



EFFECTS OF LAND DEGRADATION ON SUSTAINABILITY OF MOUNTAINOUS SETTLEMENTS IN PERI-URBAN IBADAN, NIGERIA

ABSTRACT

This study investigates the effects of land degradation on the sustainability of mountainous settlements in the peri-urban areas of Eleyele, Adetokun, Alafara, and Ologuneru in Ibadan. The research aims to assess how environmental changes impact the quality of life and overall sustainability in these regions. Methodologically, a structured survey was administered to a sample of 346 residents across

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DOI: <https://doi.org/10.70382/tijbees.v06i4.004>

Introduction

The peri-urban areas are characterized by a complex interplay of urban expansion and rural dynamics, in some cases, situated within a mountainous context. Rajendra et al. ((2024). These regions are undergoing rapid transformations due to increased population pressure, economic development, and infrastructural growth. Varkey & Manasi, (2019). This transformation often brings about significant land-use changes that can lead to land degradation, impacting the sustainability of local settlements. Sahana et al. (2023).



these settlements, with a high response rate of 325 completed surveys, resulting in an effective response rate of 94%. The survey sought to capture residents' perceptions of their living conditions, the impact of land degradation, and the general sustainability of their environment. The findings reveal that a significant majority, 87.6%, of respondents expressed satisfaction with their living conditions in the study area, indicating a positive perception despite challenges. Conversely, 22.4% of respondents reported dissatisfaction, highlighting areas for improvement. The study identified several key issues related to land degradation. The hilly terrain in these areas is notably prone to flooding, which can exacerbate the effects of land degradation and increase the vulnerability of the settlements. However, these regions also benefit from certain environmental advantages, such as reduced exposure to heat waves compared to lower-lying areas. This can contribute to a more comfortable living environment and partially offset some of the adverse impacts associated with land degradation. In conclusion, while land degradation in Eleyele, Adetokun, Alafara, and Ologuneru presents challenges, including susceptibility to flooding, residents generally maintain a positive outlook on their living conditions. The lower incidence of heat waves in these mountainous areas offers some relief. Addressing the impacts of land degradation through targeted interventions can enhance sustainability and improve overall resident satisfaction.

Key Words: Land Degradation, Mountainous Settlements, Peri-Urban Areas, Sustainability

Mountains are beneficial. Mastrojeni, (2023). They provide a critical ecosystem services that are essential for environmental health and human well-being. Price, (2022). Mountains serves as crucial water sources, biodiversity hotspots, and climate regulators. They capture and store freshwater, which is vital for drinking, agriculture, and hydropower, additionally, they support a diverse range of species and play a key role in climate regulation by influencing weather patterns and acting as carbon sinks. Fransen, (2023).



According to United Nations 2022 report, mountains provide direct sustenance to 1.1 billion of people around the world, home to 15% world population, 60 – 80% world freshwater, high quality food production and accounts for 15 - 20% of world's tourism. Others include; its role in provision of renewable energy, 20 species of plants that supplies good food all over the world have their source from the mountains. Mountains hold cultural values. United Nations (2022).

Land degradation refers to the deterioration of the quality of land in terms of its productivity, biodiversity, and ecosystem services. Adewoyin et al. (2024a). In mountainous regions, the effects of land degradation can be particularly severe due to the fragile nature of the ecosystem and the steep terrain, which exacerbates erosion and soil loss. Romeo et al. (2022). The sustainability of mountainous settlements is intricately linked to the health of the land on which they depend for food, water, and livelihoods. Govern d'Andora, (2023).

Land degradation in the peri-urban mountainous areas can result from several factors, including deforestation, expansion of agricultural activities, and urban sprawl. These activities disrupt natural land cover, leading to soil erosion, reduced soil fertility, and diminished water resources. As these areas transit from primarily rural to more urbanized environments, the pressure on land and resources intensifies, increasing the risks of degradation. Adewoyin et al. (2024b).

The loss of biodiversity is another significant consequence of land degradation in mountainous settlements. As natural habitats are degraded or destroyed, plant and animal species lose their homes and food sources, leading to declines in species richness and ecosystem resilience. Ekka et al. (2023). This can have far-reaching implications for ecosystem services such as pollination, pest control, and soil fertility, which are crucial for supporting agricultural production and maintaining the overall health of the ecosystem. In mountainous regions where biodiversity is already under pressure due to factors such as climate change and habitat fragmentation, the additional stress of land degradation can further exacerbate the loss of species and ecosystem functions. Rudgley & Sega, (2022).

The social and cultural fabric of mountainous settlements can also be impacted by land degradation. EU Science Hub, (2018). As agricultural



productivity declines and water resources become scarce, local communities may face increased competition for dwindling resources, leading to conflicts over land use and water rights. Traditional land management practices and knowledge systems may become less effective in the face of changing environmental conditions, further undermining the resilience of mountain communities. Jiao et al. (2024). Additionally, as the natural landscape is degraded, the aesthetic and recreational value of the mountains may be diminished, impacting tourism and recreational activities that contribute to local economies. Dakka, (2013).

