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AN EMPIRICAL ANALYSIS OF MAJOR LAND RESOURCE USES AND ENVIRONMENTAL IMPLICATIONS IN NASARAWA STATE, NIGERIA

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Abstract

This study investigates the mandate and operational effectiveness of the Nigeria Security and Civil Defence Corps (NSCDC) in managing land resources in Nasarawa State, Nigeria. Nasarawa occupies approximately 27,117 km², with diverse land uses: agriculture dominates at 45.3%, followed by residential settlements (19.8%), mining and quarrying (15.1%), forestry (12.0%), and commercial/industrial land (7.8%). Agriculture, comprising crop farming (54.0%), livestock grazing (32.2%), and irrigation farming (13.8%), sustains most livelihoods but generates conflicts, particularly farmer-herder disputes. Mining activities, concentrated in mineral-rich LGAs such as Nasarawa and Awe, contribute significantly to the economy but cause environmental challenges like soil erosion and deforestation. The NSCDC's specialized units, Agro-Rangers and Mining Marshals, have been instrumental in providing security and regulating these land uses, though operational constraints and community skepticism remain. Using a mixed-methods approach with 384 respondents and qualitative interviews, the study reveals that NSCDC's mandate is well-recognized, particularly in preventing illegal land grabbing (87.5%) and protecting agricultural land (83.3%), with lower confidence in dispute mediation (51.0%). The findings highlight the need for clearer legal frameworks, increased resources, and enhanced community

Keywords: Land resource management, Nasarawa State, agriculture, mining, forestry, land conflict, Agro-Rangers, Mining Marshals, environmental degradation

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engagement to improve land governance and sustainable resource management in Nasarawa State, Nigeria.

Introduction

Land is a critical resource that underpins economic development, social stability, and environmental sustainability. In Nasarawa State, Nigeria, land resources serve multiple functions, ranging from agriculture and mining to residential, forestry, and commercial uses. The state occupies approximately 27,117 km² and exhibits a diverse land use pattern that reflects both its agrarian foundation and its growing extractive economy (National Population Commission [NPC], 2022). Understanding the spatial distribution and intensity of these land uses is essential for effective resource management, policy formulation, and conflict mitigation, especially given the recurrent land disputes between farmers, herders, and mining stakeholders (Oshio, 2019). The predominance of agriculture, followed by urban settlements, mining, and forestry, illustrates the dual role of land as both an economic asset and a source of potential conflict in the region.

Agriculture remains the dominant land use in Nasarawa State, accounting for 45.3% of reported land use activities, with crop farming, livestock grazing, and irrigation farming as its major components (NPC, 2022). This sector sustains the livelihoods of most households in rural and peri-urban communities and forms the backbone of the state's economy. The mixed farming systems, where crop cultivation and pastoralism coexist, create opportunities for food production and income generation but also generate conflicts over land allocation and usage, particularly between farmers and herders (Okoli & Atelhe, 2014). Moreover, irrigation farming along the Benue River Basin enhances agricultural productivity but intensifies competition for land and water resources (Abubakar & Ahmed, 2021).

Mining and quarrying constitute the third major land use, representing 15.1% of activities, reflecting Nasarawa State's rich mineral endowment, including tin, columbite, barite, marble, coal, and lithium (Oshio, 2019). While mining drives economic development and contributes to state revenue, unregulated and illegal mining practices exacerbate environmental degradation, including soil erosion, water contamination, and deforestation (Aremu, 2021; Usman, 2022). This dual nature of mining underscores the need for integrated land governance strategies that balance economic benefits with environmental sustainability and social stability.

Forestry, residential, and commercial/industrial land uses, though less dominant, play significant roles in shaping land dynamics in Nasarawa State. Forestry accounts for 12% of land use, driven by logging, fuelwood harvesting, and exploitation of forest reserves,

often leading to deforestation and habitat loss (Adebayo, 2017; Ewah & Adesina, 2021). Residential and urban land use (19.8%) has expanded rapidly in towns such as Lafia, Keffi, and Karu due to population growth, migration, and peri-urban sprawl linked to Abuja's expansion (UN-Habitat, 2020; Nwosu & Aluko, 2019). Commercial and industrial land use, while comparatively small at 7.8%, is concentrated in urban centers and contributes to employment and local economic activities, highlighting the interplay between population growth, urbanization, and land demand.

The variation in land use patterns across Local Government Areas (LGAs) further emphasizes the complexity of land management in Nasarawa State. Residential and mining land uses show significant spatial differentiation, with urbanization pressures concentrated in Karu and Lafia, while high-intensity mining occurs in Nasarawa and Awe LGAs (NPC, 2022; Oshio, 2019). In contrast, agriculture and forestry exhibit relatively uniform distribution, reflecting the pervasive nature of farming and fuelwood dependence across the state (Ewah & Adesina, 2021). These spatial differences underscore the need for targeted policy interventions, including urban planning in high-growth areas and stronger regulatory enforcement of mining activities, to ensure sustainable land resource use and minimize conflicts (Okoli & Orinya, 2020).

