



## EVALUATION OF CATTLE HERDERS' COPING STRATEGIES TO EFFECTS OF LAND USE CHANGE IN KATSINA STATE, NIGERIA

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### ABSTRACT

The study aimed at assessing cattle herders' Coping Strategies to Effects of Land Use Change in Katsina States, Nigeria. The research centered on primary data acquired through questionnaire, Focus Group Discussion and in-depth Interview. Both descriptive (frequencies, percentages, mean) and inferential statistics (Tobit regression analysis) were used to analyze the data. Results shows the effects of land use change on herders' livelihood with land fragmentation having no significant effect. However, soil degradation, of soil degradation (-0.2095), cattle route blockade (0.0073) and conflict on land resources (0.0088) have significant negative effects on herders' livelihood while the coefficient of decline of livestock population (0.0096), livestock health (0.0090), forage availability (0.0768) and water availability (0.0007) were found to have significant positive effects on herders' livelihood. The study also established that the predominant coping strategies of cattle herders to effects of land use change are: move long distance to find pasture (RII=0.83), use of crop residues as animal feeds (RII=0.83), praying to God (RII=0.83), herds Splitting (RII=0.76), and sales of natural resources such as medicine (RII=0.76). The study as well shows that the major constraints to coping strategies in the study area are conflicts over scarce resources (pasture and water) (X=4.15), minimal extension services (X=4.04), limited access to market (X=4.01), agricultural expansion limiting livestock movement (X=4.00) and Unfavourable government policy (X=3.99). However, these strategies are constrained by conflict over scarce resources such as pasture and water, minimal extension services, limited access to market and consistent agricultural expansion limiting herds movement due to land use change. It is concluded that Cattle herders and their cattle are subjected to long treks to find water and pasture as moving long distance, use of crop residues and praying to God are there main coping strategies in the area. Therefore, to increase cattle herders' income and transition them from migratory form of herding to sedentary pastoralism, which has better production output and safety for both the cattle, herders and farmers, it is pertinent for government and NGOs to provide enormous incentives in form of land, exposure, training and capital on a frequent basis to cattle herders.

**Keywords:** Land, Use, Coping, Strategy, Cattle, Herders

### INTRODUCTION

Land-use change is a worldwide issue and several studies have linked land use change to the overall global change issues in which climate change and land use change have significant effect on the sustainability of livelihood of next generation. (Selvaraj *et al.*, 2013) cited in (Abubakar and Abdussalam, 2024). Land-use refers to the purpose for which humans exploit the land-cover for their existence. It involved both the manner in which the biophysical attributes of the land are manipulated and the reasons for manipulation. Examples of land-use are crop farming, livestock rearing, mining, housing and infrastructural development (Morrison *et al.*, 2022). Therefore, Land use change involves conversion of one type of land use for another or modification of certain type of land activities for another (Zondag and Borsboom, 2009 and Tilahun *et al.*, 2016). Thus, constant change of the use of grazing land for different purposes or activities by man issues out the types of land use prevalent in a particle area.

There is significant alteration of the earth surface man action for livelihood and other activities such as population growth and increasing arable agricultural activities thereby mounting more pressure on land, resulting to observable change in the use of land. These changes in land use directly affect cattle herders' livelihood due to consistent conversion of grazing land to farmland. Currently, the



situation is aggravated due to man's increasing intervention on different grazing land, using it for either construction, building, farming or ranching. Hence, few grazing lands on the earth's surface remain that have not been significantly altered by humans (Emenyonu, *et al.*, 2015), and (Mehdi *et al.*, 2021).