In order to address the effects of land degradation on the sustainability of mountainous settlements, holistic and integrated approaches to land management are needed. This may include promoting sustainable agricultural practices such as agroforestry, terracing, and crop rotation to reduce erosion and improve soil fertility. Restoring degraded landscapes through reforestation, soil conservation measures, and watershed management can help to enhance water availability and quality, while also supporting biodiversity conservation. Mason et al. (2022). Engaging local communities in participatory land management processes and building their capacity to adapt to changing environmental conditions can help to enhance the resilience of mountainous settlements in the face of land degradation. Kirk & Cradock-Henry, (2022).

Government policies and programs that support sustainable land management practices, provide incentives for conservation, and regulate land use activities can also play a critical role in addressing land degradation in mountainous regions. Investing in research and monitoring efforts to better understand the causes and impacts of land degradation, as well as promoting knowledge sharing and capacity building among stakeholders, can help to inform decision-making and foster collective action towards land degradation mitigation and sustainable land use practices. Jamal et al. (2019).

Understanding the impact of land degradation on the sustainability of these peri-urban mountainous settlements is essential for developing effective management strategies. Francis, (2024). This study aims to examine the extent and causes of land degradation in these areas, assess its implications for environmental health and community well-being, and explore potential



solutions to mitigate these effects. By investigating these factors, the study seeks to inform policies and practices that promote sustainable development and enhance the resilience of peri-urban communities in Ibadan.

Literature Review

Land degradation is a pressing global issue that threatens the sustainability of mountainous settlements in city fringe areas. Imbrenda et al. (2021), Tuncay & Baskan, (2022). Land degradation in mountainous areas had led to reduced agricultural productivity, loss of biodiversity, and increased vulnerability to climate change. Atieku & Segbefia, (2024). The crucial role of sustainable land management practices in improving the resilience of these communities and protecting their livelihoods needs to be emphasized. Batisani & Yarmal, (2010).

The effects of land degradation on water resources in mountainous settlements near Cape Town, South Africa after a study, erosion and deforestation were found as major contributors to water pollution and scarcity, highlighting the need for integrated watershed management approaches to ensure the sustainability of water sources. Boer & Rijken, (2016).

In Peru, the socio-economic impacts of land degradation on communities living in mountainous fringe areas of cities were examined. It was observed that degraded lands compromised food security, increased poverty levels, and heightened social vulnerability. A combination of sustainable land management practices and community-based initiatives to address these challenges and enhance the resilience of local populations was recommended. Barr et al. (2019).

The effects of land degradation on ecosystem services and livelihoods in mountainous settlements on the fringes of Himalayan region of India was investigated. The findings underscored the importance of sustainable land use planning, afforestation programs, and capacity building initiatives to restore degraded lands and safeguard the well-being of communities in these regions. Pandey et al, (2018).

A comparative study in Ethiopia and Nepal analyzed the factors influencing the sustainability of mountainous settlements in city fringe areas in the face



of land degradation. They identified resource tenure systems, land use policies, community participation, and access to markets as key determinants of resilience and sustainability. The researchers advocated for tailored interventions that account for local dynamics and empower communities to manage their natural resources effectively. Abebe et al. (2020).

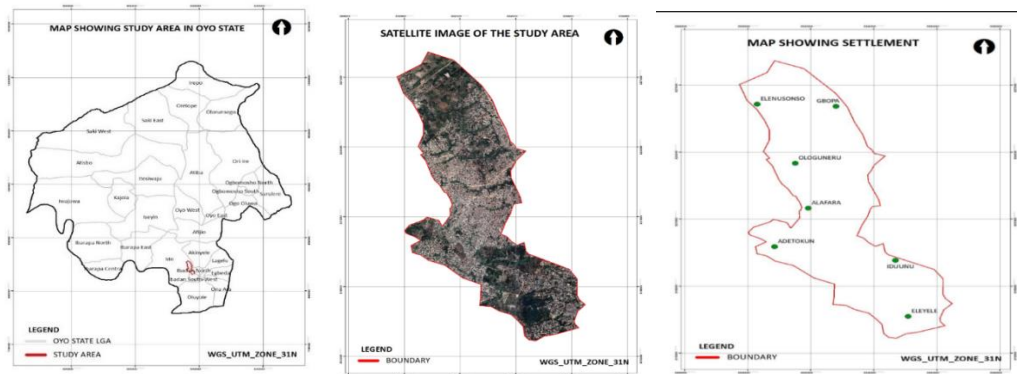
Climate variations, given mountains altitude, sun orientation and slope, do easily disrupts their ecosystems making animals and native plants to struggle to survive and losing their habitat respectively. Food and Agriculture Organization, (2024). More so, land degradation is a major threat to our mountains. Over exploitation and natural disaster all have far reaching devastating effects on mountainous communities.

These studies underscore the multifaceted impacts of land degradation on mountainous settlements in city fringe areas and the urgent need for holistic approaches to promote sustainability. Paul & Halloy, (2018). By integrating principles of sustainable land management, community engagement, and policy support, stakeholders can work together to address the root causes of land degradation, enhance ecosystem resilience, and secure the well-being of populations in these vulnerable regions.

