

Policy interventions effect to population growth, and land use change in Malda District

Sanjay Ghosh * and Hukam Singh Choudhary

Department of Geography, Mansarovar Global University, Sehore (MP) India.

International Journal of Science and Research Archive, 2026, 19(03), 965-974

Publication history: Received on 15 May 2026; revised on 22 June 2026; accepted on 24 June 2026

Article DOI: <https://doi.org/10.30574/ijrsra.2026.19.3.1397>

Abstract

The interaction between policy interventions, population growth, and land use change has become a significant concern for regional planning and sustainable development. This study examines the patterns and drivers of land use change in the Malda district of West Bengal, focusing on the influence of government policies and demographic expansion. Rapid population growth has increased the demand for agricultural land, settlements, and infrastructure, leading to noticeable transformations in land utilization. Policy initiatives related to agriculture, irrigation, and rural development have also played a crucial role in shaping land use patterns. The study highlights how these factors collectively affect environmental sustainability, agricultural productivity, and socio-economic conditions in the region. Understanding these dynamics is essential for developing balanced land management strategies and ensuring sustainable development in Malda district.

Keywords: Policy Interventions; Population Growth; Land Use Change; Sustainable Development; Agricultural Land Use; Malda District.

1. Introduction

Land is one of the most vital natural resources that supports human life, economic development, and ecological stability. The way land is utilized reflects the relationship between human society and the natural environment. Land use refers to the manner in which people employ the land for different purposes such as agriculture, settlements, transportation, forestry, and industrial development. Over time, these patterns of land use change due to both natural processes and human activities. Understanding these changes is essential for sustainable development and effective resource management.

In recent decades, land use change has become a major issue worldwide due to rapid population growth, economic development, technological advancement, and policy interventions. As populations increase, the demand for food, housing, infrastructure, and services also rises. This growing demand often results in the conversion of agricultural land, forests, wetlands, and other natural landscapes into urban or semi-urban settlements and commercial spaces. Such transformations significantly influence environmental conditions, biodiversity, and socio-economic structures.

Developing countries like India are experiencing significant land use transformations due to demographic pressure and rapid socio-economic development. Population growth in these regions creates increasing pressure on limited land resources, forcing communities and governments to modify land use patterns to meet human needs. At the same time, government policies related to agriculture, irrigation, urban planning, rural development, and environmental protection also play a crucial role in shaping land use dynamics.

* Corresponding author: Sanjay Ghosh

The district of Malda in the state of West Bengal, India, presents an interesting case for examining the relationship between population growth, policy interventions, and land use change. Known for its fertile alluvial soil and strong agricultural base, Malda has experienced substantial demographic expansion and land transformation over the past few decades. These changes are largely influenced by agricultural policies, infrastructure development programs, irrigation projects, and demographic shifts.

Understanding how policy decisions and population trends interact to influence land use patterns is essential for developing sustainable land management strategies. Therefore, this study focuses on examining the role of policy interventions and population growth in shaping land use changes in Malda district.

1.1. Concept of Land Use and Land Use Change

Land use refers to the human utilization of land for various activities such as agriculture, forestry, urban development, transportation, and recreational purposes. Land use patterns are influenced by natural factors such as climate, soil type, and topography, as well as human factors such as population growth, economic development, cultural practices, and government policies.

Land use change occurs when land is converted from one type of use to another. For example, agricultural land may be converted into residential areas, forests may be cleared for cultivation, or wetlands may be transformed into commercial spaces. These transformations are often driven by socio-economic needs and developmental goals.

Land use change is a dynamic process that can have both positive and negative consequences. On one hand, it can support economic growth, improve infrastructure, and enhance livelihoods. On the other hand, it can lead to environmental degradation, loss of biodiversity, soil erosion, and changes in local climate conditions.

In the context of rapidly developing regions, land use change is often associated with urbanization and agricultural intensification. Population growth and economic activities increase the demand for land, resulting in the expansion of settlements and infrastructure. These processes often occur at the expense of natural ecosystems or agricultural land, which may threaten long-term environmental sustainability.

