Assessing Farm-Land Expansion Along Historical Pastoral Routes: An Evidence from Daura Community, Fune Local Government Area Yobe State

Usman Muhammed Taa, Usman Adamu

Department of Geography and Environmental Management Yobe State University, Damaturu, Nigeria

DOI: https://dx.doi.org/10.47772/IJRISS.2025.907000008

Received: 12 June 2025; Accepted: 16 June 2025; Published: 26 July 2025

ABSTRACT

Pastoral corridors are vital to sustaining pastoralist livelihoods, enabling seasonal livestock mobility across semi-arid landscapes. However, these routes face increasing threats from agricultural expansion, urbanization, and infrastructural development. This study assesses the extent, spatial pattern, and projected trajectory of pastoral corridor encroachment in Daura Community, located in Fune Local Government Area of Yobe State, Nigeria. Using historical satellite imagery from Google Earth Pro (2000, 2010, and 2020), land use classifications—cropland, bare land, and built-up areas—were analyzed with ArcGIS 10.8. Graphical visualizations and descriptive statistics illustrated land use trends, complemented by qualitative insights from key informant interviews. Results show a marked transformation: in 2000, bare land comprised 85% and cropland 15%. By 2020, cropland expanded to 79% while bare land reduced to 17%, indicating significant pastoral space encroachment. These changes are driven by demographic pressure, food insecurity, and agricultural policy shifts, notably restrictions on food imports. Linear projections to 2040 suggest this trend will continue: bare land is expected to decline further to 1.14 km² (an 88% reduction from 2020), while cropland may rise to 60.4 km². Built-up areas are projected to grow to 3.1 km², compounding land use pressure. These findings underscore the urgency of addressing tensions between farming and pastoralism amid competing land demands and environmental fragility. The study calls for inclusive, sustainable land management strategies that protect pastoral corridors, promote equitable land access, and support the ecological and socio-economic resilience of pastoralist communities in Nigeria's semi-arid zone.

Keywords: Pastoral corridors, Land use change, Agricultural expansion, GIS, Daura Community, Yobe State, Satellite imagery, Pastoralism, Encroachment, Livelihood sustainability.

INTRODUCTION

Pastoralism constitutes a critical livelihood strategy for millions of people across Africa, particularly in arid and semi-arid regions where crop farming is rendered unreliable by erratic and insufficient rainfall (Fratkin, 2001; Krätli & Schareika, 2010). It is a highly adaptive and flexible system of resource management that hinges on the strategic movement of livestock to access dispersed water and grazing resources across variable landscapes. In Nigeria, pastoralism, especially the transhumant form, plays a central socio-economic and cultural role in rural economies, supporting food security, livelihoods, and regional trade (Blench, 2010).

Central to the effectiveness of pastoral systems are pastoral corridors—traditional migratory routes that facilitate the seasonal movement of herders and their livestock between wet and dry season grazing grounds. These corridors enable pastoralists to exploit the temporal and spatial heterogeneity of natural resources while minimizing the risks posed by climatic variability. Historically, pastoral corridors in Nigeria have been socially recognized and respected by various land users, with customary norms guiding coexistence between pastoralists, farmers, and other resource users (Waters-Bayer & Bayer, 1994; Turner et al., 2011).

However, the sustainability of pastoral corridors has come under severe threat over recent decades due to increasing pressures from land use change. Agricultural expansion, driven by population growth, food security concerns, and government policy interventions such as the ban on food imports, has led to the conversion of

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue VII July 2025

traditional grazing lands into croplands (Adamu et al., 2018; Moritz et al., 2013). Urbanization, infrastructural development, and the establishment of permanent settlements have further compounded the problem by physically obstructing migratory routes and fragmenting pastoral landscapes (Dong et al., 2011). In the absence of clear legal protections for pastoral corridors, and amidst weak enforcement of land tenure rights for mobile populations, encroachment has become widespread, contributing to escalating resource-based conflicts and threatening the very foundation of pastoral livelihoods (Mahmoud, 2008; Blench, 2010).

