

Effect of Climate Change on Wildlife Species in Dajin Baturiya Wetland Area, Hadejia Local Government Area, Jigawa State, Nigeria

Ejeh Lawrence Udeh,¹ Tijjani Yahaya Abdullahi,¹ and Shuaibu Uba Babanta²

¹Department of Geography, Federal University Gashua, Yobe State, Nigeria

²National Board for Technology Incubation Kano.

*Corresponding Author: E-mail: tijjaniyansabo@gmail.com,

Abstract: *The study examined the effects of climate change on wildlife species in the Dajin Baturiya Wetland Area of Jigawa State, Nigeria, using a plot sampling technique to assess environmental conditions and human activities within the ecosystem. Findings revealed that decreasing cold fronts, reduced precipitation, declining vegetation structure, low soil moisture, and increasing heat intensity are major manifestations of climate change in the area. These changes have significantly altered habitat conditions, thereby affecting wildlife survival, distribution, and biodiversity. The study further identified overgrazing, illegal logging, wildfires, illegal mining, and erosion as key drivers intensifying the impacts of climate change on wildlife species. Observations from the four sampled plots showed that all sites exhibited environmental degradation factors. Overgrazing exposed bare soil to direct sunlight, increasing erosion and reducing soil moisture. Illegal logging and wildfires destroyed vegetation cover and wildlife habitats, while erosion exposed plant roots and led to tree uprooting in some locations. These combined pressures have reduced habitat quality and ecological stability within the wetland. To mitigate these challenges, the study identified anti-poaching patrols, fire tracing, erosion control, and tree planting as critical conservation measures. It recommends intensified enforcement to prevent illegal logging, uncontrolled grazing, wildlife killing, and other forms of human intrusion. Environmental education campaigns in surrounding communities are also necessary to promote conservation awareness. Strengthening legal and policy frameworks is essential for sustainable wildlife management and climate change adaptation in the wetland ecosystem.*

Keywords: Climate Change, Wetland, Wildlife species.

INTRODUCTION

Climate change has become a topical issue in recent time because of its largely detrimental effects on natural and human systems. In spite of recent technological advances, weather and climate are still the most important variables in agricultural production (Ikpe, 2021). Although it is still uncertain which effects climate change will have in different localities, most models indicate that they will be stronger near the equator and hence in Sub-Saharan Africa than in other major regions on earth. For example, since 1970s, intense and longer droughts have been observed especially in the tropics and subtropics (Intergovernmental Panel on Climate Change, [IPCC, 2022]). It is also predicted that countries that depend heavily on the primary sector (such as agriculture) are likely to be more adversely hit than countries that have a more diversified economic base (Ikpe & Ugbede, 2025). The term climate change refers to variations in the mean and variability of basic climate parameters—such as temperature, precipitation, and wind—resulting from both natural and anthropogenic factors (IPCC, 2022). These include the concentration of greenhouse gases and aerosols in the atmosphere, the Earth's orbital changes, volcanic activity, and crustal movements (Udeh & Ikpe, 2022). Natural causes of climate change include variations in solar activity, volcanic eruptions, changes in marine water temperature, ice cap distribution, westerly and atmospheric waves (Amanchukwu et al., 2015). Human-induced causes include carbon emissions

from industrial activities, deforestation, agricultural mechanization, and the release of Freon gases that destroy the ozone layer, leading to global warming (IPCC, 2007). Climate change disrupts the agricultural environment by altering essential climatic variables such as temperature, precipitation, and sunlight. These changes have severe implications for livestock production, crop yield, and hydrological balance. Floods, droughts, and increased rainfall variability—driven by shifts in the global hydrological cycle—already negatively affect key crops such as maize, rice, soybeans, and wheat. According to the IPCC (2022), these conditions are expected to persist, leading to lower yields from rain-fed agriculture and reduced water availability for irrigation in drought-prone regions. Globally, the current warming trend is producing widespread physical and biological transformations, influencing regional climates, ecosystems, and the species that inhabit them (IPCC, 2007). Since most animal species can only survive within specific environmental limits, rapid or extreme changes beyond their tolerance levels can lead to ecological stress and species extinction. Species that are unable to adapt or have limited habitats are particularly vulnerable, and the extinction of some species has already been directly linked to climate change (Agba et al. 2017). Changes in animal phenology—including migration patterns, breeding cycles, and seasonal appearances—have been documented globally and are closely linked to shifting climate patterns. Similarly, changes in the spatial distribution of species, particularly toward the poles or higher elevations,

occur as suitable habitats either shrink or shift geographically (Afzal et al. 2016). In Arctic and marine ecosystems, rising temperatures and melting sea ice have severely impacted native species. Additionally, sea level rise, ocean acidification, and increasing sea surface temperatures are altering marine ecosystems (Udeh & Ikpe, 2022). The spread of pests and diseases has also become more prevalent under milder temperatures, posing additional threats to global biodiversity.