Despite modern grazing reserve and ranching are consistently springing up in Nigeria, available grazing land is still diminishing at an alarming rate and livestock pathways blocked as a result of constant increase in human activities. The problem of herders is further compounded with various agricultural development programmes which encouraged irrigation farming along river banks leading to blockage of pasture and water along these banks obviously disrupting the routes that ease cattle movement and access to pasture land and water (Ayanda, 2018). In Nigeria, the old grazing routes that support ease of movement and accessibility of pastureland and water by cattle herders that have existed for decades are almost gone due to poor maintenance of grazing land and water bodies along these paths usually cause by rapid land use change (Mohammed, *et al.*, 2015 and Musa and Abubakar, 2024). These changes pressured cattle herders to develop coping strategies necessary for their craft.

Conventionally, land is one of the most important and attractive resources for herders to settle, while charcoal making, selling of milk and milk products, petty trading, daily labourers, commercial livestock, cultivation of crops for food and security guards serves as a major diversification strategy. However, one of the primary restrictions encountered by herders is access to safe land, which has long been a policy problem in Nigeria causing a change in herders' perception on the sustainability of land use and its effect on their livelihood prompting the need for appropriate coping strategies (Young and Goldman, 2015 and Olanloye *et al.*, 2021).

The current effects of land use change such as fragmentation of land, soil degradation, decline of livestock, cattle route blockade, livestock health, conflict for resources, market distance, alteration of animals and water pathways have cause cattle herding to currently face serious challenges due to constant decrease in the availability of grass land. These situation hampers herders' livelihood and consequently affect nation's economy. According to Bradley (2012), there is a significant overall decline in population of herders in all countries practicing cattle herding including Nigeria. He attributed land use change to be the prime cause in the decline. This is because land is very vital in maintaining mobility and access to seasonal pastures by cattle herders. Therefore, land use change is often cited as obstacles to maintaining cattle herders' livelihood resulting to need for effective coping strategies.

Over time, cattle herders have developed different coping strategies which helped in their adaptation to adverse effects of land use change. This is achieved through their in-depth knowledge of the environment which they live. Local traditional knowledge has helped them in developing measures and techniques to deal with diverse situations arising from land use change. These coping strategies are locale specific and are inherently scientific. Documentation of such coping strategies such as migrating long distance in search of pasture and sharing such innovative approaches at large platforms have helped in setting cattle herders' priorities. A number of questions were asked to assess the strategies adopted by cattle herders to cope with the effects of land use change. The herders reported a diversity of coping strategies that included both modern and traditional methods. And with glaring conflict arising on a daily basis on land issues between farmers and cattle herders, suggest that detailed and well-documented study to assess cattle herders coping strategies to effects of land use change in Katsina State is paramount. Therefore, the study addressed the following objectives:

- i. assess the effects of land use change on cattle herders' livelihood in the study area
- ii. determine the coping strategies of cattle herders on the effects of land use change in the study area
- iii. establish the constraints faced by cattle herders in coping with the effect of land used change

## **METHODOLOGY**

### **The Study Area**

The study was conducted in Katsina State. The State is located at the North West zone of Nigeria. The study adopted a multistage sampling technique whereby all Local Governments Areas (LGAs) were first grouped based on ecological zones of North, Central and South in Katsina State. According to the 2006 population census figures, Katsina State has a population of 5,801,586 persons. However, the



population has been projected at 3.2 population growth rate to be 10,555,066 in 2025 using Thomas Malthus population projection model. Out of the figure, about 49 percent are males while 51 percent are females. On the average there are 140 persons living per square mile in terms of density of the population. The estimated livestock population is about 2.5 million.

**Method of Data Collection**

Data collection focused on households as units of observation. Multi-stage sampling technique was used for this study. Firstly, the Local Government Areas (LGAs) in the State were grouped into three ecological zones of North, Central and South. Secondly, purposive sampling was used to select two to LGAs from each zone with sizeable number of herders. This gives a total of six (6) LGAs. Secondly, purposive sampling technique was used to select two LGAs from each zone, while random and purposive sampling were used to determined actual wards and settlements respectively. Secondly, purposive sampling technique was used to select two LGAs from each zone, while random and purposive sampling were used to determined actual wards and settlements respectively. Hence, open transverse survey was conducted along each path in every selected village to mark every household. Using systematic random method, every third household in each path that engaged in herding was selected till the required number of samples for the community was obtained. 50% of the number of herders from each community were taken to form a total of cattle herders used for the study. Data for this study were obtained from primary sources. The primary data were collected by administering questionnaire instrument to the respondents. The analytical tools that were used for this research were; descriptive statistics (such as frequency and percentages,) to achieve the objectives.