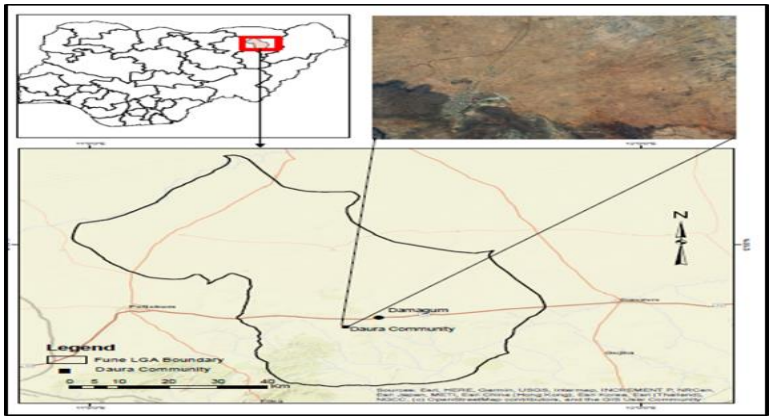
The Daura Community, situated in Fune Local Government Area of Yobe State, provides a pertinent case study of these dynamics. Located within the Sahelian ecological belt, Daura experiences a predominantly semi-arid climate characterized by a short rainy season and a long dry season, conditions which have historically supported pastoral mobility as a viable land use system. Yet, the last two decades have witnessed rapid changes in land use patterns, with substantial areas of traditional pastoral corridors converted into agricultural fields, residential settlements, and other infrastructural uses. These changes have significantly curtailed pastoral movement, disrupted traditional resource management systems, and intensified competition over dwindling natural resources.

The resultant pressures have heightened farmer-herder tensions, led to localized conflicts, and reduced the resilience of pastoral communities to environmental and economic shocks. Furthermore, the loss of pastoral corridors undermines broader ecosystem functions, including biodiversity conservation, soil regeneration, and the sustainable use of dryland resources (Davies & Hatfield, 2007).

Against this background, this study aims to systematically analyze the extent and patterns of pastoral corridor encroachment in Daura Community over a twenty-year period (2000–2020). Utilizing historical satellite imagery from Google Earth Pro and employing Geographic Information System (GIS) techniques within ArcGIS 10.8, the research maps land use changes, quantifies the degree of encroachment, and identifies the major drivers of these transformations. Complementary qualitative data gathered through key informant interviews enriches the analysis by providing local perspectives on the impacts of corridor loss on livelihoods, resource access, and conflict dynamics.

Understanding the dynamics of pastoral corridor encroachment is crucial for informing policy and practice aimed at sustaining pastoralism, promoting peaceful coexistence among land users, and ensuring the ecological health of dryland environments. Therefore, shedding light on these processes in Daura Community, this study contributes to the growing body of scholarship advocating for integrated land management approaches that recognize and protect the mobility needs of pastoralists within broader rural development and land governance frameworks.

MATERIALS AND METHODS



Study Area

Daura Community is a historic settlement situated in Fune Local Government Area of Yobe State, northeastern Nigeria. Geographically, it is located between latitudes 11° 33’ 04” and 11° 36’ 38” North, and longitudes 12°

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue VII July 2025

22’ 10” and 11° 22’ 01” East, approximately 11 kilometers south of Dogon Kuka town, along the Kano-Maiduguri highway.

The area lies within the Fika Shale geological formation, which overlays the older Gongola Formation. The Fika Shale is characterized by blue-black, ammonite-rich, open marine shale, noted for its gypsiferous content and interbedded thin limestone layers (Adegoke, Abdullahi, Hakimi, & Yandoka, 2014). This unique geological setting influences both soil characteristics and groundwater composition, impacting agricultural practices and pastoral activities in the region.

Ecologically, Daura falls within the Sudanian savanna zone, a transitional belt between the Sahel to the north and the Guinean savanna to the south. The area experiences a semi-arid climate marked by two distinct seasons: a wet season spanning June to September and a prolonged dry season from October to May. Rainfall is generally sparse and erratic, influencing land use patterns and necessitating mobility for sustainable livestock management.

The local economy is predominantly based on livestock rearing and small-scale farming, both of which are heavily reliant on the seasonal availability of pasture and water resources. Pastoral corridors are thus vital for facilitating the seasonal movement of herders and their livestock between grazing areas. The study area, covering approximately 53.5 square kilometers, was specifically selected due to its strategic location within traditional pastoral routes and its exposure to growing pressures from land use changes.