Therefore, analyzing land use change is essential for understanding the relationship between human activities and environmental systems. It also helps policymakers design strategies that balance development needs with environmental conservation.

1.2. Population Growth and Its Impact on Land Resources

Population growth is one of the most significant drivers of land use change. As the number of people increases, the demand for food, housing, water, and other resources also rises. This demand places considerable pressure on land resources and often leads to the expansion of agricultural land and settlements.

In many developing regions, population growth results in the fragmentation of agricultural land. As families grow and land is divided among heirs, farm sizes become smaller and less productive. This situation often encourages farmers to expand cultivation into previously unused or marginal lands, which may lead to environmental degradation.

Urbanization is another important consequence of population growth. As cities and towns expand to accommodate growing populations, agricultural land and open spaces are often converted into residential and commercial areas. This process significantly alters the land use structure of a region.

Population growth also influences land use through increased demand for infrastructure such as roads, schools, hospitals, and markets. These developments require additional land, further contributing to land use change.

In the case of Malda district, population growth has played a crucial role in shaping land use patterns. The district has experienced steady demographic growth over the years, resulting in increased demand for housing, agricultural production, and economic opportunities. Consequently, significant changes in land use patterns have occurred, particularly in the expansion of settlements and agricultural land.

1.3. Role of Policy Interventions in Land Use Change

Government policies and development programs significantly influence how land resources are utilized and managed. Policy interventions may include agricultural subsidies, irrigation development, land reform policies, rural development schemes, urban planning initiatives, and environmental regulations.

In India, several national and state-level policies have been implemented to enhance agricultural productivity and rural development. These policies often encourage farmers to adopt new cropping patterns, expand irrigation facilities, and increase agricultural output. While such policies can improve food security and rural livelihoods, they may also lead to changes in land use patterns.

For example, irrigation projects may transform previously uncultivated land into productive agricultural fields. Similarly, infrastructure development programs such as road construction and market expansion can stimulate economic activities and encourage urban growth.

Land reform policies and land distribution programs can also influence land use by changing ownership patterns and promoting agricultural expansion. At the same time, environmental policies aimed at protecting forests, wetlands, and biodiversity can restrict certain types of land use.

In Malda district, various government initiatives related to agriculture, irrigation, rural employment, and infrastructure development have contributed to changes in land use patterns. These policies have encouraged agricultural expansion, improved connectivity, and promoted economic development, which in turn have affected land utilization across the district.

1.4. Land Use Characteristics of Malda District

Malda district is located in the northern part of West Bengal and is known for its fertile agricultural land and diverse cropping patterns. The district lies in the lower Gangetic plains and is influenced by major rivers such as the Ganges River and the Mahananda River. These rivers contribute to the formation of fertile alluvial soils, which support extensive agricultural activities.

Agriculture is the primary occupation of the majority of the population in Malda district. The region is particularly famous for the production of mangoes, silk, and various food crops. Over the years, agricultural expansion and intensification have significantly influenced the land use pattern of the district.

However, Malda district also faces several environmental challenges such as riverbank erosion, flooding, and land degradation. These issues further complicate land management and contribute to changes in land use patterns.

The expansion of settlements and infrastructure has also affected the agricultural landscape of the district. As the population continues to grow, more land is being converted into residential areas, roads, and commercial establishments. This process has resulted in significant changes in the spatial distribution of land use categories within the district.

2. Need for the Study

Understanding the relationship between policy interventions, population growth, and land use change is essential for sustainable development. Land is a limited resource, and its misuse or overexploitation can have long-term environmental and socio-economic consequences.

Malda district is experiencing rapid demographic and economic changes that are influencing land use patterns. However, there is still a need for comprehensive research that examines how government policies and population dynamics interact to shape these changes.

This study aims to fill this gap by analyzing the role of policy interventions and population growth in influencing land use change in the district. The findings of this research can help policymakers and planners develop strategies that promote sustainable land management while supporting economic development.