**Method of Data Analysis**

Both descriptive (frequencies, percentages, mean) and inferential statistics (Tobit regression analysis) were used to analyze the data. The Tobit regression was used to determine the effects of land use change. The empirical model for achieving this objective is specified as follows:

**Effect of land use change variables**

$$Y_i = 0 \text{ if } Y_i^* < 0$$

$$Y_i = Y_i^* \text{ if } Y_i^* \geq 0$$

$$Y_i^* = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_8 X_{8i} + e_i$$

$i = 1, 2$

Where:

$Y_i$  = Livelihoods activities of cattle herders ( $Y_1$ = sales of livestock, and  $Y_2$ = sales of milk and butter,  $Y_3$ =sales of cow dung,  $Y_4$ = animal traction)

$Y_i^*$  = Unobserved livelihoods activities of cattle herders ( $[(Z - I_i) / Z]$ )

$Z$  = Number of livelihoods activities involved/practiced by cattle herders

$e_i$  = Truncated error term

$\beta_0$  = Intercept term

$\beta_1 \dots \beta_8$  = Slope coefficients

- $X_{1i}$  = Land fragmentation (Size of land fragmented in hectare)
- $X_{2i}$  = Soil degradation (Size degraded in hectare)
- $X_{3i}$  = Decline of livestock (number of livestock decline per annum)
- $X_{4i}$  = Cattle route blockade (number of cattle route block)
- $X_{5i}$  = Livestock health (How often herd fall sick per annum)
- $X_{6i}$  = Conflict for land resources (Number of occurrence per annum)
- $X_{7i}$  = Distance to market (Distance cover to market in kilometres)
- $X_{8i}$  = Forage availability (Size of available forage land in hectare)
- $X_{9i}$  = Water availability (Number of available sources of water)

**RESULTS AND DISCUSSIONS**

**EFFECT OF LAND USE CHANGE ON CATTLE HERDERS' LIVELIHOOD**

Table 1 presents the effects of land use change on cattle herders' livelihood. The coefficients and marginal effects provide insights into how land use change effects (independent variables) affects herders' livelihood (dependent variable).

**Table 1: Effect of Land Use Change on Cattle Herders' Livelihood**

| S/n | Variable               | Coef.      | Std. Err. | T      | P> t   |
|-----|------------------------|------------|-----------|--------|--------|
| 1.  | Land Fragmentation     | 0.0305     | 0.0541    | 0.56   | 0.574  |
| 2.  | Soil degradation       | -0.2095**  | 0.061     | -3.45  | 0.001  |
| 3.  | Decline of livestock   | -0.0096    | 0.0016    | -5.89  | 0.000  |
| 4.  | Cattle route blockade  | -0.0073*** | 0.0063    | -1.66  | 0.101  |
| 5.  | Livestock health       | 0.0090*    | 0.0025    | 3.56   | 0.000  |
| 6.  | Conflict for resources | -0.0088**  | 0.0053    | -1.65  | 0.101  |
| 7.  | Distance to market     | 2.56e-07*  | 5.24e-07  | 0.49   | 0.625  |
| 8.  | Forage availability    | 0.0768*    | 0.0391    | 1.96   | 0.051  |
| 9.  | Water availability     | 0.0089*    | 0.0017    | 4.98   | 0.000  |
|     | constant               | 0.4517     | 0.0552    | 8.18   | 0.000  |
|     | var(e.index2)          | 0.0268     | 0.0026    | 0.0221 | 0.0324 |

**Note:** \*\*\*, \*\* and \* significant at 1 percent, 5 percent and 10 percent levels of probability

Fragmentation of Land with a coefficient of 0.0305 and a p-value of 0.574, was not found to have a significant effect on livelihood. This is likely due to herders' migratory nature, which allows them to avoid fragmented areas. However, Joseph *et al.*, (2024) reported that land fragmentation restricts livestock mobility, leading to overgrazing and rangeland degradation.