Study Design and Approach

Research Design

This study adopted a mixed-methods research design, integrating geospatial analysis, statistical modeling, and qualitative inquiry to investigate land use changes and their implications on pastoral corridors in Daura Community, located in Fune Local Government Area of Yobe State, Nigeria. The rationale for this design was to ensure triangulation between spatial-temporal data and community narratives in order to produce a holistic understanding of landscape transformation, corridor encroachment, and livelihood vulnerability.

A longitudinal observational approach was employed to assess historical land use trends at decadal intervals. The study also incorporated predictive modeling techniques to project future land use dynamics, thereby enabling both retrospective and prospective insights. Additionally, the integration of thematic qualitative analysis allowed for the capture of local knowledge systems and perceptions, strengthening the interpretative depth of the spatial findings.

Research Methods

Geospatial Data Collection and Processing

Historical satellite imagery for the years 2000, 2010, and 2020 was obtained from Google Earth Pro. Each image was geo-referenced and digitized to extract land use categories relevant to the study objectives. The study area was delineated based on historical maps, archival records, and local consultations to accurately identify the boundaries of traditional pastoral corridors. The land use of the area was classified into four dominant categories:

Cropland
Bare land
Pastoral routes
Built-up areas

Vector-based classification techniques were applied using ArcGIS 10.8, and the areal extent of each land cover class was computed using Google Earth’s measurement tools. Further spatial analysis—such as zonal statistics and overlay functions—was performed in ArcGIS to visualize land use transitions across the three time points.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue VII July 2025

Qualitative Data Collection

In order to contextualize the spatial findings and capture experiential knowledge from stakeholders, Key Informant Interviews (KIIs) were conducted with pastoralists, farmers, community leaders, and local government representatives. The interviews focused on themes such as:

Observed land use changes
Perceived drivers of change (e.g., population pressure, policies)
Impacts on mobility, grazing access, and livelihoods
Social dynamics and conflict over land

Responses were recorded and transcribed, and a thematic coding approach was employed to analyze the qualitative data. The findings were subsequently used to enrich and explain the spatial and statistical results.

Land Use Change Projection

To assess future land use trajectories, the study employed a linear extrapolation technique. Observed land use values from 2000, 2010, and 2020 were analyzed to construct regression models for each land cover class—bare land, farmland, and built-up areas. Using Python's scikit-learn library, linear regression models were developed to predict land use values for 2030 and 2040.

This approach assumes a business-as-usual scenario, where existing trends continue in the absence of significant policy interventions or environmental shocks. Visualization of the predicted land cover values was performed using Matplotlib, enabling a comparative analysis of both historical and projected land use dynamics.

This method was selected for its simplicity, transparency, and frequent use in land use and environmental planning, especially in data-scarce settings. Lambin et al. (2001) and Liu et al. (2008) have demonstrated the utility of linear extrapolation in similar landscape transformation studies. While advanced techniques such as cellular automata and agent-based models are available, the linear model was deemed appropriate for this exploratory projection given the limited temporal dataset.

Data Integration and Interpretation

Finally, both the spatial data and qualitative insights were synthesized to identify patterns of encroachment, conflict hotspots, and areas of concern. This triangulated approach ensured a comprehensive understanding of land use dynamics from both quantitative and socio-cultural perspectives, providing a basis for informed recommendations on land governance and pastoral corridor protection.

RESULTS AND DISCUSSION

Land Use and Land Cover Dynamics (2000–2020)

The spatiotemporal analysis of satellite imagery conducted using Google Earth Pro revealed significant transformations in land use and land cover (LULC) within Daura Community over a 20-year period (2000–2020). These changes are summarized in Table 3.1 and visually represented in Figure 3.1, which illustrates the classified historical imagery for the years 2000 and 2010.

Figure 3.1. presents the classified satellite images, corroborating these trends through spatial visualization of land cover dynamics between 2000 and 2010.

Year	Bare Land km²	Farm Land km²	Built-Up km²	Total Land km²	Bare Land %	Farm Land %	Built-Up %
2000	45	8.2	1.05	54.25	82.95	15.12	1.94

2010	28	25	1.25	54.25	51.61	46.08	2.3
2020	9.57	42.5	2.18	54.25	17.64	78.34	4.02

In the year 2000, the land cover composition was heavily dominated by bare land, which spanned approximately 45.00 km², accounting for 82.95% of the total land area. Agricultural activities were limited, with farmland covering just 8.20 km² or 15.12%, while built-up areas were minimal, occupying only 1.05 km², which represented 1.94% of the land.