Climate change primarily occurs due to the greenhouse effect, where solar radiation is trapped within the Earth's atmosphere, thereby regulating global temperature. However, anthropogenic greenhouse gases—mainly carbon dioxide and methane—have intensified this effect, reflecting more solar radiation back to the Earth's surface. Atmospheric concentrations of these gases have increased since the pre-industrial era due to fossil fuel combustion and land use changes (IPCC, 2022). Consequently, the rate of climatic shifts during the 20th and 21st centuries has exceeded historical norms, leading to rising global temperatures, sea level rise, reduced sea ice, vegetation changes, and increased frequency and intensity of extreme weather events (Ikpe, 2021). These changes disrupt biotic interactions such as predator-prey relationships, and alter ecosystem composition and functioning (IPCC, 2007). Additionally, habitat fragmentation, competition from invasive species, pollution, and other human-induced disturbances are compounding the stress on animal populations, potentially accelerating biodiversity loss (Kirby, 2004). The projected temperature rise over the coming decades is expected to cause mass extinctions and exert irreversible impacts on global ecosystems (IPCC, 2007).

Biodiversity, a contraction of “biological diversity,” describes the richness and complexity of life on Earth. It encompasses both the number of species and the genetic variation within them (Patrick et al. 2022). As climate change progresses, ecosystem composition is expected to shift, with species migrating at different rates and in different directions depending on their tolerance and adaptive capacity (IPCC, 2022). Ultimately, climate change affects individual organisms, populations, species distributions, and ecosystem functions both directly and indirectly (IPCC, 2021). While some long-term effects are still being studied, current trends show that no ecosystem is immune. The situation observed in the Baturiya Wetland Area reflects this global pattern, demonstrating that climate change is indeed a universal phenomenon with local consequences for biodiversity, ecosystem stability, and human livelihoods (Agbo, 2012).

STUDY AREA

Baturiya Wetland is located at the southern tip of Jigawa State, Nigeria, bordering Hadejia Local Government Area and situated within Kirikasamma Local Government Area. The wetland covers an estimated area of about 1,000 square

kilometers and is dissected by the Hadejia River, which flows through the southern part of the reserve. This river serves as a major source of water for irrigation, fishing, and domestic use within the surrounding communities. The climate of the area is semi-arid, characterized by high temperatures throughout most of the year, except during August, which marks the peak of the rainy season, and between December and February, when the Harmattan brings cooler, dry air from the Sahara. The annual rainfall ranges between 800 mm and 1,000 mm, occurring mainly once a year, typically between April and October.

Ecologically, the Baturiya Wetland falls within the Guinea Savannah zone, consisting of gallery forests that line both sides of the river. The vegetation includes medium-sized trees, shrubs, herbs, saplings, and a rich diversity of grass species. This mosaic of vegetation provides habitat and breeding grounds for numerous wildlife species, including migratory birds, mammals, reptiles, and amphibians, making the area an important ecological and conservation hotspot in northern Nigeria. The wetland also plays a vital role in flood regulation, groundwater recharge, and nutrient cycling, while supporting agriculture and fishing as key livelihood activities for local communities. However, human pressures such as overgrazing, deforestation, and illegal hunting, combined with climate change, are threatening the ecological balance and biodiversity of the reserve.

MATERIALS AND METHOD

A reconnaissance survey was first conducted in the study area prior to the detailed fieldwork. The purpose of this preliminary survey was to assess the effects of climate change and determine suitable locations for the establishment of sample plots within the Baturiya Wetland Area. Based on the distribution of existing plant and animal species, the entire study area was divided into four (4) sample plots, each measuring 5 km by 5 km. Observations in each plot were carried out weekly, between 7:00 a.m. and 5:00 p.m., to capture variations in environmental and biological conditions. The materials and equipment used for field data collection included ranging poles, wooden pegs, measuring tapes, field notebooks, and pens. The direct sighting method was employed for the identification of areas affected by climate change within each sampled plot. This involved physical observation of vegetation changes, animal activity, and signs of habitat disturbance such as erosion, logging, and grazing. Additionally, informal interactions and interviews were conducted with local residents and wetland users to gather qualitative data on water availability, climatic changes, and community perceptions of environmental degradation. The data collected were subjected to descriptive statistical analysis, including the use of frequency distributions and percentage tables to summarize field observations. These data provided insights into the spatial variation in climate change effects, patterns of species distribution, and the extent of anthropogenic influence within the study area.