Soil degradation had a significant negative effect on livelihood, with a coefficient of -0.2095. This suggests that as soil quality declines, herders' livelihoods deteriorate. FAO (2018) highlights that soil degradation leads to increased food prices, reduced agricultural output, and possible migration to more fertile lands (Abdulmalik & Zewide, 2021). A decline in livestock numbers had a negative coefficient (-0.0096), suggesting that a reduction in herd size harm cattle herders' livelihoods. This aligns with the findings with Diana, *et al.*, (2022), who found that declining livestock numbers negatively affect pastoralists. Coefficient for cattle route blockade (-0.0073) was negatively significant, indicating that consistent blockage of cattle routes negatively affects livelihood. This suggests that appropriate measure to stop this blockade is necessary for peace and improve livelihood of herders (Michele, 2019). Livestock Health with a coefficient of 0.0090, livestock health had a positive impact on livelihood. Healthy livestock reduce veterinary costs and increase market value (Caroline *et al.*, 2023). Conflict over resources had a significant negative effect on livelihood. This supports previous findings that land conflicts disrupt pastoral economies (Kwaja Smith, 2020).

The coefficient for market distance (2.56e-07) was not significant, suggesting limited impact. However, access to markets remains important for economic participation (Duba, *et al.*, 2024). Forage availability had a significant positive effect, reinforcing its importance for maintaining herd productivity (Ouédraogo *et al.* 2021). Water availability had a positive coefficient (0.0089), highlighting its essential role in livestock productivity, particularly in arid regions (Luigi *et al.*, 2024).

#### **Herders' Coping Strategies to Effect of Land Use Change**

Table 2 presents information on various coping strategies adopted by herders in the study area. From Table 2, the following inferences can be easily drawn. The predominant coping strategies adopted by pastoralists in the study area include; moving long distances to find pasture (RII=0.83), use of crop residues as animal feeds (RII=0.83), praying to God (RII=0.83), herd splitting (RII=0.76) and Sales of natural resources such as medicine (RII=0.76). These strategies had RII score above 0.83 and 0.76, hence considered the most significant coping strategies implemented in the study area. The submission of Olanloye, *et al.*, (2021) is in line with this finding that more than half of the pastoralists engaged in the use of crop residue as feed supplements and herd size reduction as measures to ameliorate adverse effect of land use change on their activities. Similarly, Olanloye *et al.* (2021) opined that migrating to other areas was highly practiced by pastoralists during shortage of grasses.

According to Vitus (2022), land use change related challenges have forced many households to change livelihood choices. Other choices included use of traditional fodder, conserving fodder, renting pasture land and to reduce livestock numbers by selling. It is obvious from the foregoing result that the major coping strategy embark upon by pastoralists is moving long distances to find pasture. Generally,

mobility is a well-known primary risk reduction strategy, particularly in times of drought employed by pastoralists exploiting rangelands.