By 2010, there was a dramatic shift in land use. Bare land decreased substantially to 28.00 km² (51.61%), indicating a reduction of 17.00 km², likely due to increased land cultivation and settlement expansion. Farmland witnessed a remarkable surge, expanding to 25.00 km², which now constituted 46.08% of the total area—a 204.88% increase from its 2000 baseline. Built-up areas also experienced moderate growth, increasing to 1.25 km² (2.30%), reflecting ongoing rural settlement development.

The transformation continued and intensified by 2020. Bare land further declined to just 9.57 km², a reduction of 78.73% from the initial extent in 2000, representing only 17.64% of the total land. Farmland, on the other hand, expanded to a peak of 42.50 km², which constituted 78.34% of the area—an increase of 418.29% compared to the baseline year. Similarly, built-up areas rose to 2.18 km², representing 4.02% of land cover, nearly doubling in extent over the 20-year span.

These observations stress the intensifying conversion of natural or fallow landscapes into agricultural and settlement uses, driven by population growth, socio-economic demands, and possibly declining soil fertility necessitating new farmlands. The shrinking of bare land from over four-fifths of the total area in 2000 to less than one-fifth in 2020 illustrates a significant land use transition, with implications for soil erosion, biodiversity, and local climate regulation.

In 2000, bare land was the predominant land cover type, accounting for approximately 45.00 km², which represented 85% of the total study area. Farmland constituted 8.20 km² (15%), while built-up areas were negligible at 1.05 km². By 2010, the extent of bare land had declined to 28.00 km², indicating a significant loss of 17.00 km². Concurrently, farmland expanded to 25.00 km², marking a 204.9% increase. This expansion trend intensified by 2020, with farmland covering 42.50 km², an increase of 418.3% from the 2000 baseline. Built-up areas also experienced gradual growth, expanding to 2.18 km² in 2020. Figure 3.1 present the classified Google earth historical imagery for the 2000 and 2010 respectively.

Figure 3.1 . The Google Earth images depicting the areas dynamic between 2000-2010

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue VII July 2025

Figure 3.2. The Google Earth images depicting the areas dynamics for the year 2020

The Figure 3.1 illustrates clearly the dynamic shift, where bare land has sharply declined while farmland expanded at an accelerating pace. This reflects both the spatial and temporal dimensions of land use conversion in the area. These trends are consistent with broader land cover changes reported across Nigeria. Umar and Danjuma (2022) documented that intensified farming practices and population growth have contributed significantly to land conversion in northern Nigeria. Similarly, Ihemezie and Dallimer (2021) identified agricultural land-use change and rural expansion as key drivers of ecological transformation, particularly in the Sudan-Sahel ecological zone, where the competition for space is acute.

Impacts on Pastoral Corridors and Resource Use

The contraction of bare land and the simultaneous expansion of cropland into formerly open areas have severe implications for pastoral mobility. Traditionally, pastoralism in the semi-arid regions of Nigeria has relied on the existence of natural corridors that facilitate seasonal livestock movement. The reduction of these routes, as shown in this study, signals a disruption of pastoral systems, consistent with findings by Ibrahim et al. (2015), who reported that blocked livestock movement corridors have become flashpoints for herder-farmer conflicts in the northern regions of the country.

Moreover, the spatial proximity between expanding farmland and critical pastoral resources—such as grazing reserves, water sources, and transhumant routes—heightens the potential for direct competition and resource contestation. Ossai (2015) linked similar patterns of land conversion in fadama (lowland floodplain) areas with an increase in land-use disputes, as both crop farmers and herders vie for access to fertile land and water.