MATERIALS AND METHODS

Nasarawa state has an approximate land area of about 27,271.50 square kilometers. The State is located in the basement complex of northern central Nigeria between longitude 6°.45'03" and 9° 45'03" of the Greenwich meridian and latitude 7° 45' 00" and 9° 35' 00" of the equator. It stands at an elevation of 400 meter above sea level. It was created on October first, 1996 and is undergoing rapid population growth and infrastructural development due to its proximity to the Federal Capital Territory, Abuja. It shares geographical boundaries with Kaduna state in the north, Abuja Federal Capital Territory (FCT) in the West, Kogi and Benue states in the south, Taraba and Plateau states in the east respectively. The state is a gate way to the Federal Capital of Nigeria for it share border with the centre of unity. It has a population of 1,869,377 (NPC, 2006) and 2,886,000 as the current projected population with a population density of 75/km^2 (190/sg mi) (NPC, 2022).

Figure 1 shows the population distribution of the thirteen local government areas that make up the state.

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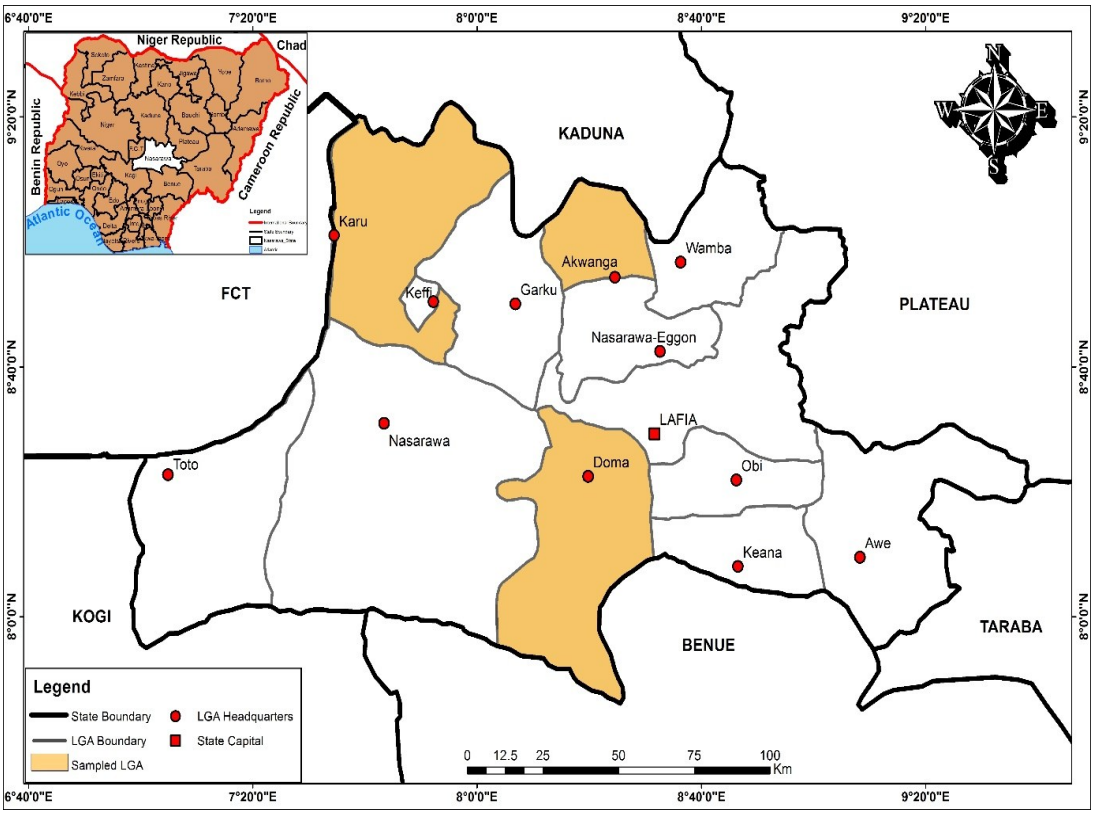

Figure 1: Nasarawa State Showing the LGAs

Source: Geography Department, Nasarawa State University, Keffi

The study employed a mixed-methods research design, combining both quantitative and qualitative approaches to examine land resource uses in Nasarawa State. Primary data were collected through structured questionnaires administered to 384 respondents across selected Local Government Areas (LGAs), focusing on agricultural, mining, forestry, residential, and commercial land uses. Key informant interviews and focus group discussions were conducted with community leaders, miners, farmers, and NSCDC personnel to capture in-depth perspectives on land use dynamics, conflicts, and enforcement challenges. Secondary data were obtained from government reports, the Nigeria Geological Survey Agency, and previous academic studies to complement field findings. Quantitative data were analyzed using descriptive statistics, including frequency distributions, percentages, and chi-square tests to assess variations in land use patterns across LGAs, while qualitative data were subjected to thematic content analysis to identify recurring trends and stakeholder perceptions (NPC, 2022; Oshio, 2019). This integrative methodology ensured a comprehensive understanding of both the spatial and socio-economic dimensions of land resource utilization in the state.

