

RESEARCH ARTICLE

Population Growth and Resource Scarcity: Implications for Conflict and Cooperation in Taraba State, Nigeria

Andeskebtso Yohanna Adaki

Department of Sociology, Taraba State University, Jalingo, Taraba State, Nigeria

Corresponding Author: Andeskebtso Yohanna Adaki. Email: Lordadaki@gmail.com

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Abstract

Population growth has profound effects on resource availability and social dynamics in many regions across the globe. In Taraba State, Nigeria, the rapid increase in population has intensified resource scarcity, leading to heightened conflicts among communities, particularly those reliant on land and water for their livelihoods. This study examines how population growth intersects with resource depletion, conflict, and cooperation in Taraba State. A mixed-methods approach was employed, involving the analysis of questionnaire data from 294 respondents and qualitative insights from interviews with 10 local leaders, agriculturalists, and herders. The findings reveal that population growth significantly exacerbates the depletion of essential resources, such as land and water, with 72.8% of respondents indicating that population increases directly impact resource availability. This scarcity has led to a 78.3% occurrence of conflicts in areas experiencing severe resource depletion. The study also shows that resource scarcity forces communities into competition, often escalating tensions into violent disputes. However, the research accentuates the critical role of traditional governance structures, which were acknowledged by 64.3% of the respondents as key to fostering cooperation and mitigating conflicts in the state. The study concludes that integrating traditional governance systems with formal frameworks is essential for sustainable resource management and conflict reduction in Taraba State. Policymakers should prioritize these strategies to address the challenges posed by rapid population growth and resource scarcity, ensuring the long-term stability and well-being of communities in the state.

Keywords: population growth; resource scarcity; conflict; cooperation; sustainability

Introduction

Population growth and resource scarcity are two intertwined forces that profoundly shape the dynamics of conflict and cooperation, particularly in resource-dependent areas. Global research has consistently established that environmental degradation leads to the exacerbation of resource scarcity by diminishing the availability of essential resources like arable land, water, and forest cover (Unfried, Kis-Katos & Poser, 2022; Linnér, 2023). These conditions often precipitate conflict, as communities begin to compete for control over dwindling resources. Numerous studies have established that rapid growth in population, when combined with environmental pressures, frequently correlates with increased conflict over resources (De Dreu & Triki, 2022; Linnér, 2023). The Environmental Scarcity Theory, articulated by Homer-Dixon, posits that as 'basic-need' resources become scarce,

competition intensifies, thereby increasing the likelihood of conflict. However, this inadequacy can also serve as a catalyst for cooperation, especially when the communities facing the scarcity recognize the need for collective management of shared resources around their vicinity. Such cooperative efforts could manifest in shared water management systems, land-use planning, or the creation of conflict resolution mechanisms that seek to balance competing interests (Mahlakeng & Solomon, 2023). This study applies Homer-Dixon's theory specifically to the context of Taraba State to explore whether the scarcity of 'basic-need' resources indeed heightens conflict or, in some cases, fosters cooperative resource management among competing groups. In the context of this study area, these global challenges have been acutely observed. The massive population growth in the state places significant pressure on limited natural resources such as land, water, and food supplies, intensifying competition among various groups. This situation is specifically pronounced in agrarian and pastoralist communities, where access to land and water resources is critical for livelihoods. Resource-driven competition, especially between farmers and herders, has led to violent confrontations, exacerbating tensions and undermining social cohesion (Jargin, 2022; Ekanem, 2022). The impacts of climate change further aggravate these problems by reducing the predictability of rainfall and straining agricultural productivity. The resulting scarcity of resources has not only triggered violent conflicts but has also, in some cases, inspired cooperative arrangements aimed at managing resource use more sustainably. Whereas the communities in Taraba State may have employed both traditional and formal governance mechanisms to mediate disputes, the persistence of conflict accentuates the complexities of resource governance in areas experiencing rapid demographic and environmental changes. Recent studies have emphasized the role of climate change in intensifying resource scarcity, leading to more frequent and severe conflicts in regions affected by population pressures (Ekanem, 2022; Smith & Thomas, 2021). In such contexts, effective resource management strategies are necessary in order to mitigate conflicts and promote sustainable cooperation among residents. While global studies have linked population growth and resource scarcity to conflict, little research has focused specifically on the dual pathways of conflict and cooperation in the context of Taraba State. Furthermore, there is limited empirical evidence on how local governance mechanisms can mediate tensions between agrarian and pastoralist communities amidst increasing environmental stress. Existing literature often generalizes findings without considering the unique socio-cultural and ecological contexts of different regions. There remains a significant gap in understanding how these dynamics play out in specific regions like Taraba State, where socio-cultural and ecological factors may alter the typical patterns observed globally. This study addresses these gaps by applying Homer-Dixon's Environmental Scarcity Theory to examine how population growth and resource scarcity impact conflict and cooperation in Taraba State. By providing a localized analysis, the research contributes to a deeper understanding of the specific factors driving conflict and the potential for cooperation in this context. This study investigates the relationship between population growth and resource scarcity, examining how these forces jointly contribute to the emergence of conflict among different groups in the state. It also explores how population pressures exacerbate resource-related tensions and sometimes serve as catalysts for cooperation in resource management. Specifically, the study focuses on the socio-economic and environmental drivers of resource competition, analyzing the role of population growth in either intensifying or mitigating conflict. Furthermore, the research examines instances where local communities have developed cooperative mechanisms to manage shared resources, highlighting the potential for collaboration despite constraints imposed by population growth and resource scarcity. To achieve these objectives, the study adopts a mixed-methods approach, integrating quantitative and qualitative data to provide a comprehensive analysis of the relationship between population growth, resource scarcity, and conflict in the study area. By combining statistical correlations with in-depth interviews from local leaders, farmers, and pastoralists, the research captures both broad trends and lived experiences of resource management in Taraba State, enhancing the robustness of the findings. This study not only contributes to the existing body of knowledge by providing empirical evidence from a previously under-researched area but also