**Table 2: Herders’ Coping Strategies to Effect of Land Use Change**

| S/N | Items                                       | SD | DA  | UN | AG  | SA | ∑f  | ∑fx | $\bar{X}$ | RII  | R  |
|-----|---|----|-----|----|-----|----|-----|-----|-----------|------|----|
| 1.  | Split herds                                 | 7  | 43  | 31 | 65  | 86 | 232 | 876 | 3.78      | 0.76 | 4  |
| 2.  | Moving long distances to find pasture       | 0  | 21  | 20 | 94  | 97 | 232 | 963 | 4.15      | 0.83 | 1  |
| 3.  | Resort to farming                           | 29 | 45  | 20 | 125 | 13 | 232 | 744 | 3.21      | 0.64 | 10 |
|     | Sales of natural resources such as medicine | 10 | 19  | 22 | 142 | 39 | 232 | 877 | 3.78      | 0.76 | 4  |
| 4.  | Shifting from large stock to small stock    | 30 | 46  | 17 | 122 | 17 | 232 | 746 | 3.22      | 0.64 | 8  |
| 5.  | Reduction in Numbers of Herds               | 36 | 43  | 36 | 98  | 19 | 232 | 717 | 3.09      | 0.62 | 11 |
| 6.  | Adopting new management system              | 14 | 55  | 25 | 107 | 29 | 230 | 772 | 3.36      | 0.67 | 7  |
| 7.  | Use of modern transport system move cattle  | 19 | 56  | 26 | 119 | 12 | 232 | 745 | 3.21      | 0.64 | 9  |
| 8.  | Switch of cattle breed                      | 4  | 46  | 45 | 113 | 24 | 232 | 803 | 3.46      | 0.69 | 6  |
| 9.  | Fight with farmers                          | 24 | 188 | 12 | 0   | 8  | 232 | 476 | 2.05      | 0.41 | 12 |
| 10. | Use of crop residues as animal feeds        | 3  | 12  | 4  | 142 | 71 | 232 | 962 | 4.15      | 0.83 | 1  |
|     | Praying to God                              | 2  | 14  | 29 | 89  | 98 | 232 | 963 | 4.15      | 0.83 | 1  |

**Source:** Field survey 2024

Eze (2023) noted that labour migration was one of the key methods identified by rural households in northern Nigeria as both a past and present land use change adaptation approach. Similarly, a study by Eze *et al.*, (2020) shows that migration could contribute to resilience and innovation in climate adaptation in northwest Africa. This is for the reason that migrant workers can boost livelihoods and build the resilience of the original home communities through remittances. Furthermore, Vitus (2022) stated that pastoral seasonal mobility is a paramount adaptation option whereby livestock needs are met in an ever variable environment. He reiterated that the ability of pastoralists to survive amidst variable forage supplies and water distribution is contingent upon their opportunistic mobility and diversified livestock husbandry. Hence, in an extensive livestock keeping, taking livestock to feed and water is less costly than bringing feed and water to livestock owing to lower labour demand and lower input. Discussion with key informants confirmed this, as one of the opinion leaders aptly stated: *We don't stay in one place, anywhere we notice there is enough grass for cattle we move there, especially during the dry season we used to go far to the southern and middle belt region of the country, where there are enough grasses and water for our animals. Nowadays our movements have been very restricted due to conflicts with crop farmers (Ibrahim, 02/11/ 2024)*

Also, Nai (2022) confirmed that these movements by herders are often affected by violent conflicts, diseases outbreaks and recurrent drought. Affirmatively, Hayatu *et al.*, (2018) maintained that this form of mobility pursued primarily for livelihood purposes and that movement of livestock to areas with secure water and pasture resources is an effective strategy against droughts, which has remained important for herders in Africa.

### **Constraints Encountered in Coping with the Effect of Land Use Change by Cattle Herders**

The analysis of constraints to cope with the effects of land use change presented in Table 3 shows major constraints to coping strategies of cattle herders in the study area. These are conflict over scarce resources such as pasture and water ( $\bar{X}$ = 4.15), minimal extension services ( $\bar{X}$  =4.04), limited access to market ( $\bar{X}$  =4.01), and agricultural expansion limiting herds movement ( $\bar{X}$  =4.00).