Methodology

A unique selection criteria of the study area is the presence of mountainous characteristics and its susceptibility to land degradation. Mac Arthur Foundation, (2010). The valley side, Eleyele Lake Water also provide a riverine community with a different socio-economic background especially water transportation means to the residents. The buffer zone of the artificial lake dam and mountainous high altitude cool breeze in Idunnu and Obaido have added to their serenity respectively.

The selection of Eleyele, Adetokun, Alafara, and Ologuneru areas in Ibadan as the study sites is due to the presence of mountainous housing characteristics and susceptibility to land degradation. A preliminary assessments of the locations was conducted to ensure the representativeness of these areas in capturing the broader issues of land degradation and sustainability in mountainous settlements.



Figures 3.1-3 Established the Study Area from Oyo State, its Satellite Imagery and Settlements.

Source: Fieldwork 2023

Data Collection was done with a combination of field surveys, remote sensing techniques, and interviews to gather primary data on land degradation and sustainability in the selected areas. Such includes data on factors contributing to land degradation such as erosion, deforestation, land use practices, and infrastructure development.

The impacts of land degradation on ecosystem services, biodiversity, water resources, agriculture, and livelihoods of the local communities were assessed through engagement of stakeholders - local communities, government agencies, NGOs, and others to gather insights and perspectives on the effects of land degradation and potential sustainability strategies in the study areas. Also focus group discussions, interviews, and participatory mapping exercises to capture local knowledge and experiences related to land degradation and sustainability were conducted. Specifically, spatial analysis with the use of GIS tools was conducted to analyze land cover changes, soil erosion patterns, vegetation cover, and slope characteristics in study areas in retrospect of 2005, 2010, 2015 and 2020. Maps generated highlight areas prone to degradation, critical ecosystems, and land use patterns to identify hotspots for intervention and restoration.

However, specific areas with significant degradation based on land use classifications and associated changes contained in the satellite imagery can only be identified with observatory schedule inspections to the communities in the study area due to technological and paucity of fund limitation. Figures 3 only shows land use changes and growth rate in the study area for 2005, 2010, 2015 and 2020.

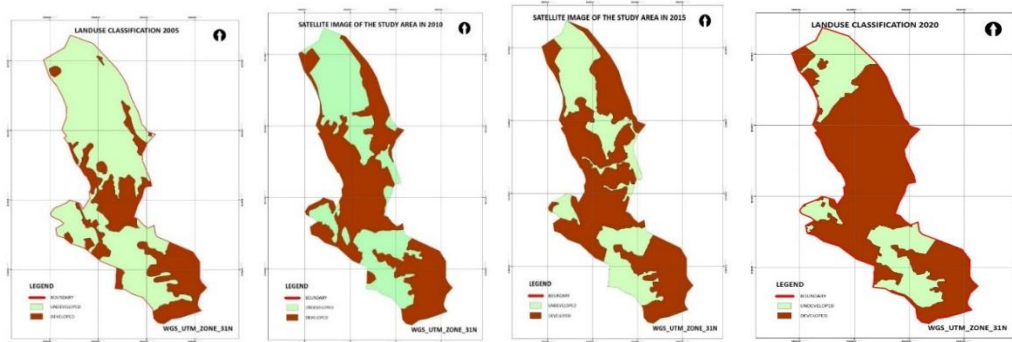


Figure 3 Land Use Classification, Year 2005, 2010, 2015 & 2020

Source: Adewoyin et al 2024

Geographical Information System/Satellite Imagery Acquisition

Through GIS, the areas are marked from the google earth map and further subjected to satellite imagery acquisition of the portion. The total land mass of the study areas stands at 3,600 hectares while the growth trend for a 20 year period – 2005, 2010, 2015 and 2020 was downloaded. See Table 3.1, and Figure 3.1.

Table 3.1. Overview of Growth Trend over Years

Land use Category	Year (Percentage)			
	2005	2010	2015	2020
Developed Area	32%	57%	63%	71%
Undeveloped Area	68%	43%	37%	29%
Total	100%	100%	100%	100%

Source: Adewoyin et al 2024

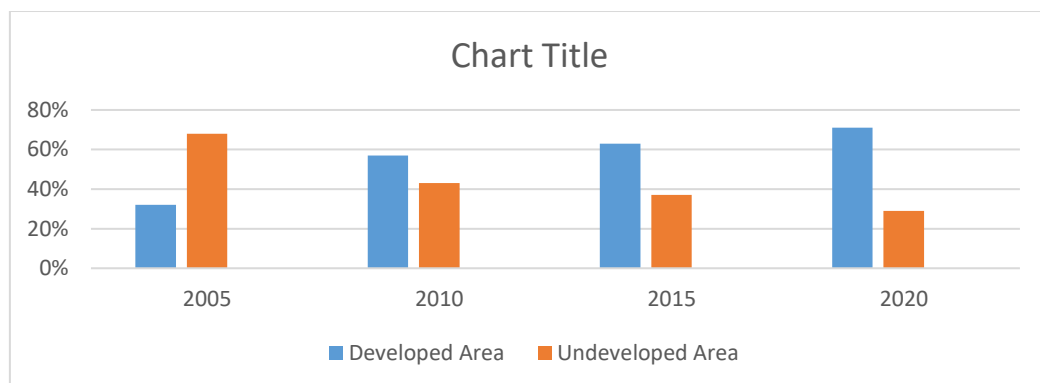


Figure 3.1. Growth Trend of the Study Area

Source: Adewoyin et al 2024



Assessment of sustainability practices to evaluate existing practices in the study areas, such as agroforestry, soil conservation measures, water management systems, and community-led initiatives were carried out to know the effectiveness and adoption rates of these practices in mitigating the effects of land degradation and enhancing the resilience of mountainous settlements. Ruiz et al. (2020).