offers insights into how local governance mechanisms can mitigate or exacerbate resource-related conflicts. The study is organized as follows: the Introduction provides an overview of the research context and objectives; the Literature Review examines relevant theory and previous studies; the Methodology outlines the research design and data collection and analysis methods; the Results and Discussion present and analyze the findings; and the Conclusion summarizes key insights and offers recommendations.

Literature Review

Population Growth and Resource Scarcity

Population growth is widely recognized as a major driver of resource scarcity, particularly in developing countries. This rapid demographic expansion places immense pressure on the country's natural resources, leading to overexploitation and environmental degradation (Blocker et al., 2023). Numerous studies have confirmed that rapid population growth heightens demand for essential resources such as land, water, and food, often resulting in deforestation, soil erosion, and biodiversity loss (Ingrao et al., 2023; Shemer, Wald & Semiat, 2023). In agrarian societies like those in Taraba State, the subdivision of land among heirs further reduces farm sizes, compelling farmers to cultivate marginal lands that are more prone to degradation (Wang & Azam, 2024). The Malthusian Theory similarly posits that unchecked population growth outpaces resource availability, leading to inevitable scarcities and societal tension (Linnér, 2023). In Taraba State, the increased demand for agricultural land has intensified competition, particularly between agrarian and pastoralist communities, mirroring Homer-Dixon's concept of demand-induced scarcity. Without effective management of this demographic pressure, the risk of conflict over resources escalates.

Environmental Degradation and Supply-Induced Scarcity

Environmental degradation plays a significant role in aggravating resource scarcity by reducing the quality and quantity of renewable resources. Deforestation, driven by the need for agricultural expansion and fuelwood, has diminished forest cover, disrupted rainfall patterns, and reduced water availability (Kumar, Kumar & Saikia, 2022). Soil erosion and desertification have further degraded arable land, lowering agricultural productivity and creating conditions of supply-induced scarcity (Nwaughu et al., 2024). In Taraba State, these environmental challenges are acutely felt, particularly by farmers and herders who depend on the same diminishing resources for their livelihoods. The regenerative capacity of ecosystems is also compromised, which further intensifies competition among resource users. As Homer-Dixon argues, supply-induced scarcity can be a powerful catalyst for conflict, particularly in areas where institutional mechanisms for managing resources are weak or absent (Mahlakeng & Solomon, 2023). Taraba State's history of farmer-herder clashes over land and water exemplifies this dynamic.

Resource Scarcity and Conflict

The connection between resource scarcity and conflict is well-documented in both academic and policy literature (Linnér, 2023; Wang & Azam, 2024). Homer-Dixon suggests that environmental scarcity, compounded by population growth, often leads to conflict in regions where governance structures are unable to mediate disputes effectively (Mahlakeng & Solomon, 2023). In discussing the implications of resource scarcity on social dynamics, the findings by Mazloun Yar and Zazia (2024) emphasize how institutional and socio-cultural barriers can hinder

development, which in turn exacerbates conflicts over resources. In Nigeria, particularly in northern regions like Taraba State, conflicts between farmers and herders have escalated as competition for land and water resources intensifies (Nwaughu et al., 2024). Studies by Setrana and Adzande (2022) emphasize how these clashes frequently result in significant loss of lives and property. Weak governance exacerbates the conflict, as the absence of effective resource management and conflict resolution mechanisms leads to breakdowns in social order (Onuoha, 2008). Research further suggests that climate change, by increasing the unpredictability of rainfall and straining agricultural productivity, has intensified these conflicts. As population growth intensifies, communities face increasing pressure on vital resources, leading to heightened conflict over land and water. Similar patterns have been observed globally, particularly among indigenous communities that are highly dependent on natural resources. For instance, Khan, Khan, and Kamal (2024) stress that climate change intensifies socio-economic vulnerabilities among the Kalash indigenous community in northern Pakistan, revealing how resource scarcity can compel displacement and conflict. Their findings illustrate that climate-induced natural disasters significantly affect livelihoods, drawing parallels to how resource competition in Taraba may escalate tensions among local populations. As population growth accelerates in areas like Taraba State, the resulting pressure on resources such as land and water can worsen existing conflicts among communities. This phenomenon is not unique to Taraba State; similar challenges are evident in other countries facing rapid demographic changes. For instance, Datta (2024) emphasizes the significance of pursuing green growth in Bangladesh to transition towards sustainable resource management. The study reviews various environmental sustainability indicators and emphasizes the critical need for effective water management and pollution control to mitigate the adverse effects of resource scarcity. Datta's findings accentuate the importance of sustainable practices in resource management, which could serve as a model for addressing the conflicts arising from resource competition in Taraba State. By adopting comprehensive strategies that include both traditional and formal governance mechanisms, communities can foster cooperation and reduce tensions over dwindling resources.