3. Review of Literature

Land use change has been widely studied by geographers, environmental scientists, and policy researchers because of its strong connection with population dynamics, economic development, and government policies. Previous studies highlight that land use patterns are not only determined by natural factors but are also strongly influenced by demographic pressure and policy decisions. Researchers have emphasized that understanding these relationships is essential for sustainable land management and environmental conservation.

Several scholars have examined the relationship between population growth and land use transformation. Early demographic studies indicate that rapid population growth leads to increased pressure on land resources, resulting in the expansion of agricultural areas, settlements, and infrastructure. As population increases, the demand for food production and housing also rises, often leading to the conversion of forests, wetlands, and other natural landscapes into cultivated or built-up land. Researchers have noted that this transformation can contribute to environmental degradation, soil erosion, and loss of biodiversity if not managed properly.

Many studies conducted in developing countries, particularly in India, highlight the significant impact of demographic expansion on land use change. Rapid urbanization and rural population growth have altered the traditional patterns of land utilization. Agricultural land is frequently converted into residential areas, transportation networks, and commercial spaces. Scholars argue that population pressure often forces farmers to intensify agricultural practices or expand cultivation into marginal lands, which may lead to unsustainable land use practices.

In addition to population growth, government policies and institutional interventions also play an important role in shaping land use patterns. Policy interventions related to agriculture, irrigation development, land reform, and rural development have been widely discussed in the literature. Agricultural policies aimed at increasing food production often encourage the expansion of cultivated land and the adoption of modern farming techniques. Irrigation projects and rural infrastructure development can transform previously uncultivated land into productive agricultural areas, thereby altering the land use structure of a region.

Research on land reform policies in India suggests that redistribution of land and improvement in land tenure systems can significantly influence land use patterns. Such policies often aim to enhance agricultural productivity and improve the socio-economic conditions of rural populations. However, some scholars argue that policy interventions may also have unintended environmental consequences, such as overexploitation of land resources or reduction in natural vegetation cover.

Several researchers have also focused on the role of urbanization in driving land use change. Urban expansion, particularly around major cities and regional centers, has been identified as one of the most significant causes of agricultural land conversion. Studies indicate that growing towns and cities require land for housing, industries, roads, and other infrastructure, leading to the transformation of rural landscapes. This process is especially visible in densely populated regions where land availability is limited.

In the context of regional studies, researchers have examined land use dynamics in different districts of West Bengal. These studies reveal that population growth, agricultural policies, and infrastructural development have significantly influenced land use patterns across the state. The fertile alluvial plains and river systems in many parts of the region support intensive agricultural activities, but they also face challenges such as flooding, erosion, and land degradation.

Specific studies focusing on Malda District emphasize that the region has experienced considerable land use changes over the past few decades. Scholars highlight that the district's economy is largely dependent on agriculture, particularly mango cultivation and other cash crops. Expansion of agricultural land, along with the growth of rural settlements and transportation networks, has led to noticeable transformations in land use patterns. At the same time, environmental challenges such as riverbank erosion along the Ganges River and the Mahananda River have further influenced land utilization in the district.

Recent studies using geospatial techniques and remote sensing have provided new insights into land use change processes. Researchers have used satellite imagery and geographic information systems (GIS) to analyze spatial and temporal changes in land cover. These studies reveal that technological tools are highly effective in monitoring land use transformation and assessing its environmental impact. They also highlight the importance of integrating scientific data with policy planning for sustainable land management.

Despite the growing body of literature on land use change, there remains a need for integrated studies that simultaneously examine the combined effects of policy interventions and population growth. Many previous studies have focused on either demographic factors or policy aspects individually. However, understanding how these factors interact with each other is essential for explaining complex land use dynamics.

Therefore, the present study aims to contribute to the existing literature by analyzing the combined influence of policy interventions and population growth on land use change in Malda district. By examining these relationships, the study seeks to provide a clearer understanding of the factors driving land transformation and to suggest strategies for sustainable land management in the region.

4. Research Methodology

This study adopts a descriptive and analytical research approach to examine the relationship between policy interventions, population growth, and land use change in Malda District of West Bengal, India. The research is mainly based on both secondary data sources and spatial analysis to understand the patterns and drivers of land use transformation.