Projected Land Use Changes (2020–2040)

The projection of land use changes in Daura Community for the period 2020 to 2040 reveals a continuation of the dominant trends observed in the previous decades, characterized by sustained agricultural expansion and a parallel decline in natural open spaces. Linear extrapolation based on historical land cover data suggests that bare land will decrease from 9.57 km² in 2020 to approximately 1.14 km² by 2040, representing a projected loss of over 88%. This dramatic reduction indicates an almost complete transformation of the natural landscape, with serious implications for ecosystem services and communal rangelands traditionally used by pastoralists.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue VII July 2025

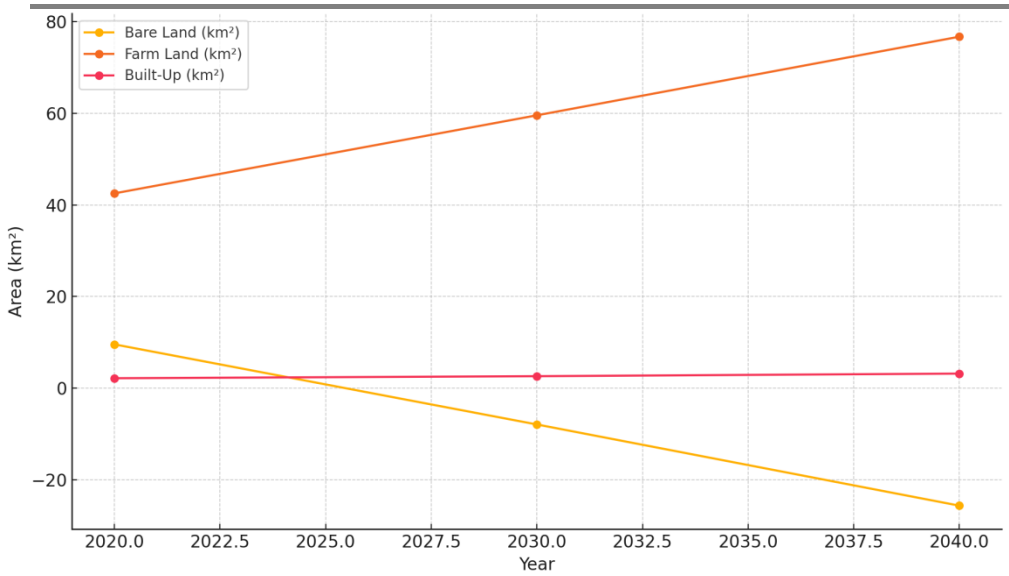


Figure 3.3. Projected Land Use Changes in Daura Community (2020-20240)

Simultaneously, farm land is expected to increase substantially, rising from 42.5 km² in 2020 to an estimated 60.4 km² by 2040, consolidating its position as the dominant land use type in the area. This surge reflects ongoing agricultural intensification, possibly driven by demographic pressures, subsistence needs, and government agricultural policies that favor domestic food production. Built-up areas will also expand modestly, reaching approximately 3.1 km² by 2040, reflecting continued urbanization trends and the gradual transformation of the rural settlement structure.

These projections are consistent with documented trends across northern Nigeria. For example, Umar and Danjuma (2022) reported similar patterns in Bauchi State, where farmland encroachment has significantly displaced traditional grazing spaces and disrupted pastoralist routes. Weak spatial planning and the absence of clearly delineated and protected pastoral corridors, which exacerbates the risk of herder-farmer conflicts and undermines the socio-economic stability of pastoral communities, further aggravate such land use dynamics.

The expected near-complete loss of bare land by 2040 raises urgent concerns about the ecological balance and sustainability of pastoralism in the region. The disappearance of unoccupied land will likely reduce access to critical dry-season grazing zones, increase livestock vulnerability to climatic stressors, and intensify resource-based conflicts. As IFAD (2022) recommends, safeguarding pastoral mobility and rangelands requires urgent policy attention, including the statutory recognition of grazing corridors and the integration of land use planning into rural development strategies.

In summary, the 2020–2040 projections underscore the need for anticipatory governance and sustainable land use frameworks in Daura Community. Without intervention, current land conversion trajectories may render pastoralism increasingly unviable, contributing to socio-environmental degradation and further marginalizing a key livelihood group in Nigeria's semi-arid region.

Community Perceptions and Socioeconomic Impacts

Qualitative data from Key Informant Interviews (KIIs) reveal that community members are acutely aware of the significant changes in land use patterns. Many expressed concern over the increasing conversion of grazing lands into agricultural fields and residential areas, which has disrupted traditional pastoral routes. One respondent lamented, "It used to be that our cattle could graze freely across these lands, but now, everywhere you look, there are farmlands where once there was grass." Another informant highlighted the rapid pace of these changes, stating, "In just the last five years, I've seen fields spring up where my father used to take our cattle."