RESULTS AND DISCUSSIONS

The results on the effects of climate change in the study area are presented in Table 1. The findings revealed that cold fronts, precipitation rates, vegetation structure, and soil moisture have drastically decreased, while heat intensity has shown a significant increase across the sampled plots.

Table 1: The effects of climate change in the study area

EFFECTS	PLOT 1	PLOT 2	PLOT 3	PLOT 4
Colds fronts	-	-	-	-
Heat intensity	+	+	+	+
Rate of precipitation	-	-	-	-
Vegetation structure	-	-	-	-
Soil moisture	-	-	-	-

Source: Field survey, 2025

Presence (+)

Absence (-)

Observations from all four (4) sample plots confirmed that the effects of climate change are widespread throughout the Baturiya Wetland Area. The identified effects include a decrease in cold fronts, increased heat intensity, reduced rate of precipitation, declining vegetation structure, and decrease in soil moisture content. These results suggest that the area is undergoing pronounced climatic and ecological transformations that directly affect both flora and fauna. The observed trends align with the findings of the Intergovernmental Panel on Climate Change (IPCC, 2007), which reported that projected temperature increases over the coming centuries are expected to lead to mass extinctions and irreversible impacts on biodiversity and ecosystem stability. Similarly, Akande et al. (2017) noted that climate change exerts multiple interrelated effects on natural vegetation, influencing its structure, productivity, and ecological function. According to their study, climate change alters seasonality, increases the frequency and intensity of extreme heat and cold events, and disrupts natural precipitation and soil moisture regimes, as well as relative humidity and ambient temperature. In the Baturiya Wetland Area, these climatic shifts manifest through the drying of wetlands, loss of riparian vegetation, and decline in soil fertility, which collectively threaten the habitat of numerous wildlife species. Reduced soil moisture and rainfall variability have also contributed to the shrinking of water bodies, thereby limiting water availability for both wildlife and human activities. The increasing temperature and aridity may further exacerbate biodiversity loss, disrupt ecosystem balance, and reduce the overall resilience of the wetland ecosystem to future climatic stress (Apata, 2012). These findings underscore the urgent need for adaptive management strategies, including sustainable water use, reforestation, and wetland restoration, to mitigate the ongoing and projected impacts of climate change in the study area

Causes of Climate Change

The results on the causes of climate change in the study area are presented in Table 2. The findings revealed that overgrazing, illegal logging, wildfires, and erosion are prevalent in all four sampled plots, while illegal mining was recorded in only one of the plots. This indicates that anthropogenic activities are the dominant drivers of environmental degradation and climatic alterations within the Baturiya Wetland Area (Ariko et al. 2024). Across all the sampled plots, several key factors contributing to climate change were identified. Overgrazing was observed to be widespread, exposing bare soil to direct sunlight, thereby increasing surface temperature, reducing soil moisture, and predisposing the area to erosion. Illegal logging was also common, leading to the destruction of trees that serve as carbon sinks and habitats for wildlife. Similarly, wildfires, often resulting from human negligence or land-clearing practices, were found to cause extensive loss of fauna and flora, altering the ecological balance of the wetland (Amaefule et al, 2023).

Table 2. The causes of climate change in the study area.

CAUSES	PLOT 1	PLOT 2	PLOT 3	PLOT 4
Overgrazing	-	-	-	-
Logging	+	+	+	+
Wild fires	-	-	-	-
Illegal mining	-	-	-	-
Erosion	-	-	-	-

Source: Baturiya Field survey 2025

Presence (+)

Absence (-)

Erosion was noted to expose tree roots, weaken plant structure, and contribute to the loss of fertile topsoil, thereby reducing vegetation cover. Illegal mining, though less prevalent, was found in one location and has led to localized soil degradation and habitat disturbance. These findings are consistent with the European Commission (2023), which emphasizes that human activities are increasingly influencing the climate and global temperature through actions such as burning fossil fuels, deforestation, and livestock production. These activities release large amounts of greenhouse gases—including carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O)—into the atmosphere, thereby intensifying the greenhouse effect and accelerating global warming (Amare et al. 2018). In the context of the Baturiya Wetland, these human-induced pressures compound the natural variability of the ecosystem, making it more vulnerable to desertification, habitat loss, and biodiversity decline. The combined effects of overgrazing, vegetation loss, and soil erosion not only modify the microclimate but also threaten the ecological services provided by the wetland, such as flood regulation, water purification, and wildlife habitat support (Alexandrov & Hoogenboom, 2000). The results thus highlight the urgent need for sustainable land management practices, such as

controlled grazing, community-based forest management, and strict enforcement of environmental protection laws, to reduce anthropogenic pressures and enhance the resilience of the wetland ecosystem to climate change impacts.