Potential for Cooperation

While resource scarcity often leads to conflict, it also holds the potential to catalyze cooperation under the right conditions. In some places, traditional mechanisms for resource sharing, such as local conflict resolution committees, have played a role in mitigating tensions between farmers and herders (Setrana & Adzande, 2022). Collaborative initiatives, like joint resource management schemes, illustrate how cooperation can emerge in response to shared resource challenges. These examples align with Homer-Dixon's view that adaptive responses to environmental scarcity can help communities avoid conflict and foster sustainable resource management. However, for these cooperative mechanisms to succeed, they require strong local governance and community buy-in.

Theoretical Framework

This study is grounded in Homer-Dixon's Environmental Scarcity Theory, which offers a comprehensive framework for analyzing how environmental degradation, population growth, and resource scarcity can lead to both conflict and cooperation. According to Homer-Dixon, environmental scarcities arise from three principal mechanisms: supply-induced scarcity, where natural resources are depleted or degraded; demand-induced scarcity, driven by population growth; and structural scarcity, where unequal distribution concentrates resources in the hands of a few (Mahlakeng & Solomon, 2023). These scarcities are particularly likely to cause violent conflict in developing regions with limited adaptive capacity. However, Homer-Dixon also notes the potential for

cooperation, as communities facing shared resource challenges may develop collective management strategies to prevent conflict. In Taraba State, rapid population growth has intensified demand-induced scarcity, exacerbating competition over critical resources like arable land and water. Supply-induced scarcity is evident through deforestation, environmental degradation, and soil erosion, which reduce productive land availability. Additionally, structural scarcity manifests in unequal access to these resources among different ethnic and social groups, often fueling grievances. Applying Homer-Dixon's framework to Taraba State allows for an understanding of how environmental and demographic pressures intersect with socio-political structures to either trigger conflict or foster cooperation.

Methodology

Research Design

A mixed-methods approach was employed in this study to comprehensively investigate how population growth and resource scarcity influence conflict and cooperation in Taraba State. This design was chosen because it allows for the blend of quantitative and qualitative methods, in order to offer a robust understanding of the research problem. The quantitative part, through structured surveys, provided numerical data on key variables such as population growth rates, resource availability, and instances of conflict or cooperation. This approach was justified as it enabled the collection of data that can be statistically analyzed to identify trends and correlations. On the other hand, the qualitative component, involving in-depth interviews (IDIs), was essential for capturing the subjective experiences and perceptions of local leaders and community members regarding resource allocation and dispute resolution. The combination of both methods ensured that the study addressed both the statistical relationships and contextual insights, leading to a more holistic understanding of the research question.

Study Location and Context

The choice of Taraba State as the study location was justified by the unique social and ecological dynamics that characterize the region. Taraba State experiences high rates of population growth combined with dwindling natural resources, making it a relevant case for studying the impacts of resource scarcity on conflict and cooperation. The state's diverse population, consisting of farmers, pastoralists, and indigenous groups, depends on natural resources such as land and water for their livelihoods. This diversity and dependency create a rich environment for examining both historical conflicts (often related to land and grazing rights) and instances of cooperation, such as around shared water resources. Taraba State's history of resource-linked conflicts and occasional cooperation justified its selection, as it offered a real-world context where the study's theoretical assumptions could be tested.

Population of the Study

The study focused on a target population that included community members, local leaders, and government officials in conflict-prone and resource-stressed areas within Taraba State. The key groups—herders, farmers, and local authorities—were selected because they play critical roles in resource management and are directly involved in both resource conflicts and cooperative activities. These groups were considered ideal for providing insights into how population pressure and resource scarcity affect social dynamics. The choice of this population was justified because their experiences and actions are directly relevant to understanding the phenomena under study.

Sample Size and Sampling Technique

A purposive sampling technique was employed, which is justified for its ability to select participants who have direct relevance to the research topic. Given the focus on conflict and cooperation related to resource scarcity, it was necessary to intentionally select individuals who could provide the most valuable insights. The quantitative sample consisted of 300 respondents, which was considered adequate to ensure statistical validity in representing the broader population of the study area (Rahi, Alnaser, & Ghani, 2019; Aithal & Aithal, 2020; Hossan, Dato'Mansor, & Jaharuddin, 2023). For the qualitative component, 20 in-depth interviews were conducted with key stakeholders such as local leaders and officials directly involved in conflict resolution and resource management. This sample size was justified as it allowed for saturation of qualitative data, ensuring a thorough exploration of the research questions without overwhelming the analysis process (Malterud, Siersma, & Guassora, 2016; Vasileiou, Barnett, Thorpe & Young, 2018).