These perceptions underscore the socio-economic impacts of land use changes on pastoral communities. The loss of grazing lands translates directly into economic hardship for pastoralists, as their livelihoods are deeply tied to cattle rearing and livestock mobility. Moreover, the encroachment on pastoral routes has intensified competition over scarce resources, exacerbating farmer-herder conflicts. One informant explained, "When there is no grazing land, our cattle stray into farms, and this causes big problems with the farmers." This observation highlights how the shrinking of pastoral corridors has led to increased instances of livestock trespassing onto farmlands, fueling tensions between pastoralists and farmers. In some cases, these tensions have escalated into violent conflicts. A respondent shared, "It's not just about grazing now; people are starting to fight over land. This land used to be for everyone, but now, everyone thinks they have to protect their piece."

These findings are consistent with the study by Chikaire et al. (2023), which analyzed the influence of socioeconomic characteristics on crop farmers and pastoralists' land use conflicts in Abia State, Nigeria. The study found that factors such as household size, educational level, and social organization membership significantly influenced the perceived causes of land use conflict among pastoralists.

Policy Implications and Recommendations

The findings of this study underscore the urgent need for effective land management policies to balance competing land uses, protect pastoral corridors, and sustain the livelihoods of both pastoralists and farmers. Without intervention, the continued expansion of agriculture and settlements will further degrade pastoral resources, exacerbating conflicts and undermining the socio-economic stability of the region.

To address these challenges, it is essential to implement inclusive and participatory land management policies that recognize the rights of pastoralists and safeguard their traditional routes. Formal recognition and mapping of pastoral corridors, coupled with the enforcement of land use regulations, could play a pivotal role in mitigating encroachment. Additionally, promoting alternative livelihoods and integrated land-use planning could help reduce reliance on agriculture and ease competition over land resources.

Furthermore, addressing the root causes of encroachment, such as population growth and economic pressures, through holistic and sustainable approaches is crucial. Policies that support climate-resilient agricultural practices, improve access to markets for pastoral products, and foster dialogue between farmers and herders could help balance competing land uses and reduce conflicts. Strengthening local governance structures and involving community members in decision-making processes could enhance the effectiveness and legitimacy of land management interventions.

These recommendations align with the suggestions by the International Fund for Agricultural Development (IFAD), which emphasizes the importance of strengthening pastoralists' adaptability, coping, and resilience capacities as part of conflict prevention processes. IFAD advocates for the identification and protection of strategic land areas for pastoralists, enabling multiple uses of land through appropriate land use planning and statutory tenure, and conducting impact assessments for all investments based on the principle of Free, Prior, and Informed Consent.

CONCLUSION

This study provides robust empirical evidence of spatial-temporal transformations affecting pastoral corridors in Daura Community, highlighting the alarming rate at which bare land is being converted into farmland and, to a lesser extent, built-up areas. The observed changes from 2000 to 2020 and the projected trends through 2040 illustrate a consistent trajectory of agricultural intensification and rural expansion. The transformations mirror broader patterns documented across Nigeria's semi-arid belt, where demographic pressure, food security concerns, and state-level agricultural policies are accelerating land use conversion.

Pastoral corridors in Daura are rapidly disappearing due to aggressive farmland expansion and settlement growth, posing a serious threat to livestock mobility and undermining rural peace. Between 2000 and 2020, bare land in the area declined by 78%, while farmland increased by over 400%. Projections indicate this trend

will persist, with further declines expected by 2040. The impacts of these changes are profound. Pastoralists face growing livelihood disruption, heightened vulnerability to drought, and an increase in farmer-herder conflicts as access to traditional grazing routes becomes restricted.

To address these challenges, key actions include mapping and legally recognizing pastoral corridors, promoting inclusive land use planning with participation from both farmers and herders, reforming land tenure systems to protect communal rights, supporting climate-resilient livelihoods and pasture restoration, and strengthening local governance and conflict resolution to foster peaceful coexistence is necessary.