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RESULTS

Major Categories of Land Resource Uses in Nasarawa State

Nasarawa State occupies a total landmass of approximately 27,117 km² and is characterized by diverse land use patterns that reflect both its agrarian base and its growing extractive economy. Survey results (n = 384) indicate that agriculture overwhelmingly dominates land use, accounting for (45.3%) of reported uses. This is followed by residential/urban settlements (19.8%), mining and quarrying (15.1%), forestry-related activities (12.0%), and commercial/industrial land (7.8%). Notably, categories such as roads, recreational spaces, and sacred lands were not independently reported by respondents, suggesting their marginal role relative to the major land use activities.

The predominance of agriculture is unsurprising, given Nasarawa agrarian economy. Subsistence and commercial farming, livestock grazing, and small-scale irrigation are the lifeline of most households in both rural and peri-urban communities. This finding is consistent with the National Population Commission (NPC, 2022), which observed that agriculture remains the principal livelihood sector in the state, engaging more than two-thirds of the working population. Furthermore, the presence of grazing reserves and irrigation schemes, particularly along the Benue River Basin, reinforces the agricultural character of the state (Oshio, 2019). However, agricultural expansion often competes with other land uses, generating tensions in land allocation, especially between farmers and herders, and between farming and mining interests.

Mining constitutes the third most significant land use, reported by 15.1% of respondents. Nasarawa is widely recognized as Nigeria's "Home of Solid Minerals," with large deposits of tin ore, columbite, barite, marble, and more recently lithium (Oshio, 2019). This explains the strong presence of mining activities in the land use survey. However, mining also brings significant environmental costs, including soil erosion, water contamination, and land degradation. Empirical studies (Aremu, 2021; Usman, 2022) note that unregulated mining has displaced agricultural activities in some mineral-rich zones, exacerbating local land conflicts. This dual role of mining—as an economic driver and as a source of environmental pressure—remains central to the land resource governance debate in Nasarawa.

Forestry-related land use accounted for 12.0% of responses, reflecting logging, fuelwood harvesting, and forest reserve exploitation. Deforestation pressures are pronounced due to the state's high dependence on biomass energy, as more than 70% of rural households rely on fuelwood and charcoal for cooking (NPC, 2022). The depletion of forest reserves such as Keana and Doma further demonstrates the unsustainable trajectory of forest use in the state. This finding aligns with Adebayo (2017), who documented declining forest

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cover in North-Central Nigeria, attributing it to population growth, unsustainable logging, and weak enforcement of conservation policies.

Residential and commercial/industrial land uses together accounted for just under 28% of land use responses. The residential category (19.8%) reflects growing urbanization in towns such as Lafia, Keffi, and Akwanga, driven by migration, administrative expansion, and population growth. While urban expansion generates new economic opportunities, it also intensifies land pressure, leading to encroachment on agricultural and forest lands (NPC, 2022). The commercial/industrial category (7.8%) remains comparatively small, highlighting the limited pace of industrial development in the state, though new extractive industries may alter this balance in the future.

Table 1: Distribution of Land Resource Uses (Survey Results, n=384)

Land Use Category	Frequency (n)	Percentage (%)	Rank
Agriculture (farming, grazing, irrigation)	174	45.3%	1st
Residential/urban settlements	76	19.8%	2nd
Mining/quarrying	58	15.1%	3rd
Forestry (logging, forest reserves, fuelwood)	46	12.0%	4th
Commercial/industrial land	30	7.8%	5th
Others (roads, recreation, sacred lands)	0	0%	–

Source: Authors Field Work 2024

Agricultural Land Use (Farming and Grazing)

Agriculture in Nasarawa State is not only the dominant land use but also the backbone of local livelihoods and the state's rural economy. Survey results (n = 174) confirm that agricultural land is divided among crop farming (54.0%), livestock grazing (32.2%), and irrigation/fadama farming (13.8%). This distribution reflects the mixed farming systems that characterize much of North-Central Nigeria, where crop cultivation and pastoralism coexist within shared landscapes. However, the dual nature of agriculture—both crop-based and pastoral—has also produced competing land claims, often culminating in violent farmer–herder conflicts.

Crop farming is the largest category, covering 54.0% of agricultural land uses. Staple crops reported by respondents include yam, cassava, maize, rice, and sesame, which are cultivated both for household subsistence and for market supply. Fertile soils in areas such as Awe, Keana, and Doma, combined with the seasonal flooding of the Benue Basin, make these areas particularly suitable for cereal and tuber production (NPC, 2022). Sesame, a high-value cash crop, has gained prominence in Nasarawa's agricultural portfolio, aligning with state-level initiatives to expand cash crop exports (Oshio, 2019). However, crop farming expansion often overlaps with grazing routes, increasing tensions

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with pastoralists. This finding is consistent with Okoli & Atelhe (2014), who identified farmland encroachment as a major trigger of farmer–herder violence across the Middle Belt.