The quantitative analysis was conducted through analysis of data collected on land degradation indicators, sustainability practices, and socio-economic variables using statistical tools. Also data from interviews, focus group discussions, and stakeholder engagements used in identifying key themes, challenges, and opportunities related to land degradation and sustainability were carried out in the study areas.

An assessment of both quantitative and qualitative findings were integrated to develop a comprehensive assessment of the effects of land degradation and the status of sustainability in the mountainous settlements of Eleyele, Adetokun, Alafara, and Ologuneru areas. Synergies and trade-offs between different sustainability practices, land use policies, and community initiatives in promoting resilience and adaptive capacity in the face of land degradation were equally identified.

Analysis and Discussion

By following this methodology, the study aims to provide valuable insights into the effects of land degradation and the pathways to sustainability in mountainous settlements in Eleyele, Adetokun, Alafara, and Ologuneru areas of Ibadan, facilitating evidence-based decision-making and fostering community resilience in the face of environmental challenges.

Residents Locational Choice

The choice of residential location of respondents in the study area is summarized in Table 4.1. It was observed that majority of the residential location choice by the respondents was as a result of budget for rent/land cost. It was found that up to 50.0% of the residents made the choice of location based on this factor. On the other hand, 22.4% and 20.6% of the respondents affirmed that easy accessibility and the quality of environment influenced their choice of residential location. The least important driver of

residential location as opined by the respondents in the study area were choice related to inheritance and nearness to kinship; thus, accounting for 7.0% and 0.3% respectively.

Across the peri-urban communities, a similar trend was observed in Eleyele, Adetokun and Alafara communities (Table 4.1). In Ologuneru community, although, majority (58.5%) of the residents' residential choice was as a result of the cost of land/rent, the aspect of quality of the environment was as well important to the dwellers when compared to the residential choice of residents in the other sampled communities. As such, it was observed that there was a statistically significant difference in respondents' residential choice across the sampled communities ($\chi^2 = 26.656$, $p = 0.009$).

Table 4.1: Choice of Residential Location

Location choice	Residential communities				Total
	Eleyele	Adetokun	Alafara	Ologuneru	
	Freq. (%)	Freq. (%)	Freq. (%)	Freq. (%)	Freq. (%)
Budget rent/land cost	33 (47.1)	76 (51.7)	38 (44.2)	24 (58.5)	171 (49.7)
Inheritance	7 (10.0)	5 (3.4)	11 (12.8)	1 (2.4)	24 (7.0)
Easy accessibility	18 (25.7)	35 (23.8)	22 (25.6)	2 (4.9)	77 (22.4)
Quality of environment	12 (17.1)	31 (21.1)	14 (16.3)	14 (34.1)	71 (20.6)
Nearness to kinship	-	-	1 (1.2)	-	1 (0.3)
*Total	70 (100.0)	147 (100.0)	86 (100.0)	41 (100.0)	344 (100.0)

***Note:** Reduced sample size due to multiple response

Source: Fieldwork 2023

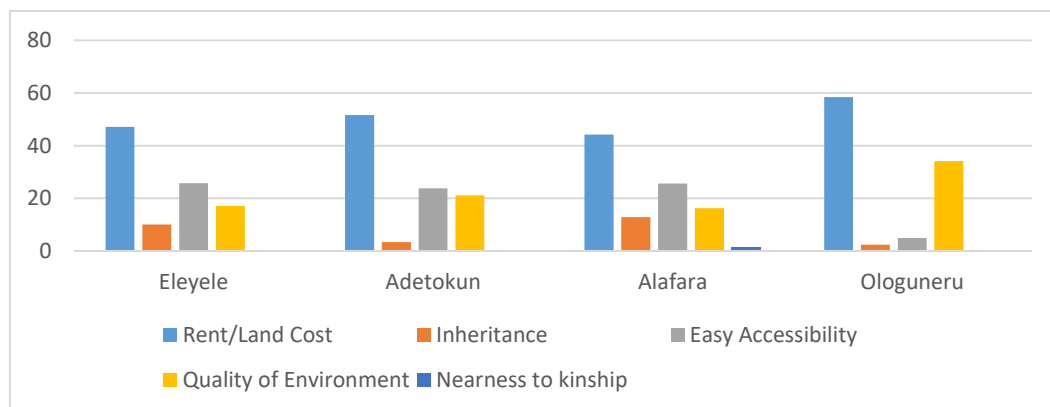


Figure 4.1 Choice of Residential Location

Source: Fieldwork 2023



Residents' Satisfaction with Living in Different Peri-Urban Communities

This finding was also similar to respondents' perceived satisfaction level with living in the community. As summarized in Table 4.2, more than two-third. 87.6% of the respondents opined to have been satisfied with living in the peri-urban areas. In Ologuneru community 95.2% were satisfied living in the community while in Adetokun, 89.9% were satisfied. The proportion of respondents in group were 89.6% and 75.7% in Alafara and Eleyele respectively.