REFERENCES

1. Abass, I. (2012). No retreat no surrender conflict for survival between the Fulani pastoralist and farmers in Northern Nigeria. European Scientific Journal, 8(1), 331–346.
2. Abdullahi, H. W., Hakimi, M. H., & Yandoka, B. S. (2014). Geochemical characterization of the Fika Formation in the Chad (Bornu) Basin Northeastern Nigeria: Implication for the depositional environment and tectonic setting. Journal of Applied Geochemistry, 1(2), 1–2.
3. Adamu, A. Y., Alhaji, M. M., & Nwankwo, U. (2018). Pastoralism and farmer-herder conflicts in Northern Nigeria: Causes, consequences and resolution strategies. International Journal of Peace and Conflict Studies, 5(1), 34–45.
4. Adamu, B., Umar, S., & Ahmed, T. (2018). Land use conflicts between farmers and pastoralists in Northern Nigeria: Causes and resolutions. Journal of Development Studies, 54(4), 569–580.
5. Adisa, R. S. (2012). Land use conflict between farmers and herdsmen – Implications for agricultural and rural development in Nigeria. In Rural development - Contemporary issues and practices
6. Agidew, A. M. A., & Singh, K. N. (2017). The implications of land use and land cover changes for rural household food insecurity in the Northeastern highlands of Ethiopia: The case of the Teleyayen sub-watershed. Agriculture & Food Security, 6(1), 1–14.
7. Blench, R. (2010). Conflict between pastoralists and cultivators in Nigeria. Kay Williamson Educational Foundation.
8. Chikaire, J., Ibe, S. S., & Anaeto, F. C. (2023). Influence of socioeconomic characteristics on crop farmers and pastoralists' land use conflict in Abia State, Nigeria. African Social Science Review, 12(1), Article 6.
9. Davies, J., & Hatfield, R. (2007). The economics of mobile pastoralism: A global summary. Nomadic Peoples, 11(1), 91–116.
10. Dong, S., Wen, L., Liu, S., Zhang, X., & Lassoie, J. P. (2011). Vulnerability of worldwide pastoralism to global changes and interdisciplinary strategies for sustainable pastoralism. Ecology and Society, 16(2), 10.
11. Ellis, E., & Pontius, R. (2007). Land-use and land-cover change. In Encyclopedia of Earth (pp. 1–4).
12. FAO. (2011). The state of the world's land and water resources for food and agriculture (SOLAW)—Managing systems at risk. Earthscan.
13. Fabusoro, E., & Oyegbami, A. (2009). Key issues in the livelihoods security of migrant Fulani pastoralist: Empirical evidence from Southwest Nigeria. Journal of Humanities, Social Sciences and Creative Arts, 4(2), 1–20.
14. Fratkin, E. (2001). East African pastoralism in transition: Maasai, Boran, and Rendille cases. African Studies Review, 44(3), 1–25.
15. Geist, H. J., & Lambin, E. F. (2002). Proximate causes and underlying driving forces of tropical deforestation. BioScience, 52(2), 143–150
16. IFAD. (2022). Pastoralism and conflict resolution: Policy brief. International Fund for Agricultural Development.
17. Ibrahim, A., Yusuf, M. J., & Abdullahi, I. (2015). The dynamics of herders-farmers conflicts in Northern Nigeria: Causes and solutions. Journal of Agricultural Studies, 3(2), 23–35.
18. Ihemezie, E. J., & Dallimer, M. (2021). Land use change and ecological impact in the Sudan-Sahel zone of Nigeria. Environmental Research Letters, 16(5), 054030.
19. Krätli, S., & Schareika, N. (2010). Living off uncertainty: The intelligent animal production of dryland pastoralists. European Journal of Development Research, 22(5), 605–622.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue VII July 2025

20. Lambin, E. F., Geist, H. J., & Lepers, E. (2001). Dynamics of land-use and land-cover change in tropical regions. Annual Review of Environment and Resources, 28, 205–241.
21. Liu, Y., Wang, J., & Long, H. (2008). Spatio-temporal analysis of land-use conversion in China's farming–pastoral ecotone. Land Use Policy, 25(2), 301–314.
22. Moritz, M., Scholte, P., Hamilton, I. M., & Kari, S. (2013). Open access, open systems: Pastoral management of common-pool resources in the Chad Basin. Human Ecology, 41(3), 351–365.
23. Turner, M. D., Ayantunde, A. A., Patterson, K. P., & Patterson, E. D. (2011). Livelihood transitions and the changing nature of farmer–herder conflict in Sahelian West Africa. Journal of Development Studies, 47(2), 183–206.
24. Umar, B., & Danjuma, I. (2022). Agricultural land conversion and implications for pastoralism in Northern Nigeria. Journal of Rural Studies, 88, 25–35.