Livestock grazing represents 32.2% of agricultural land use, dominated by cattle, goats, and sheep. The state's location along transhumance corridors attracts both sedentary and migratory pastoralists, particularly in areas bordering Benue and Plateau states. While grazing is critical to household protein supply and trade, it contributes to land pressure by competing with crop farmers for space. Respondents frequently cited livestock encroachment on farmlands as a cause of disputes, which resonates with wider scholarship on the farmer–herder crisis in Nigeria (Aliyu, 2015; Kwaja & Ademola-Adelehin, 2018). The frequency of these conflicts has made agricultural land security a core area of intervention for state institutions, particularly the Agro-Rangers unit of NSCDC.

Irrigation farming (13.8%) represents a smaller but important component of agriculture in the state, mainly practiced in fadama (low-lying floodplain) areas. Irrigation is most prominent along rivers and dams, supporting dry-season farming of rice, maize, and vegetables. Although less widespread than rain-fed farming, irrigation plays a crucial role in food security and income diversification, especially in the context of climate variability. Studies by Abubakar & Ahmed (2021) highlight that fadama farming has enhanced agricultural resilience in Nasarawa but also increases competition for water and land resources, particularly during the dry season.

The competition between these agricultural land uses—especially between crop cultivation and grazing—remains a critical driver of land insecurity. This was a key factor in the establishment of the Agro-Rangers in 2016, whose mandate includes protecting farmers and agricultural land from violent disruptions such as herder invasions and land disputes (Okoli & Orinya, 2020). The findings therefore not only highlight agriculture's dominance in Nasarawa's economy but also underscore its centrality to land-related security challenges. The dual role of agriculture—as an engine of development and as a flashpoint for conflict—necessitates a governance framework that integrates both productivity and security concerns.

Table 2: Agricultural Land Use Types (n=174)

Agricultural Activity	Frequency	Percentage (%)
Crop farming	94	54.0%
Livestock grazing	56	32.2%
Irrigation (fadama farming)	24	13.8%

Source: Authors Field Work 2024

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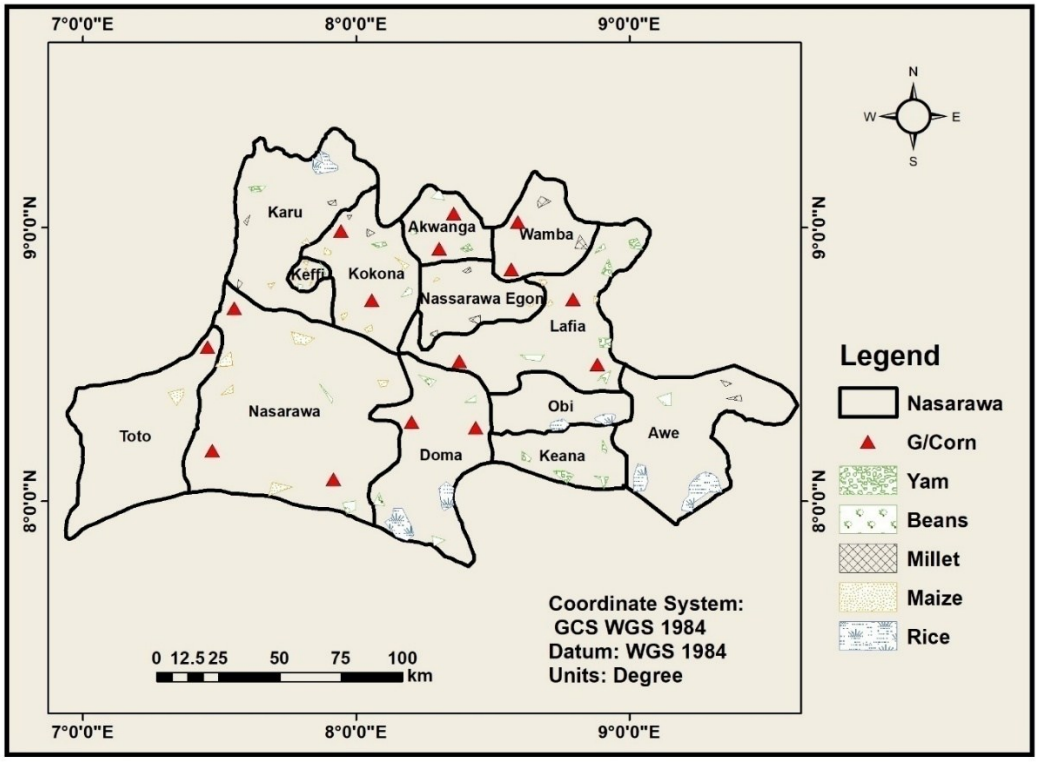

Figure 2: Agricultural Resources in the Study Area
Sources: Field Survey, 2024

Mining and Quarrying Land Uses

Mining plays a significant role in shaping land use in Nasarawa State, with deposits of barite, coal, marble, and lithium scattered across several LGAs. Despite its economic value, much of the mining is informal or illegal, occupying large tracts of land and contributing to severe environmental degradation. Survey findings reveal that over half of miners (52%) admit mining often proceeds without reclamation, leading to soil erosion, water pollution, and abandoned pits. The introduction of the NSCDC Mining Marshals marks an institutional response to regulate these activities and curb illegal operations, though enforcement gaps remain.