Table 4.2: Residents' Satisfaction with Living in Different Peri-Urban Communities

Residential Type	Residential communities				Total
	Eleyele	Adetokun	Alafara	Ologuneru	
	<i>Freq. (%)</i>	<i>Freq. (%)</i>	<i>Freq. (%)</i>	<i>Freq. (%)</i>	<i>Freq. (%)</i>
Very Satisfied	8 (11.4)	30 (20.3)	20 (23.3)	10 (23.8)	68 (19.7)
Satisfied	45 (64.3)	103 (69.6)	57 (66.3)	30 (71.4)	235 (67.9)
Neutral	3 (4.3)	-	-	-	3 (0.9)
Dissatisfied	12 (17.1)	14 (9.5)	9 (10.5)	2 (4.8)	37 (10.7)
Very dissatisfied	2 (2.9)	1 (0.7)	-	-	3 (0.9)
Total	70 (100.0)	148 (100.0)	86 (100.0)	42 (100.0)	346 (100.0)
Source: Fieldwork 2023					

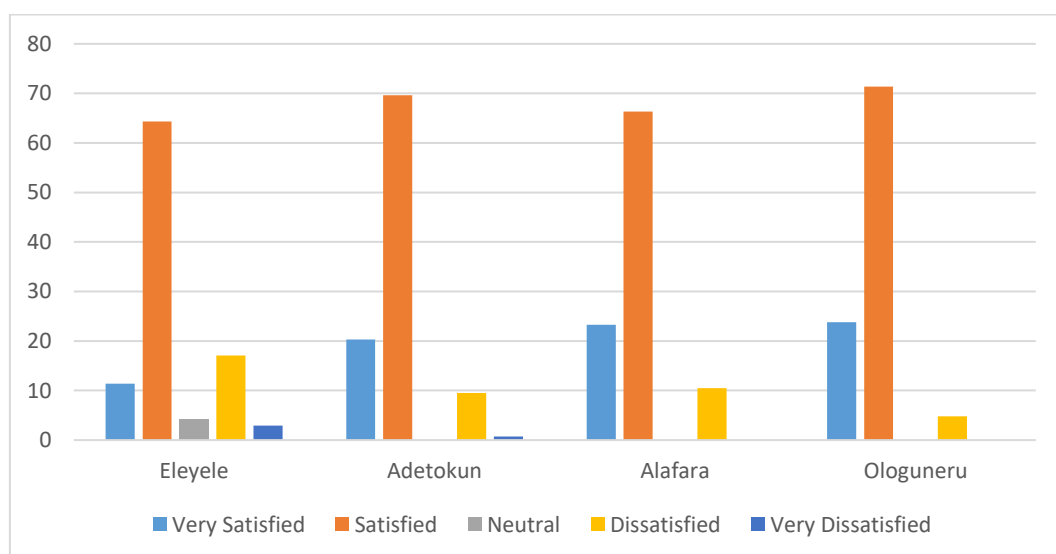


Figure 4.2. Residents' Satisfaction with Living in the Community

Source: Fieldwork 2023

Developments on Mountainous Areas

Due to urban growth, there is noticeable numbers of housing developments extending to the hilly mountainous areas in the peri-urban studied. Ehrlich et al. (2021). The Obaido, Mechanic Village and Gbamongbo are hilly but gradually, residential developments are steadily springing up in those areas. The advantages of living on hilly mountainous sides cannot be underestimated. Figure 4.32 show some developments on the mountains at Eleyele peri-urban area.

This notwithstanding, the hilly sides of Eleyele area of the study has the cultural site of Okebadan shrine which traditionalists in the ancient city worships as a deity. Figure 4.3, 4.4, 4.5 and 4.6 shows the mountainous developments in the selected part of the study area.



Figures 4.3, 4.4, 4.5, & 4.6: Housing Developments on Mountains in the Study Areas

Source: Fieldwork 2023

Types of Land Degradation Experienced in the Peri-Urban Communities

Table 4.20 summarizes the different environmental degradation perceived by residents in the peri-urban communities. In terms of flooding, majority (49.1%) of the respondents were indifferent while 18.2% were rarely affected by flood occurrence in recent years. Furthermore, about 33.0% of the respondents in the study area agreed to being affected by flood; but, on different scale. With this finding, it was established that, flooding remains a reoccurring environmental and health challenge in the peri-urban communities in recent years. It is important to note that some of the factors contributing to flooding in the study area is associated with the rapid/uncontrolled development activities and the encroachment of setbacks of water-bodies in the community.

