

AGRI MAGAZINE

(International E-Magazine for Agricultural Articles) Volume: 02, Issue: 05 (May, 2025) Available online at http://www.agrimagazine.in [©]Agri Magazine, ISSN: 3048-8656

Effects of Land Use Changes on Ecosystem Prabha Sai Mutya Vineela¹, Amardeep¹, Sugavaneshwaran Kannan² and ^{*}Yogesh Shaniware³

 ¹M.Sc. (Environmental Science and Technology), Institute of Environment and Sustainable Development, Banaras Hindu University, Varanasi-221005, India
²Ph.D. Scholar, Division of Agricultural Physics, IARI, New Delhi-110012, India
³Ph.D. Scholar, Department of Genetics and Plant Breeding, University of Horticultural Sciences, Bagalkot, Karnataka, India-587104
*Corresponding Author's email: yogeshshaniware1@gmail.com

Land use change, which refers to how land has been utilized and typically highlights the land's functional role for economic activities, is the process by which human activities alter the natural landscape. Changes in land use are frequently nonlinear and have the potential to stress living circumstances, endanger vulnerable individuals, and cause systemic feedbacks. Human well-being is impacted by changes in ecosystem services and land use, which are interdependent. The impact of LUC on ecosystem



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service providing as a result of agricultural production and hydrological system mismatches. We come to the conclusion that the assessment and measurement of LUC's impact on ecosystem service management are important, and we suggest further lines of inquiry. The majority of research indicates that LUC has a detrimental effect on ecosystem services.

Keywords: Land Use Changes, Ecosystem, Hydrological System, Human life.

Land Use Change?

Land use is a significant manmade alteration that has changed the earth's surface and impacted all of its biological processes. To mitigate the effects of human-environment interactions, it is therefore crucial to comprehend the effects of land use change, or "land use science." Since land use change (LUC) is a major driver of changes in both the natural environment and human activities, it needs to be precisely measured in order to assess the effects of these changes (**Hasan** *et al.*, **2020**). LUC entails a variety of surface changes on the planet. Land cover changes are included in LUC since the term encompasses changes that do not include later human usage of the land. Regarding sustainable development, LUC has a significant impact on global climate change and the environmental responses that follow (**Abd El-Kawy** *et al.*, **2011**). Due to population expansion and changes in lifestyle brought about by income growth, the majority of emerging nations are experiencing fast LUC. Enhancing our knowledge of LUC is essential to comprehending these effects, supporting present ecosystem management and directing future studies.

Land Use Affects Ecosystem Service

Numerous effects of land use change on ecosystem services can occur, frequently deteriorating the ones that are most vital to human welfare. Changes in land use usually affect

the supply of services by changing the resources' accessibility and availability. For example, deforestation for agricultural expansion may initially increase the supply of crops but can reduce the availability of forest products such as timber and medicinal plants (Huang H, et al., 2024). Likewise, land drainage for urban growth can change hydrological cycles, affecting local communities' access to freshwater. Land use changes are especially important for regulating services like flood control, air purification, and climate regulation. For example, by releasing stored carbon into the atmosphere, deforestation adds to carbon emissions and climate change. A higher risk of flooding can result from the disruption of natural flood mitigation processes caused by the conversion of wetlands for agricultural purposes. Urbanization also frequently results in higher levels of air and water pollution, which further interferes with these regulating services. Land use changes have a significant impact on cultural services as well. When natural landscapes are altered for mining, urbanization, or agriculture, places with significant recreational, spiritual, or aesthetic value are frequently lost. Opportunities for leisure, travel, and cultural expression are offered by forests, wetlands, and natural parks (Shang et al., 2025). However, considered the following five services as the thematic Ecological Service: i) capturing carbon (through soil and vegetation) as a part of climate regulation; ii) biodiversity; iii) hydrological (by regulating, and preserving surface and ground water); iv) landscape services (landscape beauty and recreation); and v) soil (formation of soil).

Impact of Land Use Change on Agricultural Productivity

Since agricultural land is one of the most vital provisioning services in a nation, it is a crucial part of its ecological environment and needs to be managed sustainably to feed people and protect the environment. According to some researchers, LUC brought on by fast urbanization reduced the amount and general quality of agricultural land. As a result, agricultural ecosystems are now providing fewer food provisioning services. The distribution of water resources has also led to disputes between land uses as a result of LUC. Additionally, LUC and human activity have contributed to climate change and environmental stressors that reduce a variety of provisioning and regulating ecosystem services, including food production, carbon sequestration, and water flow regulation (Revers et al., 2009). Furthermore, climate change is putting significant strain on grasslands and forests. For instance, the impact of LUC on precipitation and evaporation on the water cycle has impacted the water yield of both forests and grasslands. The water yield of both forest and grassland ecosystems has been altered by LUC from grassland to forest through afforestation and reforestation. Large-scale urbanization in the recent past has increased resource consumption, reduced biodiversity, and destroyed habitat due to LUC. However, under various conditions, LUC decisions contributed to the preservation of ESSs by expanding protected areas and conservation tactics.