Mining in Nasarawa is both a key land use and a major environmental stressor. High-activity zones such as Nasarawa and Awe LGAs exhibit the most severe ecological impacts, including deforestation and land degradation. Medium-level mining in Akwanga, Wamba, and Lafia contributes to forest clearing and soil contamination. Without effective regulation, the sector risks undermining sustainable land management. The Mining Marshals' role in enforcement is thus crucial but requires greater capacity, transparency,

and collaboration with local communities to mitigate hazards and ensure reclamation of mined lands.

Table 3: Distribution of Mining Land Use by LGA (Key Areas)

LGA	Major Minerals	Level of Activity	Environmental Impact
Akwanga	Barite, marble	Medium	Forest clearing, pits
Nasarawa	Tin, columbite, lithium	High	Land degradation
Wamba	Lithium, salt	Medium	Soil contamination
Awe	Coal, barite	High	Deforestation, erosion
Lafia	Quarry stones	Medium	Dust, habitat loss

Source: Authors Field Work 2024

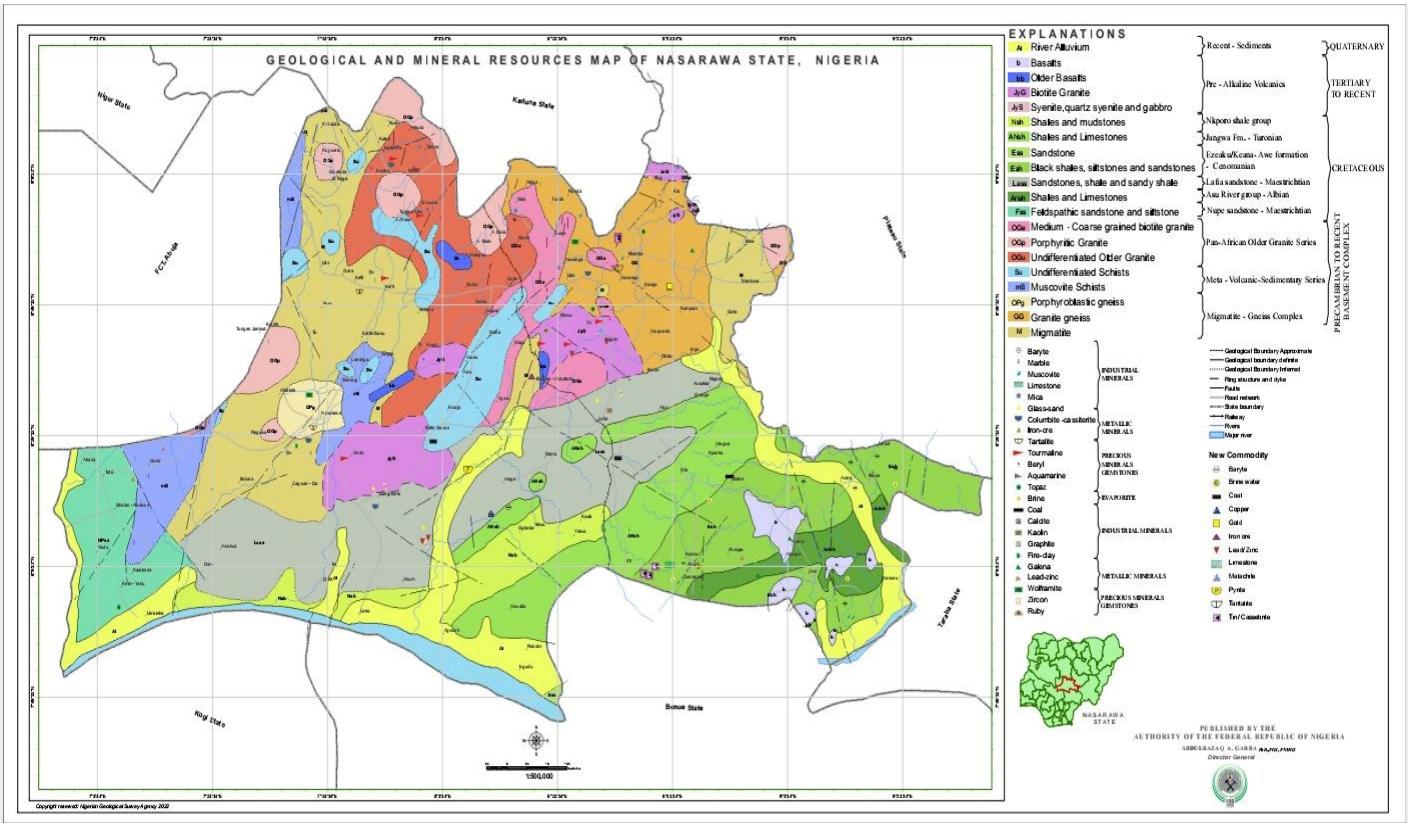

Figure 3: Map of Nigeria showing mineral resources of Nasarawa state
Source: Nigeria Geological Survey Agency (2020)

