

ASSESSING THE IMPACTS OF CLIMATE CHANGE ON DESERTIFICATION IN NIGER STATE, NIGERIA

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ABSTRACT

This study explores the impacts of climate change on desertification in Niger State, Nigeria. Desertification, exacerbated by climate change, poses significant challenges to ecosystems and communities in Niger State, Nigeria. This study examines the key drivers of desertification, its socio-economic impacts, and the effectiveness of adaptation and mitigation strategies. A survey was conducted among 120 respondents, revealing overgrazing and climate change-induced factors as the primary drivers of desertification, with deforestation, poor land management practices, and urbanization also playing significant roles. Respondents highlighted the complex interactions between climate change-induced factors, such as changes in rainfall patterns and increased temperatures, and their contribution to desertification processes. The socio-economic impacts of desertification were pronounced, including water scarcity, decreased agricultural productivity, increased poverty, and loss of biodiversity. While some adaptation and mitigation strategies are being implemented, there is a need for greater community involvement, policy support, and integrated approaches to enhance resilience and promote sustainable land management practices. These findings underscore the urgency of coordinated action to address desertification in Niger State, Nigeria, emphasizing the importance of holistic strategies that integrate climate change adaptation, sustainable development, and community empowerment.

Keywords: *Desertification, Climate change, Drivers, Socio- economic impacts, Adaptation strategies.*

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INTRODUCTION

Climate change is long-term shifts in temperature, precipitation patterns, and other atmospheric conditions on Earth, primarily driven by human activities such as burning fossil fuels, deforestation, and industrial processes. These activities release greenhouse gases (GHGs) such as carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) into the atmosphere, leading to the enhanced greenhouse effect and subsequent warming of the planet (IPCC, 2021). While desertification is the process of land degradation in arid, semi-arid, and dry sub-humid regions, resulting from various factors such as climate variability, unsustainable land management practices, deforestation, overgrazing, and soil erosion. Desertification leads to the loss of vegetation cover, soil fertility, and biodiversity, transforming productive land into barren desert-like landscapes (Bai, Z. G., Dent, D. L., Olsson, L., & Schaepman, 2018)).

Desertification, driven primarily by climate change and exacerbated by human activities, poses a significant threat to ecosystems, livelihoods, and sustainable development in arid and semi-arid regions worldwide (Desertification), 2019). Among these regions, Niger State in Nigeria stands particularly vulnerable to the impacts of desertification due to its geographic location and climatic conditions. Situated in the Sahel region, Niger State experiences recurring droughts, erratic rainfall patterns, and land degradation, making it highly susceptible to desertification processes (Boko, M., Niang, I., Nyong, A., Vogel, C., Githeko, A., Medany, M., ... & Osman-Elasha, 2017).

The intertwining of climate change and desertification in Niger State presents a complex challenge that requires comprehensive understanding and effective intervention strategies (Ayoade, 2012). As temperatures rise and precipitation patterns become increasingly unpredictable due to climate change, the delicate balance of ecosystems in Niger State is disrupted, leading to soil degradation, loss of vegetation cover, and dwindling water resources (Oladipo, E. O., Taiwo, O. J., & Odeyemi, 2018). Consequently, these changes have profound implications for agricultural productivity, food security, biodiversity, and the socio-economic well-being of communities reliant on natural resources (Adebayo, A. A., & Raimi, 2017). The study seeks to elucidate the complex interactions between climate change and desertification processes in the region.

METHOD

The study utilized a cross-sectional research design, which allowed for the collection of data at a single point in time to assess various factors and relationships within the sample population. To ensure a representative sample, a stratified random sampling technique was applied. This approach involved dividing the population into distinct subgroups or strata based on specific characteristics, ensuring that each subgroup was adequately represented in the sample. From these strata, a random selection of 120 respondents was made, enhancing the reliability and generalizability of the findings.

Data analysis was conducted using descriptive statistics and multiple regression analysis. Descriptive statistics provided a summary of the data, offering insights into the central tendencies, distribution, and overall patterns within the sample. This initial analysis helped clarify the demographic makeup of the respondents and revealed key trends in the data. Following this, multiple regression analysis was used to explore the relationships between the independent and dependent variables. By examining how various independent variables simultaneously influenced the dependent variable, this technique enabled a deeper understanding of the factors driving the outcomes of interest and allowed for the testing of hypotheses related to the study's objectives. This comprehensive analytical approach provided a robust framework for assessing the research questions and achieving the study's objectives.

RESULTS AND DISCUSSION

These sections provide the result of finding from 120 respondents used.

