land designated under this category from 2000-01 to 2020-21.

The Non-Agricultural Sector (ΔNA)

The non-agricultural sector encompasses the land utilized for purposes other than agriculture. This includes land designated for settlements (both rural and urban), infrastructure such as roads and canals, industrial areas, shops, and other similar purposesAn increase in secondary and tertiary activities generally results in a rise in this particular land use category. The area allocated to this category has witnessed a notable surge, increasing from 41,848 hectares (12.48% of the total reported area) in 2000-01 to 53,147 hectares (15.85% of the total reported area) in 2020-21. All blocks within the district have experienced an increment in the area designated under this category during this time frame.

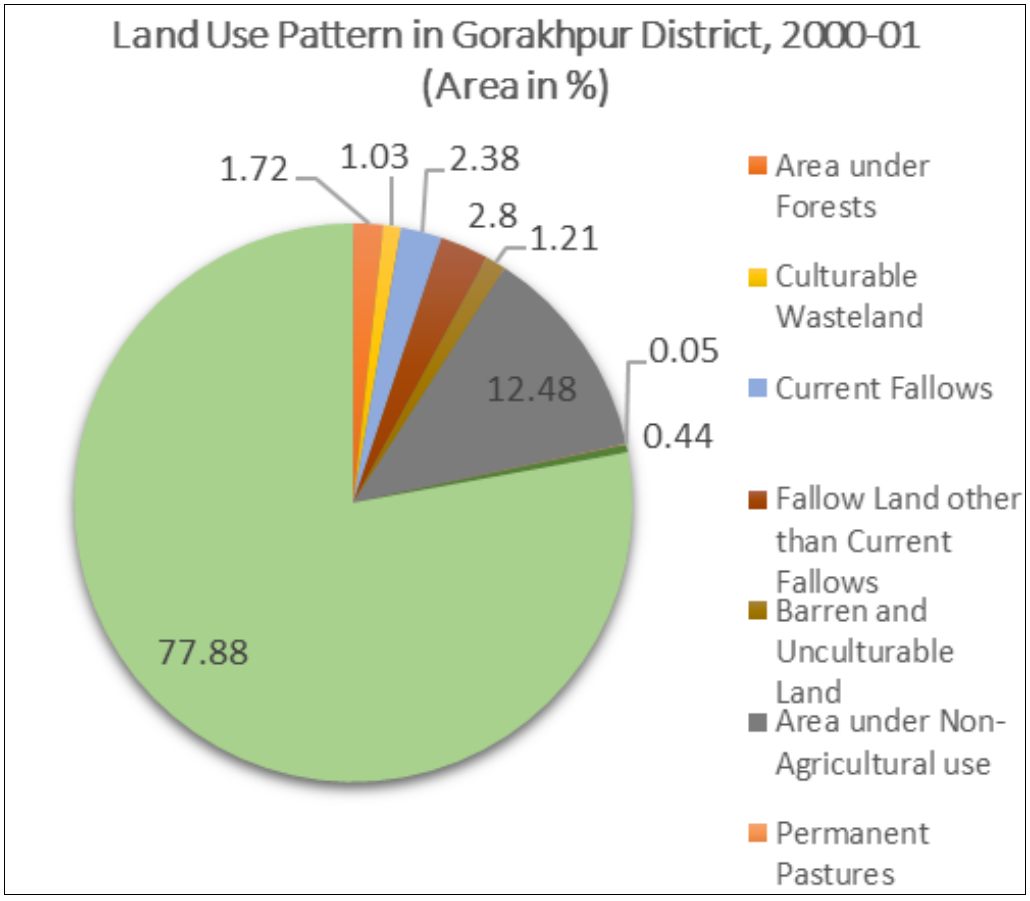

Fig 2: Land Use Pattern in Gorakhpur District, 2000-01

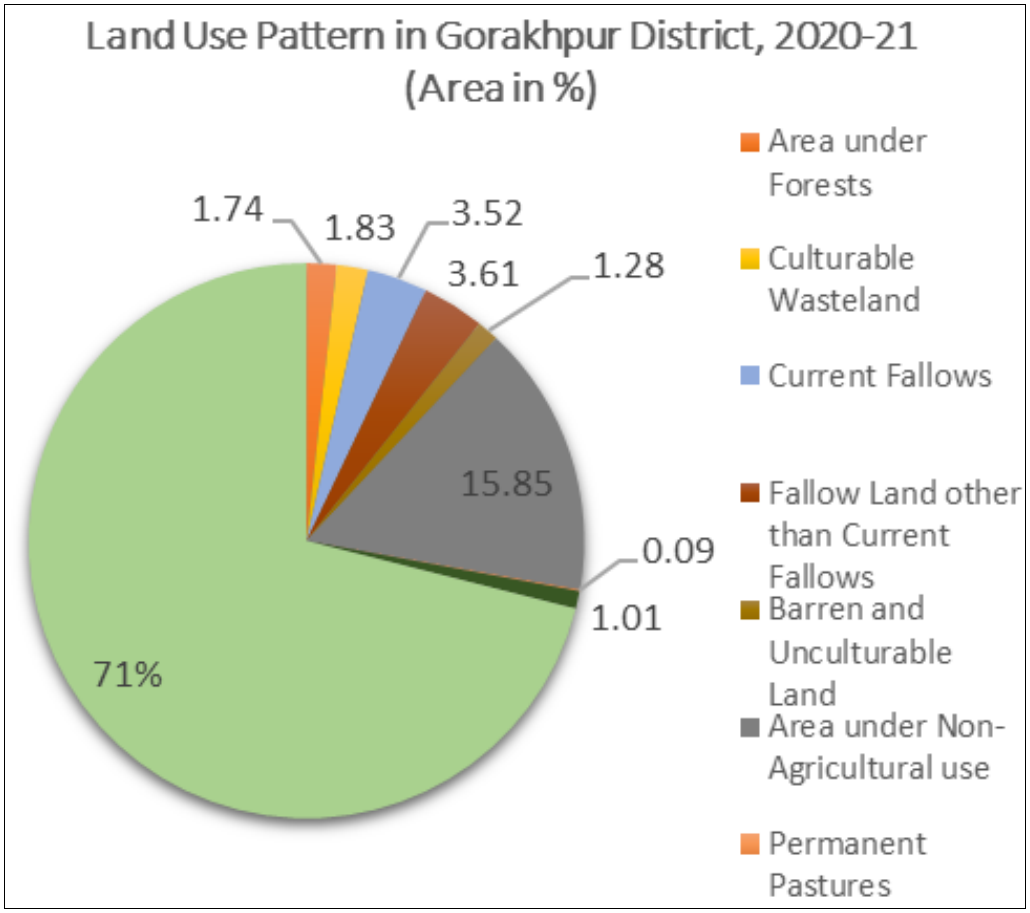

Fig 3: Land Use Pattern in Gorakhpur District, 2020-21

The desirable ecological sectors viz. Area under forests, permanent pastures and miscellaneous tree crops have witnessed a increase within the temporal frame indicating favourable ecological changes but the undesirable ecological sector namely, area under barren land has also witnessed a surge in this time period. These patterns of changes in land use are prone to causing significant ecological imbalances. The components of agricultural sector (ΔA) viz., Culturable Wasteland (ΔCW), Current Fallows (ΔF_c), Fallow Land other than Current Fallows (ΔF_o) have witnessed a remarkable surge in the areal extent but all this increment is at the sake of decline in the area under the Net sown area (ΔNSA) within the given time frame indicating an adverse impact on the agricultural sector in the years to come.

From the equation and values from the Table 1,

$\Delta R = \Delta E + \Delta A + \Delta NA$,

it is evident that the during the time period of 2000-01 to 2020-21, ΔE= 2321 ha, ΔNA= 11299 ha while there has been a significant decline in the value of ΔA= -13626, indicating a shift in land use from Net Area Sown to other categories that witnessed a surge. Much of the land under NSA has got converted into barren land, culturable wasteland, fallow land, land other than current fallows; indicating the prevalence of issue of land degradation in the district due to various factors. Some of the probable reasons for the reduction in Net Sown Area in the district can be comprehended as under:

a. The area has encountered more frequent occurrences of sudden flash floods, primarily because it depends on the river drainage network of Ghaghara, Rapti, Rohin, Kuano, and their respective tributaries. These rivers overflow during the rainy season and are susceptible to sudden rises in water levels, often triggered by water discharge from Nepal. Additionally, the rivers occasionally change their course, exacerbating the risk of flash floods, waterlogging, and land degradation, which in turn, adversely impacts the livelihoods of small and marginal farmers.