The scatter plot visualization of mining activity and environmental impact across the five LGAs in Nasarawa State highlights a clear correlation between intensity of mining operations and ecological degradation. LGAs such as Nasarawa and Awe stand out with

high levels of mining activity and correspondingly severe impacts, including deforestation, land degradation, and erosion. By contrast, LGAs such as Akwanga, Wamba, and Lafia show moderate mining activity and associated impacts, such as dust emissions and localized habitat loss. This pattern aligns with Onwualu (2021), who noted that mining intensity in central Nigerian states is directly proportional to the scale of environmental hazards observed. The scatter distribution therefore confirms that areas with extensive mining tend to experience higher ecological costs, thereby underscoring the urgent role of regulatory oversight in mitigating adverse impacts. Such visual evidence supports prior findings that link unregulated mining to long-term land degradation in the region (Ezekiel et al., 2020).

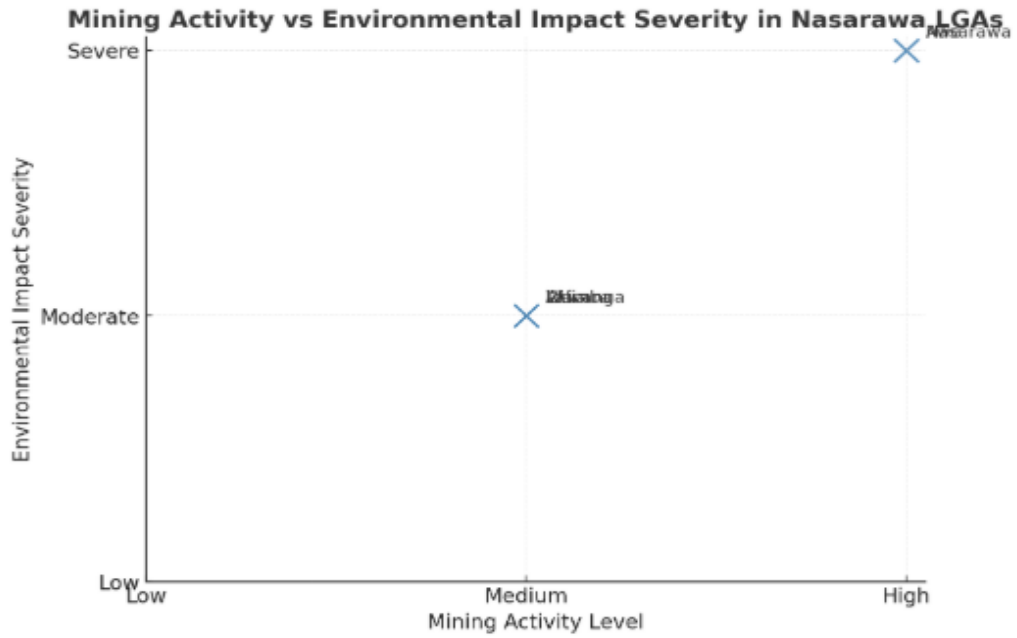

Figure 4: Scatter plot comparing mining activity levels with environmental impact severity across Nasarawa State LGAs
Source: Authors Field Work 2024

The bar and line chart provides a dual perspective on the relationship between mining activity levels and environmental impact severity across Nasarawa State. The brown bars, which depict environmental impact severity, rise significantly in Nasarawa and Awe LGAs, while the green line, representing mining activity, mirrors this upward trend. The overlap between the two metrics shows a direct and proportional relationship, where higher activity levels translate into higher environmental costs. This visualization emphasizes that mining is both an economic driver and an environmental liability, particularly in

resource-rich areas. As NPC (2022) and Oshio (2019) highlight, Nasarawa's dependence on land-based resources has created both opportunities and risks, with mining emerging as a sector where benefits often come at the expense of ecological integrity. The chart reinforces the need for stricter land-use monitoring and reclamation efforts by the NSCDC Mining Marshals, as unregulated activities threaten not only land productivity but also community livelihoods.