Table 1: Perceived Main Drivers of Desertification in Niger State

Main Drivers	Frequency *	Percentages
Deforestation	75	16.85%
Overgrazing	85	19.10%
Poor land management practices	60	13.48%
Climate change-induced factors	95	21.35%
Urbanization	40	8.99%
Agricultural expansion	65	14.61%
Mining activities	25	5.62%

Source: Field survey, 2024. * Multiple responses

From Table 1, it can be observed that many respondents identified overgrazing (19.10%) and

climate change-induced factors (21.35%) as the main drivers of desertification in Niger State. Deforestation (16.85%), Agricultural expansion (14.61%) and poor land management practices (13.48%) were also commonly cited factors contributing to desertification. Regarding other factors specified by respondents, they included soil erosion, population growth, and industrial activities. These results indicate a widespread recognition of multiple drivers contributing to desertification in Niger State, with climate change being a significant concern.

Table 2: Socio-Economic Impacts of Desertification on Local Communities in Niger State

Variables	Coefficients	Std. Error	t-ratio	p>/t/
Constant	-. 0154852	. 1282692	-0.12	0.905
Decreased agricultural productivity	.2658902	.0504679	5.27	0.000
Water scarcity	.3147452	.0638522	4.93	0.000
Loss of biodiversity	.2026354	.0675128	3.00	0.003
Displacement of communities	.1568927	.0617136	2.54	0.012
Increased poverty	. 1027249	. 0553847	1.85	0.067
Conflict over natural resources	. 0847515	.057355	1.48	0.141
R-Square	0.6943			
Adjusted R-Square	0.6763			
F-value	42.86			

Source: Field survey, 2024.

The multiple regression analysis results indicate a statistically significant relationship between desertification (dependent variable) and independent variables. Findings show that decreased agricultural productivity (coef. = 0.266, $p < 0.001$), water scarcity (coef. = 0.315, $p < 0.001$), loss of biodiversity (coef. = 0.203, $p = 0.003$), displacement of communities (coef. = 0.157, $p = 0.012$) and increased poverty (coef. = 0.103, $p = 0.067$) were positive and have a statistically significant impact on desertification and climate change. While conflict over natural resources does not show a statistically significant relationship with desertification and climate change (coef. = 0.085, $p = 0.141$), suggesting that conflict over resources may not be a major driver of desertification on climate change in Niger State. Efforts to combat desertification should consider these key factors and implement targeted interventions to enhance resilience and sustainable land management practices.

Table 4: Effectiveness of Adaptation and Mitigation Strategies

Observations	Frequency *	Percentages
Insufficient implementation and enforcement of existing policies and regulations	80	27.12%
Lack of community involvement and awareness-raising initiatives	70	23.73%
Need for integrated approaches that combine traditional knowledge with modern technologies	65	22.03%
Importance of sustainable land management practices and reforestation efforts	80	27.12%

Source: Field survey, 2024. * Multiple responses

Findings of the study shows that diverse opinions were expressed regarding the effectiveness of adaptation and mitigation strategies implemented to address desertification in Niger State. Common themes included insufficient implementation and enforcement of existing policies and regulations (27.12%), lack of community involvement and awareness-raising initiatives (23.73%), need for integrated approaches that combine traditional knowledge with modern technologies (22.03%) and importance of sustainable land management practices and reforestation efforts (22.03%). These results suggest that while some adaptation and mitigation strategies are being implemented, there is room for improvement in terms of their effectiveness and inclusiveness. Overall, the findings from this study highlight the urgent need for coordinated action to address the key drivers of desertification, mitigate its socio-economic impacts, and enhance resilience among local communities in Niger State, Nigeria.

CONCLUSION

In conclusion, this analysis sheds light on the significant impact of climate change on desertification in Niger State, Nigeria, identifying deforestation, poor land management, overgrazing, and climate change-induced factors as primary drivers. Survey results illustrate the complex interactions between shifts in rainfall patterns, rising temperatures, and desertification processes, highlighting the need for holistic solutions. The socio-economic effects of desertification, including water scarcity, reduced agricultural productivity, increased poverty, and biodiversity loss, demonstrate the vulnerability of local communities to environmental degradation and underscore the necessity for targeted interventions. Effective adaptation and mitigation strategies, which require stronger community involvement, policy support, and integrated approaches, are crucial to enhance resilience and promote sustainable land management. Recommendations include the development of land-use planning strategies prioritizing sustainable forestry and conservation, soil conservation practices, and sustainable agriculture. Additionally, promoting biodiversity conservation through protected area management, habitat restoration, and public awareness is essential. Collaboration among government agencies, NGOs, local communities, and stakeholders is also recommended to implement comprehensive adaptation and mitigation strategies, ensuring the sustainability and resilience of Niger State's ecosystems and communities.