Other Constraints include; inappropriate policy ( $\bar{X}$  =3.99), Seasonality of Pasture Growth ( $\bar{X}$  =3.98), Lack of control in conversion of pasture land for other purpose ( $\bar{X}$  =3.97), Insecurity ( $\bar{X}$  =3.95), Further probing with FGDs participants revealed that some of these desired strategies, such as



development of water sources, concentrate feeding and grain and fodder storage facilities require an initial investment capital that is beyond the reach of many households. Access to improved livestock breeds and suitable veterinary services are also problematic, because of financial constraints. Insecurity and conflicts associated with livestock raids are also major constraints to some of the coping responses in the study area. A discussant succinctly declared:

*We are aware of some of the new and better ways of taking care of cattle but not all of us have the money to purchase the materials. Please help us tell government to assist using the area of bore holes, health facilities and conflict management (Umaru, 06/12/2024)*

A study by Kennedy *et al.*, (2018) contended that violent conflicts can undermine the gains of adaptation programme, if not managed properly. For instance, water and pasture resources can only be accessed in areas with security (Eze, 2023).

**Table 3: Constraints Encountered in Coping with the Effect of Land Use Change**

| S/N | Items   | SD | D  | UN | A   | SA | ∑f  | ∑fx | $\bar{X}$ |
|-----|---|----|----|----|-----|----|-----|-----|-----------|
| 1.  | Unfavourable government policy                                  | 1  | 8  | 4  | 199 | 20 | 232 | 925 | 3.99      |
| 2.  | Agricultural expansion limiting livestock movement              | 4  | 8  | 4  | 184 | 32 | 232 | 928 | 4.00      |
| 3.  | Lack of access to credit  | 5  | 8  | 14 | 181 | 24 | 232 | 907 | 3.91      |
| 4.  | Financial barriers  | 9  | 11 | 12 | 171 | 29 | 232 | 896 | 3.86      |
| 5.  | Lack of control in conversion of pasture land for other purpose | 2  | 8  | 4  | 198 | 20 | 232 | 922 | 3.97      |
| 6.  | Land reclamation due to climate change                          | 7  | 16 | 4  | 185 | 20 | 232 | 891 | 3.84      |
| 7.  | Minimal extension services                                      | 0  | 8  | 8  | 183 | 33 | 232 | 937 | 4.04      |
| 8.  | Economy of Transition   | 6  | 28 | 9  | 175 | 14 | 232 | 859 | 3.70      |
| 9.  | Inability to Own Most of the Pastureland                        | 3  | 12 | 3  | 191 | 23 | 232 | 915 | 3.94      |
| 10. | Seasonality of Pasture Growth                                   | 2  | 4  | 6  | 204 | 16 | 232 | 924 | 3.98      |
| 11. | Insecurity  | 7  | 8  | 7  | 177 | 33 | 232 | 917 | 3.95      |
| 12. | Inadequate Planning and Control on how land is use              | 1  | 8  | 4  | 199 | 20 | 232 | 925 | 3.99      |
| 13. | Conflicts over scarce resources-pasture and water               | 4  | 6  | 8  | 147 | 67 | 232 | 963 | 4.15      |
| 14. | Limited market accessed   | 2  | 8  | 5  | 188 | 29 | 232 | 930 | 4.01      |
| 15. | Natural Disaster  | 2  | 8  | 8  | 194 | 20 | 232 | 918 | 3.96      |
| 16. | Lack of information   | 4  | 13 | 9  | 187 | 19 | 232 | 900 | 3.88      |

**Source:** Field Survey, 2024

### CONCLUSION AND RECOMMENDATIONS

It is concluded that, cattle herders and their cattle are subjected to long treks to find water and pasture as moving long distance, use of crop residues and praying to God are there main coping strategies in the area. However, these strategies are constrained by conflict over scarce resources such as pasture and water, minimal extension services, limited access to market and consistent agricultural expansion limiting herds movement due to land use change. Therefore, it is recommended that: i) to increase cattle herders' income and transition them from migratory form of herding to sedentary pastoralism, which has better production output and safety for both the cattle, herders, and farmers, it is pertinent for government and NGOs to provide enormous incentives in form of land, exposure, training and capital on a frequent basis to cattle herders.

ii) With cattle route blockade having negative effects on herders' livelihood, it important also that both Federal and State agencies such as Federal Ministry of Livestock Development (FMLD), National Agricultural Land Development Authority (NALDA), and National Centre for

iii) Remote Sensing (NCRS) should ensure that all cattle routes in the country are well preserved and disruption of cattle route in any form should be avoided and all obstruction on the route should be removed.