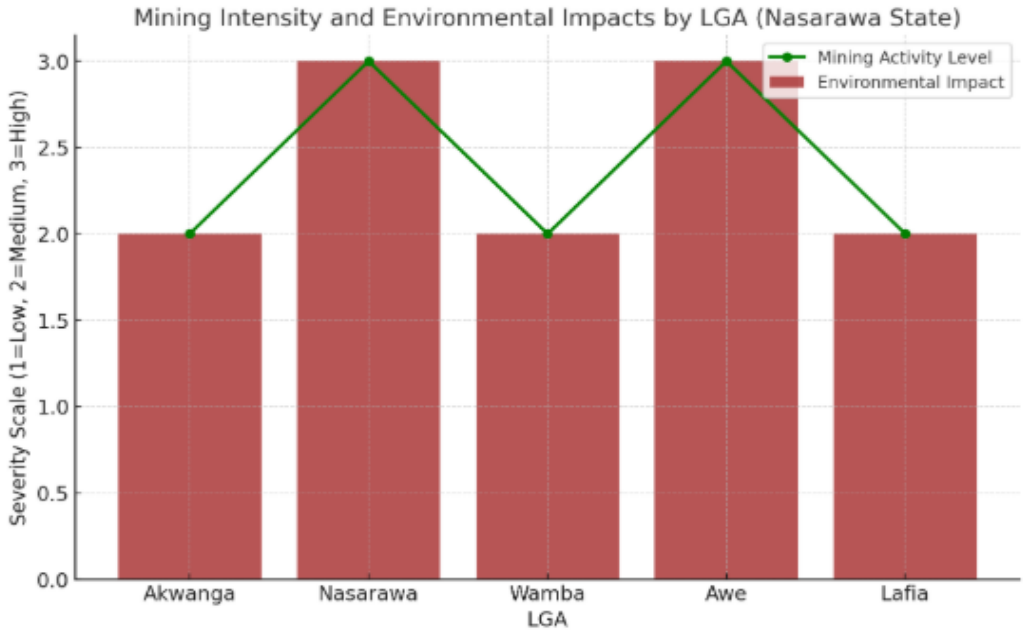

Figure 5: Bar + line chart showing mining activity levels and environmental impacts across Nasarawa State LGAs
Source: Authors Field Work 2024

Forestry, Residential and Other Land Uses

Result reveal that secondary land uses in Nasarawa State are shaped by population growth, urbanization, and energy dependence. Residential and urban expansion is most visible in Karu, Keffi, and Lafia LGAs, reflecting the pressures of migration and proximity to Abuja. In Karu, the peri-urban sprawl driven by Abuja's expansion has been particularly rapid, resulting in extensive conversion of agricultural and forest lands to housing estates and informal settlements. This trend is consistent with UN-Habitat (2020) and Nwosu & Aluko (2019), who observe that peri-urban corridors in Nigeria are among the fastest urbanizing spaces, often without commensurate infrastructure or planning.

Forestry uses, by contrast, are in decline. In LGAs such as Doma, Obi, and Kokona, households reported heavy reliance on fuelwood, with 41% of respondents identifying forestry as a primary land use. This aligns with NPC (2022), which notes that over 65% of households in Nasarawa State rely on fuelwood as their main source of energy. The result has been widespread deforestation, soil exposure, and degradation of forest reserves. The ecological consequences are compounded by agricultural expansion, further reducing forest cover. As Ewah & Adesina (2021) argue, unsustainable fuelwood dependence threatens biodiversity and weakens forest-based livelihoods in central Nigeria.

Industrial and commercial land uses, while less dominant, are concentrated in Karu and Lafia, where higher population density and infrastructure attract business activities. Though only 28% of respondents reported such uses, these spaces contribute significantly to local revenue generation and employment. Sacred and recreational lands, such as shrines, ancestral burial grounds, and community groves, were reported by only 9% of respondents, particularly in Nasarawa Eggon. Although quantitatively minor, these lands are socially significant, serving as custodians of cultural heritage and identity (Aremu, 2018).

Table 4: Secondary Land Uses in Nasarawa State

Land Use	High Intensity LGAs	% of Respondents Reporting
Residential/urban	Karu, Keffi, Lafia	62%
Forestry/fuelwood	Doma, Obi, Kokona	41%
Industrial/commercial	Karu, Lafia	28%
Sacred/recreational lands	Nasarawa Eggon	9%

Source: Authors Field Work 2024

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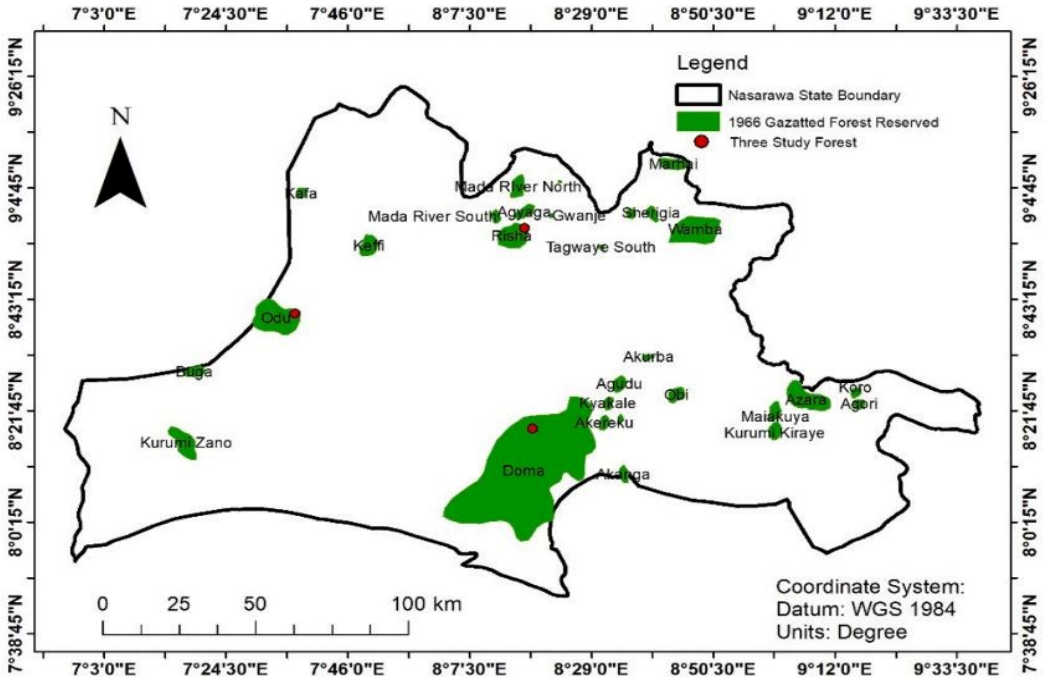