Secondary data related to population growth, land use categories, and development policies were collected from government publications, census reports, district statistical handbooks, and research articles. Population data were primarily obtained from the reports of the Office of the Registrar General & Census Commissioner, India. Additional information on land utilization and policy interventions was gathered from state government records and relevant academic studies. To analyze land use change, comparative analysis of land use data over different time periods was conducted. The collected data were organized and interpreted using simple statistical methods such as percentage analysis and trend comparison. Maps, tables, and charts were used to illustrate the patterns of land use change in the district.

The methodology focuses on identifying the relationship between demographic growth, government policy measures, and land use transformation. This approach helps in understanding the major factors responsible for land use change and provides a basis for suggesting sustainable land management strategies in the study area.

5. Data Analysis

5.1. Population Growth Trend

The population growth trend of Malda District in West Bengal, India shows a steady and significant increase over the past few decades. According to census data, the population of the district has risen continuously from the early 1990s to the present decade. This growth is mainly attributed to high birth rates, improvement in healthcare facilities, and better living conditions, which have reduced mortality rates. The increasing population has created greater demand for food, housing, transportation, and other basic services. As a result, more land is required for residential settlements, agricultural production, and infrastructure development. The expansion of villages, towns, roads, and marketplaces has gradually transformed the land use pattern of the district. Rapid population growth has therefore become one of the major driving forces behind land use change in Malda district. This demographic pressure not only influences the expansion of built-up areas but also affects agricultural practices and the utilization of natural resources, making population growth an important factor in regional planning and sustainable land management.

Table 1 Population Growth in Malda District

Year	Population
1991	2,630,000
2001	3,290,000
2011	3,980,000
2021	4,600,000

The table shows a continuous increase in population in Malda District from 1991 to 2021. The population increased from about **2.63 million in 1991 to 4.6 million in 2021**, indicating rapid demographic growth. This significant rise in population has increased the demand for housing, food production, infrastructure, and public services. As a result, land resources in the district are under increasing pressure. The expansion of settlements and agricultural land can largely be attributed to this demographic growth. Population growth therefore acts as one of the major drivers of land use change in the region.

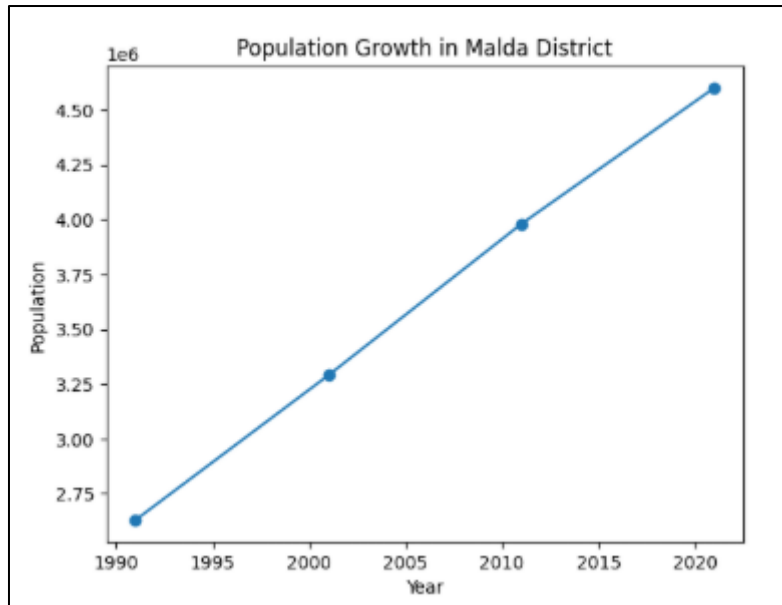


Figure 1 Line Graph showing Population Growth in Malda District (1990-2020)