Possible Measures to Minimize the Impacts of Climate Change in the Study Area

The results on the possible measures to minimize the impacts of the climate change in the study area are shown in Table 3. The results showed that ant poaching patrol, stopping logging activities, tire tracing, erosion control, and reducing overgrazing could be measures that Can minimizes the impacts of climate change in the study area as observed and identified by the researcher.

Table 3: Measures to Minimize the Impacts of Climate Change in the Study Area

Measures t	PLOT 1	PLOT2	PLOT 3	PLOT 4
Anti-poaching patrol	+	+	+	+
Stopping logging	+	+	+	+
Fire tracing	+	+	+	+
Erosion control	+	+	+	+
Reducing overgrazing and tree planting	+	+	+	+

Source: Baturiya Field survey 2025

Suggested (+)

Denied (-)

The findings shows that measures to minimize or reduce the impacts of climate change in the study area in relation to the identified effects and causes of climate change includes; ant poaching patrol to reduce or minimize human activities. This is in line with assertion by the Commission of the European Communities (2019) that CO₂ is the greenhouse gas produced by human activities and it is responsible for 64% of the man-made global warming. Other measures include stopping logging activities, fire tracing reduce fire incidence, erosion control and reducing overgrazing and organizing tree campaigns.

The study focused on effects of climate change on wildlife species in Baturiya wetland Area in Jigawa state. The methodology employed in the study was sampled plots. The results reveal that decreasing cold fronts, decrease in precipitation, decreasing vegetation structure, soil moisture and increasing heat intensity are the effects of climate change and on other hand the causes of climate change on wildlife species in Dajin Baturiya wetland include overgrazing, logging, wildfires, illegal mining and erosion. It also identifies ant poaching, fire tracing, erosion control and tree planting as measures to mitigate the impacts of climate change in the study area.

CONCLUSION

The findings of this study concluded that the effects of climate change in the Baturiya Wetland Area are increasing at an alarming rate. The results revealed that only a few resilient species—such as certain birds, reptiles, amphibians, and small mammals like primates—continue to survive within the ecosystem. This indicates that the Baturiya Wetland is experiencing significant ecological stress, with limited ecological niches capable of supporting wildlife species that can adapt to the changing environmental conditions. The observed decline in biodiversity and habitat quality is largely attributed to anthropogenic activities, including frequent bush burning, tree felling, overgrazing, and illegal resource extraction. These human-induced pressures have accelerated the degradation of vegetation cover, disrupted the wetland’s hydrological balance, and reduced the availability of food and shelter for wildlife species. It is therefore imperative that urgent and sustainable management measures be implemented to conserve and restore the ecological integrity of the wetland. Proper habitat management, community participation, and policy enforcement are essential for ensuring the long-term sustainability of wildlife populations and the continued functioning of the Baturiya Wetland ecosystem in the face of climate change.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations are proposed:

1. Enhanced Anti-Poaching Patrols:

The reserve authorities should intensify anti-poaching operations and strengthen surveillance systems to prevent human intrusion, illegal logging, grazing, and wildlife killing within the wetland. This will help protect vulnerable species and reduce habitat disturbance.

2. Environmental Education and Community Awareness:

Environmental education campaigns should be conducted regularly in the communities surrounding the wetland to raise awareness about wildlife conservation, sustainable resource use, and the impacts of climate change and global warming. Local communities should be actively involved in wetland management initiatives to ensure long-term success.

3. Strengthening Legal and Policy Frameworks:

There is a need to improve and enforce environmental legislation related to climate change, natural resource management, and biodiversity conservation. Stronger political commitment at local and state levels is essential to ensure compliance with environmental protection policies.

4. Habitat Restoration and Reforestation:

Reforestation programmes should be initiated to restore degraded areas of the wetland, improve soil stability, and

enhance vegetation cover. Tree planting along riverbanks can help prevent erosion and provide natural habitats for wildlife.

5. Sustainable Land Use Practices:

Grazing and farming activities around the wetland should be properly regulated to prevent overexploitation of natural resources. The introduction of controlled grazing systems and alternative livelihood options can reduce pressure on the ecosystem.