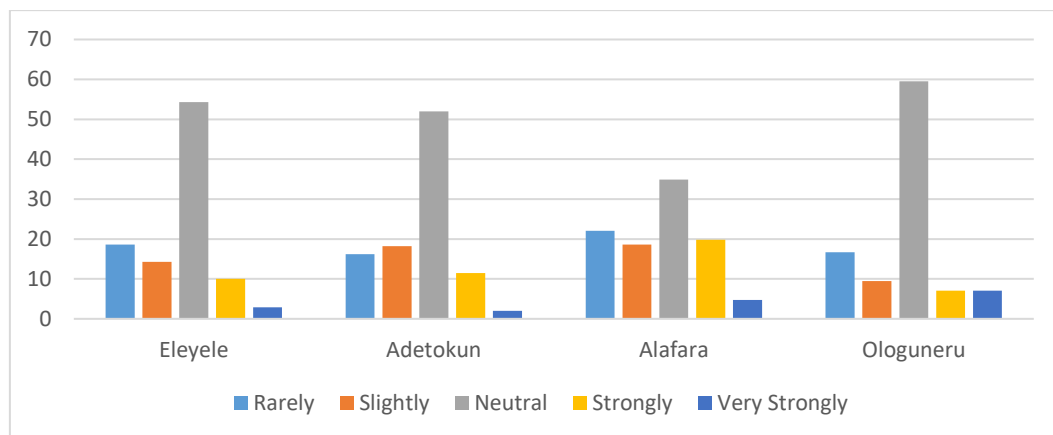


Figure 4.7 Flooding Occurrence in the Study Areas

Source: Fieldwork 2023

In similar manner, majority of the respondents were neither satisfied nor dissatisfied (neutral) with the process of soil/sand lifting in the study area. As observed from Table 4.20, 32.7% of the sampled respondents had an indifferent perception regarding the process of soil lifting activity in the study area. On the other hand, 21.4% of the respondents were observed to be satisfied while 27.5% were slightly satisfied. Respondents who were rarely satisfied accounted for 18.5% only. The proportion of respondents who were rarely satisfied was further observed to be higher in Eleyele community (27.1) compared to the other sampled communities of Alafara (24.4%), Adetokun (14.2%) and Ologuneru (7.1%). See Figures 4.8., 4.9. & 4.10.

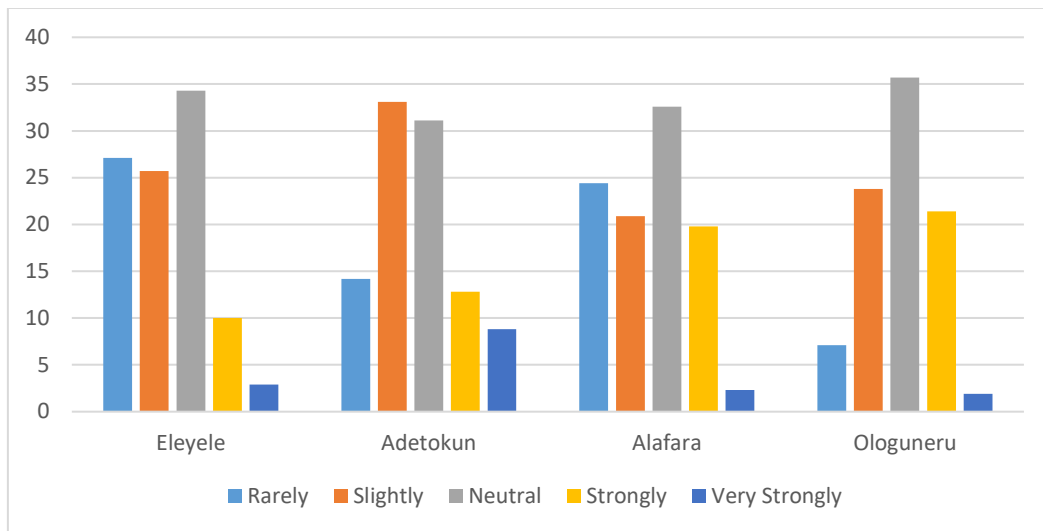


Figure 4.8 Sand Lifting Activities in the Study Area

Source: Fieldwork 2023



Figures 4.9, & 4.10: Soil Lifting Activities and Land Degradation in the Study Area

Source: Fieldwork 2023

Conclusion and Recommendations

The study on the effects of land degradation and sustainability of mountainous settlements in Eleyele, Adetokun, Alafara, and Ologuneru areas of Ibadan has uncovered significant challenges and opportunities for promoting environmental resilience and community well-being in these sensitive ecosystems. The analysis of land degradation indicators, sustainability practices, and stakeholder perspectives has highlighted the interconnectedness of environmental health, livelihoods, and socio-economic development in the study areas. Dame et al. (2019).



The findings indicate that land degradation, driven by factors such as erosion, deforestation, and unsustainable land use practices, poses a substantial threat to the ecological integrity and socio-economic stability of mountainous settlements in the study area. The degradation of natural resources has adverse impacts on water availability, agricultural productivity, biodiversity, and the overall resilience of local communities to environmental shocks.

Despite the challenges posed by land degradation, the study also uncovers promising sustainability practices and community-led initiatives that hold the potential to enhance the adaptive capacity of mountainous settlements. Agroforestry, soil conservation measures, water management systems, and community engagement efforts emerge as effective strategies for mitigating the effects of degradation and promoting ecosystem restoration in the study areas. Jiang et al. (2024).