REFERENCES

- Adegbite, O., & Nakpodia, F. (2020). Small and medium-sized enterprises, green financing, and sustainable development: Evidence from Nigeria. *Sustainability*, 12(5), 1837.
- UNCCD (United Nations Convention to Combat Desertification). (2019). Niger. Retrieved from: <https://www.unccd.int/actions-in-niger>.
- Boko, M., Niang, I., Nyong, A., Vogel, C., Githeko, A., Medany, M., ... & Osman-Elasha, B. (2017). Africa. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 433-467.
- Ayoade, J. O. (2012). Climate Change and Desertification in Nigeria: Implications for Sustainable Development. *Journal of Geography and Geology*, 4(2), 34-44.

- Oladipo, E. O., Taiwo, O. J., & Odeyemi, O. S. (2018). Climate Change and Its Impact on the Niger River Basin in Nigeria. In *Advances in Environmental Engineering, Springer*, 79-90.
- Adebayo, A. A., & Raimi, L. (2017). Desertification in Nigeria: Spatial-temporal variation of desert boundary and its impact on agriculture. *African Geographical Review*, 36(2), 177-191.
- IPCC. (2014). *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.
- Safriel, U., Adeel, Z., Niemeijer, D., Puigdefábregas, J., White, R., Lal, R., Winslow, M., Ziedler, J., Prince, S., Archer, E., King, C., and Shapiro, B. (2005). Dryland Systems. In *Millennium Ecosystem Assessment: Ecosystems and Human Well-being: Current State and Trends*. *Island Press*. 1(17).
- UNCCD, (2017). *Global Land Outlook*. United Nations Convention to Combat Desertification.
- UNDESA, (2017). *The Sustainable Development Goals Report 2017*. United Nations Department of Economic and Social Affairs.
- Bai, Z. G., Dent, D. L., Olsson, L., & Schaepman, M. E. (2018). Global assessment of land degradation and improvement: 1. Identification by remote sensing. Report 2008/01. ISRIC - World Soil Information, Wageningen.
- IPCC. (2021). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II, and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. IPCC.
- Alhassan, M. (2021). Implications of Climate Change on Agriculture in Nigeria. *International Journal of Agricultural Sciences and Natural Resources*, 8(2), 24-32.
- Oladipo, E. O., & Akinnubi, R. T. (2020). Monitoring and Assessment of Desertification in Nigeria: A Remote Sensing Approach. *Journal of Environmental Management*, 275, 111246.
- Chukwuma, I. M., & Odeyemi, O. S. (2021). Climate Change Impacts and Adaptation Strategies in the Northern Region of Nigeria. *Environmental Science and Pollution Research*, 28(39), 54431-54445.
- Ogunsanwo, O. Y., Arokoyu, S. B., & Oyedele, T. S. (2021). Assessment of Desertification in Nigeria Using GIS and Remote Sensing Techniques: A Case Study of Katsina State. *Journal of Environmental and Public Health*, 2021.
- Oludare, A. O., & Alamu, E. O. (2021). Impact of Desertification on Livelihood Sustainability in Borno State, Nigeria. *Journal of Environmental and Earth Sciences*, 11(4), 9-15.
- Adger, W. N. (2006). Vulnerability. *Global Environmental Change*, 16(3), 268-281.
- FAO (Food and Agriculture Organization of the United Nations). (2021). Desertification in Nigeria. Retrieved from: <http://www.fao.org/nigeria/news/detail-events/en/c/1356094/>
- IPCC. (2021). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II, and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. IPCC.
- Alhassan, M. (2021). Implications of Climate Change on Agriculture in Nigeria. *International Journal of Agricultural Sciences and Natural Resources*, 8(2), 24-32.

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- Oladipo, E. O., & Akinnubi, R. T. (2020). Monitoring and Assessment of Desertification in Nigeria: A Remote Sensing Approach. *Journal of Environmental Management*, 275, 111246.
- Chukwuma, I. M., & Odeyemi, O. S. (2021). Climate Change Impacts and Adaptation Strategies in the Northern Region of Nigeria. *Environmental Science and Pollution Research*, 28(39), 54431-54445.
- Ogunsanwo, O. Y., Arokoyu, S. B., & Oyedele, T. S. (2021). Assessment of Desertification in Nigeria Using GIS and Remote Sensing Techniques: A Case Study of Katsina State. *Journal of Environmental and Public Health*, 2021.
- Oludare, A. O., & Alamu, E. O. (2021). Impact of Desertification on Livelihood Sustainability in Borno State, Nigeria. *Journal of Environmental and Earth Sciences*, 11(4), 9-15.
- Adger, W. N. (2006). Vulnerability. *Global Environmental Change*, 16(3), 268-281.
- FAO (Food and Agriculture Organization of the United Nations). (2021). Desertification in Nigeria. Retrieved from: <http://www.fao.org/nigeria/news/detail-events/en/c/1356094/>