Instruments of Data Collection

Two primary instruments were used: a structured questionnaire for quantitative data collection and a semi-structured interview guide for qualitative data. The structured questionnaire was chosen because it allowed for the systematic collection of quantitative data on key variables such as population growth, resource access, and conflict occurrence. This instrument was justified because it facilitated the collection of comparable data from a large number of respondents, which is critical for statistical analysis. The semi-structured interview guide for the qualitative component was used to explore more complex, subjective experiences related to resource competition and cooperation. This guide was flexible enough to allow for in-depth discussions, enabling participants to share their perspectives on the role of both traditional and formal institutions in managing disputes. The combination of these instruments was justified to ensure a comprehensive data collection process that addressed both the numerical and narrative dimensions of the study.

Data Collection Procedure

The surveys were administered by trained research assistants, which ensured consistency and reliability in the data collection process. The face-to-face administration of surveys was justified because it allowed the research assistants to clarify questions and ensure accurate responses from the participants. The in-depth interviews were conducted by the principal investigator, ensuring that the complex dynamics surrounding conflict and cooperation were thoroughly explored. Interviews were conducted in confidential settings to protect the privacy of participants, and consent was obtained for both participation and recording. These steps were justified to maintain the ethical integrity of the research and ensure that participants felt comfortable providing honest and open responses.

Ethical Considerations

The study received ethical approval from a recognized institutional review board, which was essential to ensure that the research met accepted standards for human subject research. Participants were fully informed of their rights, including the right to withdraw from the study at any time, and confidentiality was strictly maintained. The use of consent forms further ensured that participants were aware of the research's aims and their role in it. These ethical procedures were justified as they protected the dignity and privacy of participants, while also ensuring that the research adhered to international ethical standards.

Data Analysis

The quantitative data were analyzed using descriptive statistics (mean, frequency) and inferential tests (chi-square, regression analysis) to explore relationships between population growth, resource scarcity, and conflict. Descriptive statistics were justified because they provided a clear summary of the data, while inferential tests (Pearson Correlation Coefficient, Chi-Square and Logistic Regression) were necessary to examine causal relationships and predictive patterns. The qualitative data were analyzed thematically using NVivo software, which allowed for the systematic identification of recurring patterns related to both cooperation and conflict. This software was justified as it facilitated the efficient and accurate analysis of large volumes of qualitative data, ensuring that all relevant themes were captured and properly categorized.

Results and discussions

Here is the detailed analysis of the data obtained from the field, structured to address the research objectives and hypotheses. This data presentation includes both quantitative results from the 294 questionnaires and qualitative insights from 20 in-depth interviews that were conducted. After the presentation, the findings are interpreted and discussed with reference to existing literature.

Quantitative Data Analysis

Demographic Characteristics of Respondents

Before going into the core analysis of the research data, it is important to understand the demographic characteristics of the study participants which is necessary for interpreting the results in the context of Taraba State's socio-cultural and economic conditions.

As illustrated in Table 1, a majority of the respondents were male (64.0%), with the largest age group falling between 31-45 years (42.2%). Farmers comprised the largest occupational group (46.6%) among the respondents, and this indicates the predominance of agricultural activities in the study area. The educational levels of the respondents showed a varied distribution, with majority of them having either secondary (37.1%) or primary education (28.6%).

Population Growth and Resource Scarcity

The first objective of this study was to examine the relationship between population growth and resource scarcity in Taraba State. To address this, the respondents were asked to provide their perceptions of population growth, resource availability, and the relationship between the two.

From the data in Table 2, a large proportion of the respondents (70.7%) agreed that population growth had increased significantly in their communities. Similarly, 65.4% reported that resource availability—particularly land and water—had decreased, with 72.8% affirming that population growth negatively affected access to resources in their area. These findings support the theoretical proposition that population growth places pressure on limited resources, particularly in areas like Taraba State, where land and water are essential for agriculture and livestock-related activities.

Table 1: Demographic Characteristics of Respondents (n = 294)

Variable	Frequency (n)	Percentage (%)
Gender		
Male	188	64.0
Female	106	36.0
Age Group		
18-30 years	85	28.9
31-45 years	124	42.2
46-60 years	67	22.8
60+ years	18	6.1
Occupation		
Farmer	137	46.6
Pastoralist	69	23.5
Local Authorities	24	8.2
Other	64	21.7
Educational Level		
None	43	14.6
Primary	84	28.6
Secondary	109	37.1
Tertiary	58	19.7

Table 2: Perceptions of Population Growth and Resource Scarcity

Statement	Agree (%)	Neutral (%)	Disagree (%)
Population has increased significantly	70.7	16.2	13.1
Resource availability has decreased	65.4	18.6	16.0
Population growth affects access to resources	72.8	12.9	14.3

Resource Scarcity and Conflict

In this study, resource scarcity was explored in relation to the occurrence of conflicts among different groups in Taraba State. The respondents were asked about their experiences with conflicts related to land, water, and other vital resources in the state. The perception of the respondents is captured in Table 3 below:

Table 3: Perceptions of Resource Scarcity and Conflict

Statement	Agree (%)	Neutral (%)	Disagree (%)
Resource scarcity is the primary cause of conflict	67.1	20.4	12.5
Conflicts over land and water have increased	69.2	18.0	12.8
Conflicts involve farmers and pastoralists	72.9	14.6	12.5

Over two-thirds (67.1%) of respondents in Table 3 agreed that resource scarcity was the primary cause of conflict in their communities, particularly over land and water resources, as a significant number (69.2%) reported that conflicts over these resources had increased, with a notable percentage (72.9%) stating that these conflicts primarily involved farmers and pastoralists. The data indicates that a substantial portion of respondents associates

resource scarcity with conflict, particularly highlighting tensions between farmers and pastoralists over land and water resources.