As part of recommendations, the adoption of sustainable land management practices such as agroforestry, terracing, and soil conservation techniques to prevent erosion, improve soil health, and enhance the resilience of mountainous ecosystems in the study areas must be encouraged. Local community involvement in land use planning, natural resource management, and decision-making processes to ensure the sustainability of interventions and increase local ownership of conservation efforts is hereby encouraged. Haller & Branca, (2023).

There should be an establishment of robust monitoring and evaluation systems to track changes in land degradation indicators, assess the effectiveness of sustainability practices, and measure progress towards environmental restoration goals in the study areas. Recognition and integration of traditional ecological knowledge and practices of local communities into conservation initiatives, leveraging indigenous wisdom for sustainable natural resource management and biodiversity conservation. Chen et al. (2022).

Development of climate-resilient infrastructure, such as water harvesting systems, drought-resistant crops, and reforestation programs, to enhance the adaptive capacity of mountainous settlements to climate change impacts and extreme weather events. Also to foster multi-stakeholder partnerships among government agencies, NGOs, academia, and local



communities to implement integrated and cross-sectoral solutions for addressing land degradation, promoting sustainability, and supporting the livelihoods of residents in the study area. Ding & Peng, (2018).

The government should provide training programs, workshops, and awareness campaigns on sustainable land management practices, environmental conservation, and climate change adaptation to empower local communities with the knowledge and skills needed to protect and restore their natural resources.

Lastly, advocacy for the development and enforcement of policies that prioritize sustainable land use practices, biodiversity conservation, and ecosystem restoration in mountainous settlements, aligning government regulations with community-driven initiatives for long-term sustainability.

In conclusion, addressing the effects of land degradation and promoting the sustainability of mountainous settlements in the study areas require a holistic and collaborative approach that integrates ecological, socio-economic, and cultural dimensions. By implementing the recommended strategies and fostering a culture of environmental stewardship and resilience, the study envisions a future where the communities in these mountainous regions can thrive in harmony with their natural surroundings, ensuring a sustainable and prosperous future for generations to come.

References

- Abebe, Y. F. Fekadu, G., & Mihret, A. (2020). Peri-urbanization and its Impacts on Livelihoods and Environment in Ethiopia: A Case of Bahir Dar City. *Journal of Environmental Planning and Management*, 63(10), 1745-1763.
- Adewoyin, I. B. Abimbola, M. L., Falegan, A. V. Ajijola, S. O. Adediran, A. F., & Adedire, F. M. (2024). Anthropological and Legal Dimensions to Mitigating Land Degradation in the Peri-Urban Interface of Ibadan. *Journal of Built Environment & Geological Research*, Volume 5, Number 4. 139-152
- Adewoyin, I. B. Falegan, A. V., Ajijola, S. O., Adediran, F. A. & Adedire, F. M. (2024). Land Degradation, Classification, and Peri-Urban Dynamics' Relationship: A Study of an African City Interface. *Ethiopian Journal of Environmental Studies & Management*, 17(2), 202-215.
- Atieku, J. N. & Segbefia, S. K. (2024). Land Degradation: A Global Challenge and its Effects on Humankind and the Environment. with a Special Focus on Ghana. *Indiana Journal of Humanities and Social Science*, Volume 05, Issue 07, 58-64.
- Barr, S. Dekker, S., & van Maarseveen, M. (2019). Peri-urbanization and the Spatial Patterns of Livelihoods in Africa. *Journal of Rural Studies*, 72, 241-251.
- Batisani, N. & Yarmal, B. (2010). Peri-urban Livelihoods and Environmental Degradation in Developing Countries: A Case Study of Gaborone, Botswana . *Journal of Environmental Planning & Management*, 53(5), 633-652.