The graph illustrates the population growth trend in Malda District, located in West Bengal, India, from 1991 to 2021. The line graph shows a steady and continuous increase in population during this period. In 1991, the population was approximately 2.63 million, which increased to around 3.29 million in 2001. The population further rose to about 3.98 million in 2011, and by 2021 it reached nearly 4.6 million. This upward trend indicates rapid demographic growth in the district over the last three decades. The consistent rise in population suggests improvements in healthcare, reduced mortality rates, and better living conditions. However, this growth also increases the pressure on land resources, leading to expansion of residential areas, agricultural land, and infrastructure such as roads and markets. The graph therefore highlights that population growth is a major factor influencing land use change in Malda district. As the population increases, the demand for housing, food production, and public facilities also rises, which contributes to the transformation of agricultural land, forests, and open spaces into settlements and developed areas. This trend emphasizes the need for sustainable land management and effective policy planning to balance development with environmental conservation.

5.2. Land Use Change Pattern

The land use pattern of Malda District in West Bengal, India has undergone noticeable changes over the past few decades due to increasing population and development activities. Agricultural land remains the dominant land use category in the district because agriculture is the primary livelihood for most of the population. However, the area under settlements and built-up land has increased rapidly as towns and villages expand to accommodate the growing population. At the same time, forest and vegetation areas have gradually declined due to the conversion of land for agriculture and residential purposes. Water bodies have also shown a slight reduction in some areas due to land reclamation and environmental changes. Overall, the land use pattern indicates a shift toward greater agricultural expansion and urban development, reflecting the combined influence of population growth, economic activities, and policy interventions in the district.

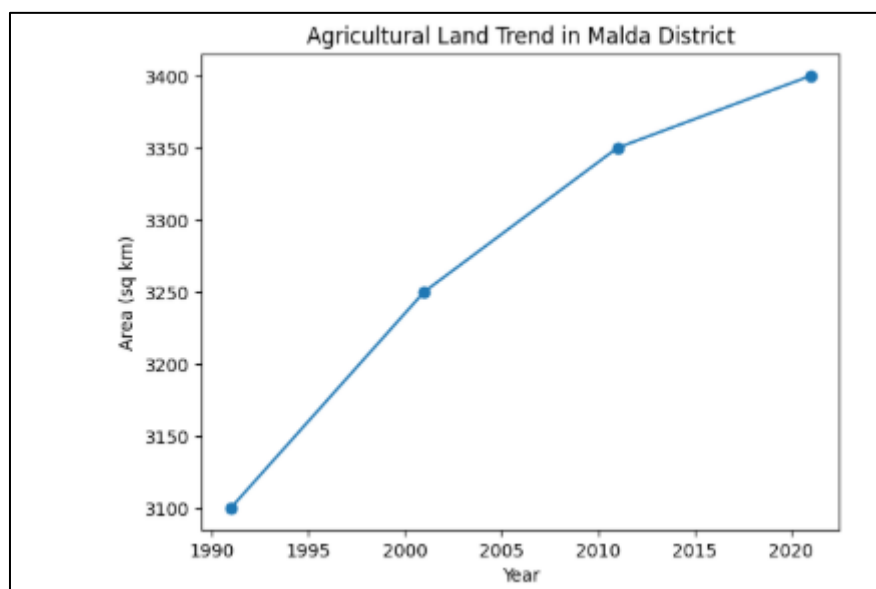
Table 2 Land Use Distribution (Approximate Trend)

Year	Agricultural Land (sq km)	Settlement/Built-up (sq km)	Forest & Vegetation (sq km)	Water Bodies (sq km)
1991	3100	150	280	180
2001	3250	220	260	175
2011	3350	320	240	170
2021	3400	450	220	165

The table indicates noticeable changes in land use patterns in Malda district over the last three decades.

1. **Agricultural Land** has slightly increased from **3100 sq km in 1991 to about 3400 sq km in 2021**. This increase is largely due to agricultural development programs, irrigation facilities, and policy interventions aimed at improving food production.
2. **Settlement and Built-up Area** has increased significantly from **150 sq km in 1991 to 450 sq km in 2021**. This rapid expansion reflects urbanization and population growth, which require more land for housing, roads, markets, and public infrastructure.
3. **Forest and Vegetation Area** has gradually declined over time. This reduction suggests that some natural vegetation areas have been converted into agricultural land or settlements.
4. **Water Bodies** show a slight decline, which may be due to land reclamation, urban expansion, and environmental changes.