Population Growth and Conflict

In addition to examining resource scarcity, the study also explored the role of population growth in causing conflicts. The respondents were asked whether they believed that population growth heightened competition for resources and escalated conflicts.

Table 4: Population Growth and Conflict

Statement	Agree (%)	Neutral (%)	Disagree (%)
Population growth has worsened resource conflicts	68.4	19.3	12.3
Increased population intensifies competition	70.1	17.9	12.0

As Table 4 shows, 68.4% of respondents agreed that population growth worsened resource conflicts, particularly in areas where natural resources were already limited. Similarly, 70.1% agreed that the increased population had intensified competition for vital resources, especially land and water. These findings support the hypothesis that population growth aggravates conflict related to resource allocation.

Cooperation in Resource Management

Despite the prevalence of conflict in the state, there were also instances of cooperation in managing shared resources, particularly when traditional or formal dispute resolution mechanisms were in place.

Table 5: Perceptions of Cooperation in Resource Management

Statement	Agree (%)	Neutral (%)	Disagree (%)
Cooperation exists over shared water resources	61.8	25.1	13.1
Traditional institutions foster cooperation	64.3	19.8	15.9
Formal government intervention resolves conflicts	55.7	26.5	17.8

In Table 5, While a majority of respondents (61.8%) reported instances of cooperation, particularly over shared water resources, they attributed this success largely to traditional institutions (64.3%), which played an essential role in fostering cooperation within the state. However, fewer respondents (55.7%) believed that formal government interventions were effective in resolving conflicts.

Test of Hypotheses

Hypothesis 1 (H1): There is a positive relationship between population growth and resource scarcity in Taraba State.

Statistical Test: Pearson Correlation Coefficient

The relationship between population growth (independent variable) and resource scarcity (dependent variable) was analyzed using the Pearson correlation coefficient to assess the strength and direction of the relationship.

Table 6: Pearson Correlation Between Population Growth and Resource Scarcity

Variables	Resource Scarcity
Population Growth	$r = 0.612, p < 0.001$

Pearson Correlation (r): 0.612; p-value: < 0.001 (significant at the 0.05 level)

The Pearson correlation coefficient of 0.612 in Table 6 indicates a moderate positive relationship between population growth and resource scarcity. This means that as the population grows in Taraba State, there is a significant increase in resource scarcity, particularly regarding land and water availability. Given the p-value (< 0.001), the relationship is statistically significant, providing evidence to support the hypothesis (H1). These results suggest that population growth is strongly associated with the increasing scarcity of essential resources, which could lead to heightened competition and conflict.

Hypothesis 2 (H2): Resource scarcity significantly increases the likelihood of conflict among communities in Taraba State.

Chi-square test was used to examine the relationship between resource scarcity and the occurrence of conflict. The data were categorized into groups based on whether communities experienced resource scarcity and whether conflicts had occurred.

Table 7: Chi-Square Test for the Relationship Between Resource Scarcity and Conflict

Conflict	Resource Scarcity (n = 294)	No Resource Scarcity (n = 294)	Chi-Square (χ^2)	p-value
Conflict Present (%)	78.3	45.5	$\chi^2 = 16.87$	p < 0.001
Conflict Absent (%)	21.7	54.5		

Chi-Square (χ^2): 16.87; p-value: < 0.001 (significant at the 0.05 level)

The chi-square test results in Table 7 show that 78.3% of communities experiencing resource scarcity reported conflicts, compared to 45.5% of those without resource scarcity. The chi-square statistic ($\chi^2 = 16.87$) is significant with a p-value < 0.001, showing a strong association between resource scarcity and conflict. These findings confirm the hypothesis (H2) that resource scarcity significantly increases the likelihood of conflict among communities in Taraba State. The scarcity of vital resources like land and water escalates tensions, often leading to violence, particularly between pastoralist and farming communities.

Hypothesis 3 (H3): Population growth exacerbates conflicts related to resource allocation, particularly over land and water.

A logistic regression analysis was performed to examine whether population growth increases the likelihood of conflicts related to resource allocation, particularly land and water conflicts. The outcome variable (conflict occurrence) was binary (1 = conflict occurred, 0 = no conflict), and the predictor variable was population growth. The logistic regression analysis in Table 8 reveals that population growth significantly increases the likelihood of conflicts related to resource allocation. The odds ratio (OR = 4.15) means that for each unit increase in population growth, the odds of conflict over land and water increase by 4 times.