## REFERENCES

- Abdulmalik, K., & Zewide, I. (2021). Effect of land degradation on livelihood. *Asian Journal of Plant Science and Research*, **11**(5): 149–153.
- Abiodun, A. M. (2014). Economic value of livestock loss on pastoralists' livelihood: An analysis of Ethiopian pastoralist households. *Journal of Research in Agriculture and Animal Science*, **2**(7): 1–12.
- Abubakar, M., & Abdussalam, A. (2024). Geospatial analysis of land use changes and wetland dynamics in Kaduna Metropolis, Nigeria. *Science World Journal*, **19**: 687–696.
- Ayanda, I. F. (2018). Assessment of the effect of climate change on the livelihood of pastoralists in Kwara State, Nigeria. *Journal of Development and Agricultural Economics*, **6**: 78-89.
- Bradley, H. R. (2012). *Implications of land development on nomadic pastoralism: Ecological relaxation and biosocial diversity in human populations* (Scripps Senior Theses, Paper 68).
- Caroline, M. M., Salome, B., Hamilton, M., Dismas, O., Matthew, B., Kennedy, M., Eric, F., & Olivia, H. (2023). Prioritization of livestock diseases by pastoralists in Oloitoktok Sub-County, Kajiado County, Kenya. *PLOS ONE*, **18**(7): 231-239. <https://doi.org/10.1371/journal.pone.0287456>
- Diana, W. G., Jeffrey, S. F., & Anna, J. (2022). Pastoralist herd size maintenance during drought with the use of reseeded fields near Lake Baringo, Kenya. *Pastoralism: Research, Policy and Practice*.
- Duba, M. G., Chalchissa, A. K., & Shashi, K. (2024). Livestock marketing effect on pastoralist community's economic status in Ethiopia: Mediation by market intermediaries. *International Journal of Social Science, Management and Economics Research*, **2**(1): 44. 52.
- Emenyonu, C. A., Orebiyi, J. S., Eze, C. C., Onyemauwa, C. S., Odi, M. A., & Eririogu, I. H. (2015). Analysis of land use/cover change in Western Niger Delta: A panacea for agricultural land reduction. Federal University of Technology, Owerri.
- Erick, D. S. (2022). The role of livestock marketing in improving the livelihoods of pastoralists. *International Journal of Livestock Policy*, **1**(1): 2003–2005.
- Eze, J., Ibrahim, P., Tihamiyu, S., & Alfa, M. (2020). Assessment of drought occurrences and its implications on agriculture in Niger State, Nigeria.
- Eze, J. (2023). Impact of land use and land cover change on agricultural productivity in semi-arid region of Nigeria. *Badeggi Journal of Agricultural Research and Environment*, **5**: 125–133.
- Food and Agriculture Organization of the United Nations. (2018). Soil portal: Key definitions. <http://www.fao.org/soils-portal/about/all-definitions/e>
- Fiona, F. (2011). The causes, processes and impacts of land fragmentation in the rangelands of Ethiopia, Kenya and Uganda.
- Hayatu, N. G., Abdullahi, A., Sharu, M., Anka, A., Muhammad, A., Haruna, F., Nabayi, A., Abdullahi, I., & Abubakar, L. (2018). Role of pastoralism in land regeneration, water management and climate change adaptation in Nigeria: A historical perspective.
- Joseph, M. M., Jacob, B. K., & Joel, E. S. (2024). The impacts and causes of land fragmentation on farm productivity: Case review of East African countries. *Open Journal of Ecology*, **14**: 455–482.
- Kennedy, S. K., David, W., Judith, S., & Oliver, V. W. (2018). Impacts of long-term land-use changes on herd size and mobility among pastoral households in Amboseli ecosystem, Kenya. *Ecological Processes*.
- Kwaja, C. M., & Smith, K. (2020). Transnational dimensions of conflict between farmers and herders in the Western Sahel and Lake Chad Basin. *Search for Common Ground*.
- Luigi, P., Stefano, T., Giuliano, B., Diego, A., Menestrey, S., Giulio, C., & Elena, B. (2024). Over-reliance on water infrastructure can hinder climate resilience in pastoral drylands. *Nature Climate Change*, **14**: 267–274. <https://doi.org/10.1038/s41558-024-01929-z>
- Mehdi, S., Miandad, M., Anwar, M., Rahman, G., & Ashraf, H. (2021). Temporal variation in land use and land cover in Gujrat (Pakistan) from 1985 to 2015. *Geography and Natural Resources*, **42**: 386–394.