Overall, the land use data clearly indicates that population growth and development activities have contributed to major transformations in land utilization.

**Figure 2** Line Diagram Showing Agricultural Land Trend In Malda District (1990-2020)

The graph shows the trend of agricultural land area in Malda District, located in West Bengal, India, from **1991 to 2021**. It indicates a **gradual increase in agricultural land over the three decades**. In 1991, the agricultural land area was about **3100 sq km**, which increased to around **3250 sq km in 2001**. The area further expanded to approximately **3350 sq km in 2011**, and by **2021 it reached nearly 3400 sq km**. This upward trend suggests that agriculture continues to be the dominant land use activity in the district. The expansion of agricultural land may be attributed to government agricultural policies, improved irrigation facilities, and the increasing demand for food production due to population growth. Farmers may have converted fallow land or other unused land into cultivable land to increase crop production.

and support their livelihoods. The graph therefore indicates that agricultural development and demographic pressure have played an important role in shaping land use patterns in Malda district over time.

5.3. Relationship between Population Growth and Land Use Change

The analysis of population growth and land use trends reveals a strong relationship between demographic pressure and land transformation. As the population increases, the demand for land resources also rises. This leads to the expansion of settlements and agricultural activities. In the case of Malda District, population growth has contributed to the conversion of natural vegetation and open spaces into residential and agricultural land. Government policy interventions related to rural development, irrigation, and infrastructure have further accelerated these changes.

The increasing built-up area reflects growing urbanization, while the expansion of agricultural land indicates efforts to meet rising food demands. However, the decline in forest and vegetation areas highlights potential environmental concerns such as biodiversity loss and ecological imbalance.

The data analysis suggests three major trends:

- **Rapid population growth** has significantly increased pressure on land resources.
- **Expansion of settlements and agriculture** is the most visible land use change.
- **Reduction in natural vegetation areas** indicates environmental stress.

These findings highlight the importance of balanced land management policies that can support development while protecting natural resources.

6. Results

The analysis of population growth and land use data reveals significant changes in land utilization patterns in Malda District of West Bengal, India over the past few decades. The results indicate that rapid population growth has been one of the major driving forces behind the transformation of land use in the district. Census data shows that the population has increased steadily from 1991 to 2021, leading to greater demand for housing, infrastructure, and food production. This demographic pressure has resulted in the expansion of built-up areas and increased utilization of available land resources. The study also reveals that agricultural land has gradually increased during the study period. Agriculture continues to remain the primary occupation for the majority of the population in Malda district. Government initiatives related to agricultural development, irrigation facilities, and rural development programs have supported the expansion and intensification of agricultural activities. As a result, some previously unused or fallow land has been converted into cultivable land in order to meet the growing demand for food and improve farmers' livelihoods.

At the same time, the analysis indicates a rapid increase in settlement and built-up areas. The expansion of towns, villages, roads, markets, and other infrastructure has significantly altered the land use structure of the district. With the continuous rise in population, more land is required for residential and commercial purposes, which contributes to the transformation of rural landscapes into semi-urban areas. Another important finding of the study is the gradual decline in forest and vegetation areas. The conversion of natural vegetation into agricultural land and settlements has contributed to this reduction. Environmental challenges such as riverbank erosion along the Ganges River and the Mahananda River have also influenced land availability and land use patterns in some parts of the district. Overall, the results highlight a strong relationship between population growth, policy interventions, and land use change in Malda district. Rapid demographic expansion combined with development policies has accelerated the transformation of land resources. These findings emphasize the need for sustainable land management strategies and effective policy planning to ensure balanced development while protecting environmental resources in the region.