b. In recent years, the region has observed changes in the monsoon cycle, characterized by low-intensity rainfall followed by frequent dry spells. These changes have affected the cropping patterns of farmers, resulting in an increase in fallow, culturable wasteland, and barren land.
c. Issues such as soil erosion, waterlogging, salinization, inappropriate cropping methods, lack of diversified cropping systems, and untreated discharge from industries polluting groundwater (CGWB, 2013) have contributed to a decline in soil productivity and land use under NSA.
d. Furthermore, the region faces challenges stemming from increasing population, urbanization, industrialization, and infrastructural developments. These factors have led to improper and erratic conversion of agricultural land, posing severe threats to meeting the future food demand of the growing population.

Conclusion

Land plays a pivotal role as a finite natural resource on our planet, and it's crucial to grasp the trends in its utilization within the district, especially considering its implications for agriculture. Agriculture is the backbone of the district's

economy, and while various land use categories have shown an overall increase, the area designated as Net Sown Area has notably declined. This decline is indicative of escalating land degradation and developmental activities within the district.

Moreover, the study highlights a dual trend within the ecological sector: while areas like forests, permanent pastures, and miscellaneous trees and groves have expanded, there has been a simultaneous increase in barren and uncultivable land, potentially leading to adverse ecological outcomes in the future.

In the agricultural sector, the significance of wasteland, fallow land, and net sown area cannot be understated. The observed shift in land use patterns, with a decrease in net sown area and a rise in culturable wasteland and fallow land, underscores the urgency for immediate action and land reclamation initiatives. Furthermore, there has been a notable uptick in the area allocated for non-agricultural purposes.

Therefore, there's an urgent need for meticulous planning and effective implementation of strategies to ensure optimal land utilization. Reclaiming degraded and less fertile lands can be facilitated through the implementation of government schemes like the Deen Dayal Upadhyaya Kisan Samriddhi Yojana and sustained efforts by Bhoomi Sudhar Nigam. Promoting diversified cropping and raising awareness about optimal agricultural practices to improve soil fertility, alongside embracing technological advancements and modern agricultural techniques, are essential steps to address challenges like waterlogging and promote climate-resilient agriculture.

By swiftly adopting these measures, the district can meet the agricultural needs of its expanding population while ensuring sustainable land use practices that align with economic development and ecological preservation. This holistic approach will pave the way for the district's sustainable development in the long run.

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