Challenges

There are many issues associated with land use change, such as resource competition, biodiversity loss, and environmental degradation. Climate change, urbanization, and population growth are some of the factors that make these problems worse because they all increase the demand for land.

1. Environmental Degradation: Agricultural productivity and the general health of ecosystems can be impacted by changes in land use, especially unsustainable practices like intensive agriculture and deforestation, which can cause soil erosion, organic matter loss, and decreased soil fertility. Carbon dioxide and other greenhouse gases are released by deforestation and changes in land cover, aggravating climate change and its related effects, such as sea level rise and extreme weather. Also, water sources may become contaminated by deforestation and agricultural runoff, resulting in decreased water quality and availability that affects ecosystems and human health (Nesa et. al., 2024).

Framework for the impacts of land use change, including cover change) and climate variations on human well-being through alteration of ecosystem services (**Deng** *et. al.*, **2013b**).



2. Biodiversity Loss: The loss of habitat and biodiversity can result from the fragmentation of ecosystems caused by the conversion of land from natural habitats to urban areas, agricultural fields, or other uses. Biodiversity and ecosystem services may be impacted by species decline and extinction as a result of habitat loss and other environmental degradation brought on by changes in land use. Pollination, water purification, and carbon sequestration are examples of vital ecosystem services that can be negatively impacted by biodiversity loss, which can have an effect on both the environment and human wellbeing (Franco *et al.*, 2023).

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Future Perspectives

Future projections of land use change include the effects of ecological protection laws, possible changes in agricultural land, and ongoing urban growth. Carbon sequestration, biodiversity, and ecosystem services may all be significantly impacted by these changes.

- 1. Forecasts indicate that urban areas will continue to expand, possibly at the expense of natural areas. This growth may result in more pollution and resource consumption, as well as a decline in biodiversity and natural habitats.
- 2. Depending on a number of variables, such as population growth, dietary shifts, and climate change, agricultural land may expand or contract. Crop rotation and soil conservation are two sustainable agricultural techniques that can lessen these risks.
- 3. Pollination, nutrient cycling, water purification, and other ecosystem services can all be significantly impacted by changes in land use. These services may be lost when ecological land is converted to urban or agricultural uses, which may have detrimental effects on the environment and human well-being.
- 4. Land use changes can be influenced by socioeconomic factors like globalization, urbanization, and population growth. Land use patterns can also be impacted by technological developments, such as the creation of new farming methods.

Conclusions

The fastest rate of land degradation occurs when land use shifts to continuous cropping. There is a real connection between poverty and land degradation, which is exacerbated by gender inequality. The cycle of poverty and land degradation can be broken. Farmers make investments in soil management as the agricultural industry grows more lucrative and other circumstances improve. Programs and policies could have a significant impact during this transitional phase, when short- to medium-term returns on soil investment could be realized. The marginal areas where environmental and human system vulnerability overlap are where the situation is most dire. The expansion of the mixed crop-livestock system puts even more people at risk of decreased productivity and wildly fluctuating rainfall in this area.

References

- 3. Hasan, S. S., Zhen, L., Miah, M. G., Ahamed, T., & Samie, A. (2020). Impact of land use change on ecosystem services: A review. *Environmental Development*, *34*, 100527.
- 4. Abd El-Kawy, O. R., Rød, J. K., Ismail, H. A., & Suliman, A. S. (2011). Land use and land cover change detection in the western Nile delta of Egypt using remote sensing data. *Applied geography*, *31*(2), 483-494.
- 5. Huang, H., Xue, J., Feng, X., Zhao, J., Sun, H., Hu, Y., Ma, Y. (2024). Thriving arid oasis urban agglomerations: Optimizing ecosystem services pattern under future climate change scenarios using dynamic Bayesian network. Journal of Environmental Management 350:119612.
- 6. Shang, B., (2025). The interplay of land use change and ecosystem service sustainability. *Ukrainian Journal of Ecology*. 15:1-3.
- 7. Reyers, B., O'Farrell, P. J., Cowling, R. M., Egoh, B. N., Le Maitre, D. C., & Vlok, J. H. (2009). Ecosystem services, land-cover change, and stakeholders: finding a sustainable foothold for a semiarid biodiversity hotspot. *Ecology and Society*, *14*(1).
- 8. Nesa, M. M., Propa, S. M., Sen, S., & Abdullah, H. M. (2024). Land Use Change and Soil Erosion: Challenges and Way Forward to Management. In *Climate Change and Soil*-

Water-Plant Nexus: Agriculture and Environment (pp. 547-571). Singapore: Springer Nature Singapore.

- Franco, A.L., Carvalho, R.L., Andresen, E. *et al.* Dung beetle morphological traits show intraspecific differences among four land uses in the *Cerrado* biome. *J Insect Conserv* 27, 97–106 (2023).
- 10. de Jong, L., De Bruin, S., Knoop, J., & van Vliet, J. (2021). Understanding land-use change conflict: A systematic review of case studies. *Journal of Land Use Science*, 16(3), 223-239.