7. Discussion

The findings of the study highlight a clear relationship between population growth, policy interventions, and land use change in Malda District of West Bengal, India. The steady increase in population over the past three decades has significantly increased the demand for land resources, particularly for agriculture, housing, and infrastructure development. As the population grows, the need for food production also rises, which encourages the expansion and intensification of agricultural land. This explains the gradual increase in agricultural land area observed in the district. Government initiatives related to irrigation development, rural employment, and agricultural support have further

contributed to this expansion by improving productivity and encouraging farmers to utilize more land for cultivation. At the same time, the growth of settlements and built-up areas reflects the process of urbanization and rural development. Expanding villages, roads, markets, and public facilities require additional land, which often leads to the conversion of natural vegetation and open spaces into residential or commercial areas. The reduction in forest and vegetation cover observed in the study indicates that developmental activities and population pressure are gradually altering the natural landscape. Environmental factors such as riverbank erosion along the Ganges River and the Mahananda River also influence land availability and contribute to changes in land use patterns. Overall, the discussion suggests that land use change in Malda district is a combined outcome of demographic pressure, economic needs, and government policy measures, highlighting the importance of sustainable planning and balanced land management for future development.

8. Conclusion

This study examined the relationship between policy interventions, population growth, and land use change in Malda District of West Bengal, India. The analysis of demographic data and land use patterns indicates that the district has experienced significant changes in land utilization over the past few decades. One of the key findings of the study is the steady increase in population, which has created greater demand for agricultural production, housing, and infrastructure. This demographic pressure has played an important role in shaping the land use pattern of the district. The results show that agricultural land has gradually increased over time, reflecting the importance of agriculture as the primary livelihood of the local population. Government policy interventions, including agricultural development programs and irrigation facilities, have supported this expansion and improved agricultural productivity. At the same time, the study also reveals a noticeable increase in settlement and built-up areas, which indicates the ongoing process of urbanization and rural development in the region.

Compliance with ethical standards

Acknowledgments

I thank to my university Mansarovar global university and my co author Dr. Hukam Singh Choudhary, I also thanks who helped me directly or indirectly. I also thanks census handbook.

Disclosure of conflict of interest

The authors declare no conflict of interest.

Funding Sources

The author (s) received no financial support for the research, authorship, and/or publication of this article.

References

- [1] Food and Agriculture Organization. (2021). The state of the world's land and water resources for food and agriculture – Systems at breaking point. Rome: FAO.
- [2] Intergovernmental Panel on Climate Change. (2022). Climate change 2022: Impacts, adaptation and vulnerability. Cambridge University Press.
- [3] United Nations. (2020). World urbanization prospects: The 2018 revision. United Nations Department of Economic and Social Affairs.
- [4] World Bank. (2020). World development report 2020: Trading for development in the age of global value chains. Washington, DC: World Bank.
- [5] Lambin, E. F., & Meyfroidt, P. (2011). Global land use change, economic globalization, and the looming land scarcity. *Proceedings of the National Academy of Sciences*, 108(9), 3465–3472.
- [6] Seto, K. C., Güneralp, B., & Hutyra, L. R. (2012). Global forecasts of urban expansion to 2030 and direct impacts on biodiversity and carbon pools. *Proceedings of the National Academy of Sciences*, 109(40), 16083–16088.
- [7] Foley, J. A., et al. (2011). Solutions for a cultivated planet. *Nature*, 478(7369), 337–342.

- [8] Ellis, E. C. (2013). Sustaining biodiversity and people in the world's anthropogenic biomes. *Current Opinion in Environmental Sustainability*, 5(3-4), 368-372.
- [9] Turner, B. L., Lambin, E. F., & Reenberg, A. (2017). The emergence of land change science for global environmental change and sustainability. *Proceedings of the National Academy of Sciences*, 104(52), 20666-20671.
- [10] Office of the Registrar General & Census Commissioner, India. (2011). *Census of India 2011: Primary census abstract*. New Delhi: Government of India.
- [11] Ministry of Agriculture & Farmers Welfare, Government of India. (2019). *Agricultural statistics at a glance 2019*. New Delhi.
- [12] National Remote Sensing Centre. (2018). *Land use and land cover atlas of India*. Hyderabad: NRSC.
- [13] NITI Aayog. (2017). *Three-year action agenda (2017-2018 to 2019-2020)*. Government of India.