Figure 6: Nasarawa state map showing the distribution of gazette forest
Source: Ministry of Environment and Natural resources, Nasarawa (2020)

Inferential Analysis of Land Use Patterns across LGAs

To assess whether land use patterns differ significantly across Local Government Areas (LGAs) in Nasarawa State, a chi-square test of independence was conducted. The results reveal that residential and mining land uses vary significantly across LGAs, while agriculture and forestry do not show statistically significant variation. This indicates that pressures from urbanization and resource exploitation are the most spatially differentiated drivers of land change in the state.

Specifically, Lafia and Karu LGAs recorded higher proportions of residential land use. This aligns with population growth and the influence of Abuja's peri-urban expansion into Karu, as well as Lafia's role as the state capital (NPC, 2022). These findings are consistent with Nwosu & Aluko (2019), who observed that peri-urban settlements near Abuja expand rapidly due to housing demand, leading to large-scale conversion of agricultural land into residential plots. By contrast, Awe and Nasarawa LGAs show stronger mining land use, reflecting the concentration of mineral deposits such as coal, barite, and columbite in these areas (Oshio, 2019). Mining pressures are further exacerbated by illegal activities, which often occur outside formal regulatory frameworks.

Agriculture, despite being the dominant land use across the state, did not show significant variation across LGAs. This suggests that agricultural practices are relatively widespread

and evenly distributed across Nasarawa State, consistent with its identity as an agrarian economy. Similarly, forestry land use, while under pressure from fuelwood extraction, also displayed no significant statistical variation across LGAs. This may reflect the generalized nature of fuelwood dependence and deforestation across rural communities (Ewah & Adesina, 2021).

The statistically significant differences in residential ($\chi^2 = 28.66$, $p = 0.003$) and mining ($\chi^2 = 31.84$, $p = 0.001$) land uses highlight the dual pressures of urbanization in peri-urban LGAs and resource exploitation in mineral-rich LGAs. These findings reinforce the need for differentiated policy interventions: urban planning strategies in high-growth LGAs such as Karu and Lafia, and stronger enforcement of mining regulations in Awe and Nasarawa. As Okoli & Orinya (2020) argue, land conflicts in Nasarawa are often tied to uneven land use pressures, particularly where urban expansion and resource exploitation intersect.

Table 5: Chi-Square Test of Land Use Variation across LGAs

Land Use	χ^2 Value	df	p-value	Remark
Agriculture	14.52	12	0.27	NS
Residential	28.66	12	0.003	Significant
Mining	31.84	12	0.001	Significant
Forestry	10.45	12	0.57	NS

Source: Authors Field Work 2024

CONCLUSION

The study concludes that land resources in Nasarawa State are under diverse and competing uses, with agriculture, residential settlements, and mining emerging as the dominant categories. Agriculture remains the backbone of the state's economy, supporting livelihoods through crop farming, livestock grazing, and irrigation, yet it also generates conflicts with pastoralists and miners over land allocation. Mining, while contributing significantly to economic development, has caused environmental degradation, including soil erosion, water contamination, and deforestation, particularly in high-activity LGAs such as Nasarawa and Awe. Forestry and urban expansion further exert pressure on land, with unsustainable fuelwood harvesting and peri-urban sprawl threatening forest reserves and agricultural land. The spatial analysis shows that residential and mining land uses vary significantly across LGAs, highlighting the differential pressures of urbanization and resource exploitation, while agriculture and forestry are more evenly distributed. Overall, the findings underscore the need for integrated land management strategies that balance economic development, environmental sustainability, and social stability (NPC, 2022; Oshio, 2019; Ewah & Adesina, 2021).

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Recommendations

In light of these findings, the study recommends that the state government should strengthen land-use planning and zoning regulations, particularly in peri-urban areas and mineral-rich LGAs, to reduce conflicts between agriculture, urbanization, and mining. Enhanced enforcement mechanisms, including expanding the NSCDC Mining Marshals' capacity and resources, are necessary to regulate illegal mining and ensure environmental reclamation. There should also be community engagement and participatory governance, ensuring that farmers, pastoralists, miners, and local leaders are involved in decision-making to foster cooperation and reduce disputes. Sustainable forestry management practices should be promoted, including alternative energy sources to reduce dependence on fuelwood. Finally, the state should invest in awareness campaigns and capacity-building programs for stakeholders on land rights, environmental conservation, and conflict resolution to ensure equitable and sustainable use of land resources across Nasarawa State.

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