- Boer, R. & Rijken, B. (2016). Peri-Urbanization and Livelihoods in Southeast Asia. *Land Use Policy*, 57, 132-142.
- Chen, X. W. Wang, Z., Bao, Y., Luo, Q., & Wei, W. (2022). Combined Impacts of Buildings and Urban Remnant Mountains on Thermal Environment in Multi-Mountainous City. *Sustainable Cities and Society Volume 87*, 104247.
- Dakka, A. S. (2013). The Role of Indigenous Knowledge in Land Management for Carbon Sequestration and Ecological Services in Southern Ethiopia. *Journal of Economics and Sustainable Development*, Vol.4, No.17., 79-92.
- Dame, J. S. Schmidt, S., Muller, J., & Nusser, M. (2019). Urbanization and Socio-ecological Challenges in High Mountain Towns: Insights from Leh (Ladakh), India. *Landscape and Urban Planning Volume 189*, 189-199.
- Ding, Y. & Peng, J. (2018). Impacts of Urbanization of Mountainous Areas on Resources and Environment: Based on Ecological Footprint Model. *Sustainability* 10(3), 765.
- Ehrlich, D. M. Melchiorri, M., & Capitani, C. (2021). Population Trends and Urbanization in Mountain Ranges of the World. *Land* 10(3):255.
- Ekka, P. P. Patra, S., Upreti, M., Kumar, G., Kumar, A., & Salkia, P. (2023). Land Degradation and its Impacts on Biodiversity and Ecosystem Services. *Land and Environmental Management through Forestry, Chapter 4*.
- EU Science Hub. (2018). *Land Degradation Threatens the Well-being of People and the Planet*. European Commission.
- Food and Agriculture Organization. (2024). *Mountains and Climate Change*. Food and Agriculture Organization.
- Francis, O. (2024). *The Role of Indigenous Knowledge in Environmental Conservation*. Medium.
- Fransen, B. (2023). *Why Mountain Ecosystems Matter: A Call to Preserve our Peaks*. EcoMatcher.
- Govern d'Andora. (2023). *Mountains and Climate Change: Highlighting the Need for the Protection of Vulnerable Mountain Ecosystems while Building the Resilience of Mountain Peoples and Economic, to Reduce Loss and Damage*. Andorra la Vella.
- Haller, A. & Branca, D. (2023). *Urbanization and the Verticality of Rural-Urban Linkages in Mountains*. Montology Palimpsest.
- Imbrenda, V. Q. Quaranta, G., Salvia, R., Egidi, G., Salvati, L., Prokopova, M., Coluzzi, R., & Lanfredi, M. (2021). Land Degradation and Metropolitan Expansion in a Peri-Urban Environment. *Geomatics, Natural Hazards and Risk, Volume 12, Issue 1*.
- Jamal, S. A. Ahmad, W. S., Ali, A., & Sharma, A. (2019). Monitoring Land Use/Land Cover Change Detection and Urban Expansion with Remote Sensing and GIS Techniques in Anantnag District of Kashmir Valley. *The Geographer*, Vol. 66. No. 1, 60-69.
- Jiang, Y. Z. Zhou, L., Wang, B., Zhang, Q., Gao, H., Wang, S., & Cui, M. (2024). The Impact of Gradient Expansion of Urban-Rural Construction land on Landscape Fragmentation in Typical Mountain Cities, China. *International Journal of Digital Earth Volume 17, Issue 1*.
- Jiao, W. Y. Yang, X., & Li, Y. (2024). Traditional Knowledge's Impact on Soil and Water Conservation in Mountain Agricultural Systems: A Case Study of Shexian Dryland Stone Terraced System, China. *Ecological Indicators, Volume 159*, 11742.
- Kirk, N. A. & Cradock-Henry, N. A. (2022). Land Management Change as Adaptation to Climate and other Stressors: A Systematic Review of Decision Contexts Using Values-Rules-Knowledge. *Land* 11(6), 791.
- Mac Arthur Foundation. (2010). Climate Change Impact and Vulnerability in the Eastern Himalayas. In K. S. Tse-ring, *Climate Change Vulnerability of Mountain Ecosystems in the*



- Eastern Himalayas*. Kathmandu: International Centre for Integrated Mountain Development.
- Mason, C. W. (2022). Rethinking the Role of Indigenous Knowledge in Sustainable Mountain Development and Protected Area Management in Canada and Aotearoa/New Zealand. *Mountain Research and Development*, 42(4), 1-9.
- Mastrojeni, G. (2023). *Why Mountains Matter*. One Earth.
- Pandey, B. J. (2018). Assessing the Impact of Peri-urbanization on Agricultural Land Use and Livelihoods: A Case of Gurugram, India. *Land Use Policy*, 79, 548-558.
- Paul, H. & Halloy, S. R. P. (2018). *High Mountain Ecosystems Under Climate Change*. Oxford University Press.
- Price, M. F. (2022). *Mountains: Globally Important Ecosystems*. Oxford: Mountain Region Programme at the Environmental Change Unit.
- Rajendran, L. P. Raul, L., Chen, M., Andrade, J. C. G., Akhtar, R., Mngumi, L. E., Chander, S., Srinivas, S., & Ray, M. R. (2024). The 'Peri-urban Turn': A Systems Thinking Approach for a Paradigm Shift in Reconceptualising Urban-Rural Futures in the Global South. *Habita International*, Volume 146, 103041.
- Romeo, R. M. (2022). *The International Year of Sustainable Mountain Development 2022: An Opportunity to Promote Action for Mountains*. Rome: Sustainable Food Systems.
- Rudgley, G. & Seega, N. (2022). *Biodiversity Loss and Land Degradation - An Overview of the Financial Materiality*. Cambridge: University of Cambridge Institute for Sustainability Leadership.
- Ruiz, I. A. Almagro, M., Garcia de Jalon, S., Sola, M. D. M., & Sanz-Sanchez, M. (2020). Assessment of Sustainable Land Management Practices in Mediterranean Rural Regions. *Journal of Environmental Management* 276(1-3):111293.
- Sahana, M. Ravetz, J., Patel, P. P., Dadashpoor, H., & Follman, A. (2023). Where is the Peri-Urban? Systematic Review of Peri-Urban Research and Approaches for Its Identification and Demarcation Worldwide. *Remote Sensing Approaches to Landscape Analysis of Urban and Peri-Urban Environments*, 15(5), 1316.
- Tuncay, T. & Baskan, O. (2022). Assessment of Land Degradation Factors. *Chapter Metrics Overview* 192 .
- United Nations. (2022). *Benefits of Mountains*. New York: United Nations.
- Varkey, A. M. & Manasi, S. (2019). A Review of Peri-Urban Definitions, Land Use Changes and Challenges to Development. *Urban India Vol. 39 (1)*, 96-110.