REFERENCES

Afzal, M., Ahmed, T., & Ahmed, G. (2016). Empirical assessment of climate change on major agricultural crops of Punjab, Pakistan.

Agba, D., Adewara, S., Adama, J., Adzer, K., & Atoyebi, G. (2017). Analysis of the effects of climate change on crop output in Nigeria. *American Journal of Climate Change*, 6(3), 554–571. <https://doi.org/10.4236/ajcc.2017.63028>

Agbo, C. U. (2012). Climate change and crop production in Nigeria: Effects and adaptation options. In A. A. Enete & M. I. Uguru (Eds.), *Critical issues in agricultural adaptation to climate change in Nigeria* (pp. 114–143). Chenglo Ltd.

Akande, A., Costa, A. C., Mateu, J., & Henriques, R. (2017). Geospatial analysis of extreme weather events in Nigeria (1985–2015) using self-organizing maps. *Advances in Meteorology*, 2017, Article 8576150. <https://doi.org/10.1155/2017/8576150>

Alexandrov, V., & Hoogenboom, G. (2000). The impact of climate variability and change on crop yield in Bulgaria. *Agricultural and Forest Meteorology*, 104(4), 315–327. [https://doi.org/10.1016/S0168-1923\(00\)00166-0](https://doi.org/10.1016/S0168-1923(00)00166-0)

Amaefule, C., Shoaga, A., Ebelebe, L. O., & Adeola, A. S. (2023). Carbon emissions, climate change, and Nigeria's agricultural productivity. *European Journal of Sustainable Development Research*, 7(1), em0206. <https://doi.org/10.29333/ejdsdr/1257>

Amare, M., Jensen, M. N., Shiferaw, B., & Cissé, J. D. (2018). Rainfall shocks and agricultural productivity: Implications for rural household consumption. *Agricultural Systems*, 166, 79–89. <https://doi.org/10.1016/j.agsy.2018.07.014>

Amanchukwu, R. N., Amadi-Ali, T. G., & Olofube, N. P. (2015). Climate change education in Nigeria: The role of curriculum review. *Education*, 5(3), 71–79.

Apata, T. G. (2012). Effects of global climate change on Nigerian agriculture: An empirical analysis. *CBN Journal of Applied Statistics*, 2(1), 31–50.

Ariko, J. D., & Ikpe, E. (2024). Analysis of rainfall trend and its relationship with sorghum yield in Sudan Savanna regions

of Nigeria. *International Journal of Scientific Research in Multidisciplinary Studies*, 10(3), 1–4.

Commission of the European Communities. (2009). *Adapting to climate change: Challenges for European agriculture and rural areas*.

Dinar, A., Mendelsohn, R., Evenson, R., Parikh, J., Sanghi, A., Kumar, K., McKinsey, J., & Lonergan, S. (1998). *Measuring the impact of climate change on Indian agriculture* (World Bank Technical Paper No. 402). World Bank.

Ikpe, E. (2021). *Effect of climate change on the yield of selected grains and farmers' adaptation strategies in Sokoto State, Nigeria* (Unpublished doctoral dissertation). Department of Geography and Environmental Management, Zaria, Nigeria.

Ikpe, E., & Ugbede, D. O. (2025). Effect of rainfall variability on the yield of rice and farmers' adaptation strategies towards food security in selected local government area of Benue State, Nigeria. *Gujarat Journal of Extension Education*, 39(1), 19–27.

Intergovernmental Panel on Climate Change. (2007). *Climate change 2007: Impacts, adaptation, and vulnerability*. Cambridge University Press.

Intergovernmental Panel on Climate Change. (2021). Summary for policymakers. In *Climate change 2021: The physical science basis* (pp. 3–33). Cambridge University Press. <https://doi.org/10.1017/9781009325844.001>

Intergovernmental Panel on Climate Change. (2022). Summary for policymakers. In *Climate change 2022: Impacts, adaptation, and vulnerability* (pp. 3–33). Cambridge University Press. <https://doi.org/10.1017/9781009325844.001>

Patrick, J. A., Omede, U. D., & Ikpe, E. (2022). Comprehensive description of body shapes, sizes and plumage colorations of domestic pigeons in Benue State, Nigeria. *Gujarat Journal of Extension and Education*, 34(1), 9–16.

Udeh, E. L., & Ikpe, E. (2022). Public perception of the risk of climate change issues in Zaria City and its environs in Kaduna State, Nigeria. *International Journal of Geography and Regional Planning*, 15(1), 1–9.