Table 8: Logistic Regression of Population Growth and Conflict Occurrence

Predictor	Coefficient (B)	Standard Error (SE)	Odds Ratio (OR)	p-value
Population Growth	1.423	0.327	4.15	p < 0.01
Constant	-0.892	0.211	-	p < 0.05

Odds Ratio (OR): 4.15 (indicating a 4-fold increase in the odds of conflict with population growth); p-value: < 0.01 (significant at the 0.05 level)

The p-value < 0.01 confirms the statistical significance of the finding. Thus, hypothesis H3 is supported, demonstrating that rapid population growth increases the chances of conflicts, especially over critical resources like land and water, which are already in limited supply.

Hypothesis 4 (H4): Despite resource scarcity, cooperation is more likely to emerge in areas with strong traditional or formal dispute resolution mechanisms.

A binary logistic regression was conducted to determine whether the presence of traditional or formal dispute resolution mechanisms increased the likelihood of cooperation over resources despite resource scarcity. The outcome variable was cooperation (1 = cooperation, 0 = no cooperation), and the predictor was the presence of traditional/formal mechanisms. This is captured in In Table 9 below:

Table 9: Logistic Regression of Traditional/Formal Dispute Resolution Mechanisms and Cooperation

Predictor	Coefficient (B)	Standard Error (SE)	Odds Ratio (OR)	p-value
Traditional/Formal Mechanisms Present	1.689	0.392	5.41	p < 0.01
Resource Scarcity	-0.721	0.301	0.49	p < 0.05
Constant	-1.054	0.241	-	p < 0.05

Odds Ratio (OR) for dispute mechanisms: 5.41; p-value: < 0.01 (significant at the 0.05 level)

The logistic regression results show that the presence of traditional or formal dispute resolution mechanisms increases the likelihood of cooperation, despite resource scarcity, by more than 5 times (OR = 5.41). The negative coefficient for resource scarcity (B = -0.721) shows that resource scarcity alone reduces the likelihood of cooperation, but the presence of effective resolution mechanisms reverses this trend. The p-value < 0.01 confirms the statistical significance of the model, thus supporting the hypothesis (H4). Communities with strong traditional or formal governance structures are more likely to engage in cooperative resource management despite the pressures of scarcity.

Qualitative Data Analysis

The qualitative data analysis for this study utilized NVivo software to systematically code and analyze the responses of 20 in-depth interviews conducted with local leaders, community members, farmers, pastoralists, and government officials across various regions of Taraba State. The aim was to gain deep insights into the dynamics between population growth, resource scarcity, and the implications these have for conflict and cooperation in Taraba State. By leveraging NVivo, the research followed a structured process of open coding, where initial concepts were identified directly from the interview data, followed by axial coding to group related concepts, and finally selective coding to focus on the core themes. This stepwise approach ensured that the analysis was both

rigorous and grounded in the lived experiences of the research respondents. The results are organized around the four key objectives of the study, with direct quotes from participants that bring the analysis to life.

Objective 1: The Relationship Between Population Growth and Resource Scarcity

Codes: Population Growth and Resource Scarcity

Identified Themes:

- Increased Pressure on Resources
- Environmental Degradation
- Perceptions of Scarcity

The relationship between population growth and resource scarcity was found as a central theme in the interviews. Respondents across all demographic groups consistently expressed concerns about the growing pressures placed on land, water, and other natural resources due to an increasing population. A community leader from Jalingo remarked:

As our population has grown, the land that was once sufficient for farming and grazing is no longer adequate. The increased number of people means more competition for the same resources, leading to noticeable shortages (IDI, F1, Age 51, Jalingo LGA).

This statement reflects the perceived scarcity of resources that has accompanied the population boom in the state. Similarly, a farmer from Yorro emphasized the environmental consequences of this pressure:

The rapid growth of our community has led to deforestation and soil depletion. More people are using the same amount of land, which exacerbates the scarcity of arable land (IDI, F2, Age 47, Yorro LGA).

The reference to deforestation and soil depletion stresses the dual nature of population growth—while it increases resource demand, it can also accelerate environmental degradation, thereby reducing the availability of vital resources like fertile soil and grazing land. This degradation of environmental resources, in turn, intensifies the perception of scarcity, as described by a pastoralist in Wukari:

There's a growing sense of scarcity in our community. The water sources are drying up faster than before, and it's a direct result of more people using the same resources (IDI, F3, Age 39, Wukari LGA).

The data strongly suggest that the interplay between population growth and resource scarcity is not only about the quantitative availability of resources but also about subjective perceptions of scarcity, which are just as impactful in driving behavior and decision-making. These qualitative insights align with the quantitative Pearson correlation analysis in this study, which indicated a statistically significant relationship between population growth and resource scarcity. What is critical to note here is how this qualitative information adds depth to the quantitative data by showing the ways in which individuals and communities experience these pressures in their everyday lives.

Objective 2: Resource Scarcity and the Occurrence of Conflict

Codes: Resource Scarcity and Conflict

Themes Identified:

- Resource Competition
- Increased Tensions
- Conflict Over Land and Water

One of the most striking findings from the qualitative data is the clear link between resource scarcity and the rise in conflicts among different groups in Taraba State. Across various communities, the respondents recounted how competition over scarce resources, particularly land and water resources has led to amplified tensions and, in many cases, outright conflict in the state. A local leader in Takum noted:

Scarcity of water resources has led to frequent disputes between farmers and herders. Each group competes for the limited water available, which often results in conflicts (IDI, F4, Age 44, Takum LGA).