- Michele, N. (2019). Pastoralist milk is a viable commodity: What enables it to flourish? Pathways to Sustainability.
- Mohammed, I., Ismaila, A. B., & Bibi, M. U. (2015). Assessment of farmers–pastoralists conflict using GIS. *International Journal of Engineering Science Invention*, **4**: 67-74.
- Morrison, K. L., Victor, T. S., & Lamin, R. M. (2022). Impacts of land-use and land-cover change on rural livelihoods: Evidence from eastern Sierra Leone. *Applied Geography*, **147**: 123-132.
- Musa, K., & Abubakar, M. (2024). Monitoring urban growth and landscape fragmentation in Kaduna, Nigeria, using remote sensing approach. *Journal of Degraded and Mining Lands Management*, **12**: 6757–6769.
- Naah, J., Guuroh, R. T., & Linstädter, A. (2017). Factors influencing local ecological knowledge of forage resources: Ethnobotanical evidence from West Africa’s savannas. *Journal of Environmental Management*, **188**: 297–307.
- Nai, J. (2022). Addressing land conflict between farmers and pastoralists in Tanzania. *Journal of Research for International Educators*, **1**(1): 1-10.
- Olanloye, F. A., Adeokun, O., Oladoja, M., & Onasanya, A. (2021). Causes, effects and resolutions to farmers–transhumance pastoralists conflicts in Ogun State, Nigeria.
- Ouédraogo, K., Zaré, A., Korbéogo, G., Ouédraogo, O., & Linstädter, A. (2021). Resilience strategies of West African pastoralists in response to scarce forage resources. *pastoralism: Research, Policy and Practice*, **3**: 91-98.
- Schareika, N., Brown, C., & Moritz, M. (2021). Critical transitions from pastoralism to ranching in Central Africa. *Current Anthropology*, **62**: 53–76.
- Selvaraj, M., Kangabam, R. D., Kumar, P., & Govindaraju, P. (2013). Assessment of land use/land cover class conversions within the forest ecosystem through remote sensing and GIS technology. *International Journal of Recent Scientific Research*, **4**(5): 560–562.
- Tilahun, M., Angassa, A., Abebe, A., & Mengistum, A. (2016). Perception and attitude of pastoralists on the use and conservation of rangeland resources in Afar Region, Ethiopia. *Creative Commons Attribution*, **5**: 67-79.
- Turner, M. D. (2017). Livestock mobility and the territorial state: South-Western Niger. *Africa*, **87**(3): 578–606.
- Vitus, G. (2022). Perception of climate change and the adaptation strategies of rural smallholder women in the Nadowli-Kaleo District of Ghana.
- Young, H., & Goldman, L. (2015). Livelihoods, natural resources, and post-conflict peace building. Routledge.
- Zondag, B., & Borsboom, J. (2009). Driving forces of land-use change. Netherlands Environmental Assessment Agency (PBL).