This observation emphasizes how water, a critical resource in agrarian and pastoralist economies, becomes a flashpoint for disputes as it becomes increasingly scarce. Similarly, a community member in Gashaka explained how scarcity of grazing land has worsened tensions in the area:

The scarcity of grazing land has intensified conflicts between different communities. When resources are scarce, tensions rise, and conflicts become more frequent (IDI, F5, Age 56, Gashaka LGA).

It is important to situate this finding within a broader socio-political context. In many parts of Nigeria, and particularly in Taraba State, historical and ethnic rivalries are often aggravated by resource competition, as different groups vie for control of limited land and water supplies. This dynamic is compounded by the fact that resource allocation is often politicized, with local power structures influencing who has access to which resources.

As noted by a government official from Jalingo:

Resource scarcity has made it difficult to manage conflicts effectively. As resources become more limited, the likelihood of clashes increases (IDI, F6, Age 45, Jalingo LGA).

These qualitative insights do not only confirm the chi-square test results showing a significant association between resource scarcity and conflict but also reveal the complexity of managing such conflicts in a context where governance structures may lack the capacity or legitimacy to mediate disputes effectively. This is an important insight for policymakers, as it suggests that efforts to reduce conflict must go beyond merely increasing resource availability; they must also address the governance and institutional frameworks that manage resource distribution.

Objective 3: Population Growth and Conflict Intensity

Codes: Population Growth and Conflict Intensity

Themes Identified:

- Escalation of Conflicts
- Mitigation Through Resource Sharing
- Population Pressure and Resource Allocation

The relationship between population growth and conflict intensity was another prominent theme in the interviews as several respondents pointed to the fact that as populations grow, conflicts that may have been manageable in the past become more severe. A pastoralist from Ussa observed:

Population growth has made existing conflicts over resources more intense in our area. As more people move into the area, disputes over land and water become more frequent and severe (IDI, F7, Age 42, Ussa LGA).

This escalation of conflict is not merely a result of increased competition over resources but also stems from the fact that traditional conflict resolution mechanisms are often overwhelmed by the sheer number of disputes that arise in densely populated areas. A farmer in Lau mentioned one potential mitigation strategy:

In some cases, communities have managed to mitigate conflicts by setting up agreements for sharing resources. However, these solutions are increasingly strained as the population grows (IDI, F8, Age 40, Lau LGA).

While resource-sharing agreements have historically been a means of preventing conflicts, the strain on such agreements due to population pressure is a growing concern. These findings are consistent with the logistic regression results, which indicate that population growth intensifies conflicts related to resource allocation. The qualitative data provide valuable information into the fragility of mitigation strategies in the face of growing demographic pressures. This suggests that more robust, scalable solutions are needed to cope with the increasing strain on shared resources.

Objective 4: Cooperation in Resource Management

Codes: Cooperation in Resource Management

Identified Themes:

- Role of Traditional Institutions
- Formal Dispute Resolution Mechanisms
- Community-Based Solutions

Despite the pressures of population growth and resource scarcity, instances of cooperation in resource management were noted in several communities in Taraba State. These instances offer valuable lessons on how resource scarcity, rather than being purely a driver of conflict, can also catalyze cooperative behavior, particularly when strong institutional frameworks are in place. A community leader in Karim Lamido described the role of traditional institutions in resolving conflicts:

Our traditional dispute resolution methods have been crucial in managing conflicts. When conflicts arise, we convene traditional councils to mediate and find cooperative solutions to the dispute (IDI, F9, Age 63, Karim Lamido LGA).

Traditional institutions, long a cornerstone of governance in many African societies, continue to play a fundamental role in mediating disputes and promoting cooperation in the aspect of resource scarcity. This finding is echoed by a government official in Sardauna, who pointed to the effectiveness of formal mechanisms:

Formal mechanisms, such as community resource committees, have also been effective in promoting cooperation. These committees help manage resources and reduce conflicts (IDI, F10, Age 49, Sardauna LGA).

These mechanisms—both traditional and formal—are essential for maintaining peace and promoting equitable resource distribution. As a pastoralist in Ardo-kola mentioned, community-based solutions, such as agreements for the shared use of water sources, have helped to reduce tensions:

Despite the scarcity, we have managed to establish agreements for shared use of water sources. This cooperation has helped maintain peace among the different groups (IDI, F11, Age 53, Ardo-kola LGA).

This data supports the logistic regression findings from the quantitative data of this study, which show that cooperation is more likely in areas with strong dispute resolution mechanisms. As such, the study emphasizes the need for policy interventions that strengthen local governance capacities and support community-based solutions to resource management challenges.

Discussion of Findings

This study examined the relationship between population growth, resource scarcity, conflict, and cooperation in Taraba State, as it empirically confirms a positive and significant correlation between population growth and resource scarcity. The quantitative analysis confirmed that the growing population density directly reduces the availability of essential resources such as land, water, and agricultural inputs in the state. This was further corroborated by the qualitative data, as community members echoed the consequences of population pressure, including environmental degradation—deforestation and soil depletion were cited as after-effects of the expanding population. These findings agree with the work of scholars like Ingrao et al (2023), Shemer et al (2023) and Linnér (2023), who have long identified population growth as a major contributor to resource exhaustion in the society. One of the key implications of these findings is the urgent necessity for sustainable resource management practices in Taraba State. With the population increasing, the stress on natural resources has increased, pushing the environment and community livelihoods to the brink. The experiences shared by respondents align with global discourses on population pressure and resource depletion, reinforcing the argument that without immediate intervention, the situation may spiral further into ecological and economic crises. This suggests that, Taraba State,

much like other territories experiencing rapid population growth, must prioritize adaptive strategies that enhance resource conservation, sustainable agricultural practices, and long-term planning to mitigate the adverse impacts of overpopulation. Moreover, the findings of the study also establish a direct link between resource scarcity and conflict in the Taraba State. Through both quantitative and qualitative lenses, it became evident that dwindling resources heighten tensions among diverse groups, particularly between farmers, pastoralists, and other community stakeholders in the state. The chi-square test results corroborated the significant association between resource scarcity and increased conflict incidents, particularly over water and grazing land. The study respondents often described intense competition, noting that disputes frequently escalate into violent confrontations. This finding aligns with conflict theory as articulated by Mahlakeng & Solomon (2023) and Nwaugha et al (2024), where the struggle over limited resources is seen as a catalyst for social friction in the society. Such competition is not merely a theoretical construct but a lived reality for many in Taraba State, where agricultural productivity, water access, and land ownership have become highly contested and increasingly politicized. The gravity of these findings is not limited to statistical significance alone but extends into the lived experiences of the affected communities. Population growth amplifies existing conflicts, particularly over land and water, as conveyed by the logistic regression results in this research. As more individuals vie for the same limited resources, the intensity of disputes naturally escalates. However, while the data highlight conflict escalation, they also reveal emerging cooperative efforts among some communities. These communities, particularly in areas most affected by resource scarcity, have devised resource-sharing agreements to mitigate the severity of conflicts. Nevertheless, as the population continues to swell, these agreements are strained and risk breaking down under the weight of increased demand for resources. This finding reinforces the perspective of scholars like Setrana and Adzande (2022), who argue that population growth, by intensifying the demand for finite resources, worsens existing socio-economic tensions and conflicts. Despite these challenges, the study uncovers evidence of successful cooperation, signaling hope for conflict mitigation through local governance and community-driven solutions. The data from the interviews revealed the central role of traditional institutions and formal dispute resolution mechanisms in fostering cooperation. Traditional councils and community resource committees, for instance, were cited as key actors in negotiating resource-sharing agreements and mediating disputes between competing groups. These local governance structures offer critical insights into the potential for hybrid models of resource management that blend both traditional and formal dispute resolution mechanisms. This is in line with Ostrom's theory on managing common-pool resources, where the integration of 'traditional governance' can play an essential role in ensuring sustainable management and conflict prevention. The relevance of these cooperative mechanisms cannot be overstated, as they present a viable pathway toward conflict resolution and sustainable resource management. The findings suggest that strengthening traditional governance structures and formal legal systems could greatly enhance the capacity of local communities to manage conflicts and foster long-term cooperation. Additionally, these findings stress the potential of institutional frameworks that encourage collective resource management and conflict resolution. Empowering these local structures through greater governmental and non-governmental support could provide a scalable model for addressing similar challenges in other resource-scarce regions.

Conclusion

This study explored the relationship between population growth, resource inadequacy, conflict, and cooperation in Taraba State, Nigeria. It has successfully achieved its aim by providing robust evidence that captures the impact of population pressure on the depletion of essential resources, such as land and water. The findings of the study contribute to existing knowledge by establishing that rapid population growth worsens environmental degradation, as seen in deforestation, soil depletion, and reduced access to critical resources. The significance of this study lies

in its emphasis on the urgent need for sustainable resource management practices in response to the challenges posed by population expansion in Taraba State. The study's implications are far-reaching, particularly in its identification of the strong correlation between resource scarcity and the frequency of conflicts, especially among farmers and herdsmen. These conflicts, driven by competition over land and water, accentuate the importance of addressing resource management issues to mitigate violence. Furthermore, this research provides data on the potential of cooperation as a counterbalance to conflict. It reveals that despite the pressures of resource scarcity, many communities in Taraba State have developed effective mechanisms for resource-sharing and conflict resolution, facilitated by traditional councils and community resource committees. These findings highlight the value of integrating traditional and formal governance structures to foster cooperation and reduce tensions. Future research should focus on further developing sustainable agricultural practices and resource conservation strategies to alleviate the strain on dwindling resources. Additionally, there is a need to strengthen local governance frameworks that incorporate both traditional and formal dispute resolution mechanisms, offering a pathway to sustained cooperation and conflict mitigation in Taraba State.

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Consent to participate: Informed consent was obtained from all individual participants involved in the study. Participants were briefed on the study's objectives, and their participation was entirely voluntary.

Consent for publication: All participants provided consent for their anonymized data to be used in this research and for its findings to be published in academic and public platforms.

Data availability: The datasets generated during and analyzed during the current study are available from the corresponding author on reasonable request.

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