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Abundance and structural characteristics of termite mounds in a tropical rainforest and implications for agroecosystems in Okomu National Park, Nigeria

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Abstract: Termites are decomposers that contributes to nutrient cycling, soil aeration, and biodiversity support through mound construction. However, there is limited research focused on the distribution, diversity, and structural characteristics of termite mounds in tropical rainforest ecosystems like Okomu National Park (ONP) in Edo State, Nigeria. The objective of this study was therefore to examined the abundance and distribution of termite mounds within ONP. The research was conducted across four designated ranges within ONP (Arakhuan, Igwuowan, Julius Creek, and Babui Creek), using a standardized belt transect method (100 × 2 m^2). Termite mounds were identified, counted, and classified based on structural features (shapes, circumference, and heights) during the rainy and dry seasons. Data collected were subjected to descriptive statistics and one-way analysis of variance at $p<0.05$. The results showed there were significant variations in mound structure and abundance across the ranges. The cylindrical mounds were the most dominant type, with higher densities recorded in the Arakhuan (32) and Igwuowan (26) ranges. Seasonal differences indicated a higher number of termite mounds during the rainy season (162) than the dry season (137). Mound were taller and circumference larger during the rainy season compared to the dry season. The drop suggests moisture plays a key role in termite mound establishment. Cylindrical mounds were considered dominant across seasons in the Okomu National Park. The mound types and distribution demonstrates that termite activity generates small-scale fertility gradients that can directly influence crop production in adjoining agricultural zones.

Keywords: Ecosystem engineering, tropical rainforest, mound structure, seasonal differences, crop production.

Abundância e características estruturais de cupinzeirtos em uma floresta tropical úmida e suas implicações para os agroecossistemas no Parque Nacional de Okomu, Nigéria

Resumo: Os cupins são decompositores que contribuem para a ciclagem de nutrientes, aeração do solo e suporte à biodiversidade por meio da construção de cupinzeiros. No entanto, há poucas pesquisas focadas na distribuição, diversidade e características estruturais dos cupinzeiros em ecossistemas de floresta tropical úmida, como o Parque Nacional de Okomu (PNO), no estado de Edo, Nigéria. O objetivo deste estudo foi, portanto, examinar a abundância e a distribuição de cupinzeiros dentro do PNO. A pesquisa foi conduzida em quatro áreas designadas dentro do PNO (Arakhuan, Igwuowan, Julius Creek e Babui Creek), utilizando um método padronizado de transecto em faixa (100 × 2 m^2). Os cupinzeiros foram identificados, contados e classificados com base em características estruturais (formas, circunferências e alturas) durante as estações chuvosa e seca. Os dados coletados foram submetidos a estatísticas descritivas e análise de variância unidirecional (ANOVA) com p<0,05. Os resultados mostraram variações significativas na estrutura e abundância dos cupinzeiros ao longo das áreas estudadas. Os cupinzeiros cilíndricos foram o tipo mais dominante, com maiores densidades registradas nas áreas de Arakhuan (32) e Igwuowan (26). As diferenças sazonais indicaram um número maior de cupinzeiros durante a estação chuvosa (162) do que na estação seca (137). Os cupinzeiros eram mais altos e tinham circunferências maiores durante a estação chuvosa em comparação com a estação seca. Essa queda sugere que a umidade desempenha um papel fundamental no estabelecimento dos cupinzeiros. Os cupinzeiros cilíndricos foram considerados dominantes em todas as estações do ano no Parque Nacional de Okomu. Os tipos e a distribuição dos montículos demonstram que a atividade dos cupins gera gradientes de fertilidade em pequena escala, que podem influenciar diretamente a produção agrícola em zonas agrícolas adjacentes.

Palavras-chave: Engenharia de ecossistemas, floresta tropical, estrutura dos cupinzeiros, diferenças sazonais, produção agrícola.

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1. INTRODUCTION

Termites are known as cellulose-eating and eusocial insects belonging to the order Blattodea, which are closely related to cockroaches (INWARD et al., 2007). Ecologically, they can construct intricate mound structures that serve as microhabitats for many other organisms. These mounds, built from soil, saliva, and feces, can reach several meters in height, and remain stable for decades. Termites, was reported to influence local biodiversity by modifying soil properties, creating localized microclimates, and providing shelter for numerous other organisms (invertebrates, reptiles, amphibians, and small mammals) as well as nesting sites and perches for birds (ASHTON et al., 2019).

Termite mounds significantly enhance soil fertility and nutrient cycling in tropical and subtropical regions. As reported by Tilahun et al. (2021), termite mounds are often enriched in nutrients like nitrogen, phosphorus, and organic matter compared to surrounding soils, creating localized fertility hotspots. Termite mounds and nest structures store large amounts of carbon, acting as long-term carbon sinks, especially in tropical and arid ecosystems (FORBES et al., 2025). Their mounds increase ecosystem robustness against climate change by enhancing soil properties and plant growth while their induced heterogeneity interacts with vegetation patterns, making ecosystems more resilient to aridity (BONACHELA et al., 2015). Thus, keeping soils healthier and plants thriving even in dry spells. For crop production, the implication is either beneficial and challenging (AHMAD et al., 2021). Positively, termite activity enhances soil fertility, a boon for Nigeria's agriculture, which relies heavily on crops like cassava, maize, cocoa, and oil palm (TUMA et al., 2022). Nevertheless, high abundance can turn termites into pests.

In natural habitats, termite assemblages are determined by vegetation structure, soil characteristics, and disturbances like bushfires. Termite habitat type and environmental variables such as woody plant diversity and organic carbon content affect their species distribution and feeding group composition (KONÉ et al., 2018). According to Alamu and Ewete (2021), seasonal variations significantly influence termite populations, with higher activity observed during rainy seasons and warmer months. Daily activity patterns have been observed, peaking in late afternoon, primarily influenced by temperature rather than humidity (WAN UMAR & AB MAJID, 2022).

In the lush, rain-drenched landscapes of southern Nigeria, termites play a quiet but powerful role in shaping the environment. These tiny architects build elaborate mounds that dot the forest floor, acting as both indicators of soil health and agents of change in ecosystems. As reported by Oladejo and Eghenure (2021), Okomu National Park, nestled in Edo State and spanning about 200 square kilometers within the larger Okomu Forest Reserve, stands as one of the last strongholds of Nigeria's lowland rainforest. Amid towering trees like *Celtis zenkeri* and *Triplochiton scleroxylon*, and a chorus of birds (grey parrot and black-casqued hornbill), termite mounds emerge as key features in the humid tropical setting, where annual rainfall often exceeds 2,000 mm and soils tend to be acidic and sandy (AIGBE & NCHOR, 2021). In Okomu National Park, termite mounds are a prominent feature of the landscape, which significantly shapes the park's ecological structure. These mounds vary in size, shape, and composition, reflecting the adaptability of different termite species to environmental conditions. The diversity of mound types serves as an indicator of ecosystem health, influencing species interactions and habitat formation (BONACHELA et al., 2015). Given the park's status as one of Nigeria's last remaining lowland rainforests, understanding how these mounds contribute to its biodiversity is vital for conservation planning and would offer valuable insights into climate adaptation within and farmlands bordering the park.

Despite the recognized significance of termites in tropical ecosystems, comprehensive studies on termite abundance, distribution, diversity, and the ecological functions of their mounds within ONP are not adequate. It is established that the main effect of these termites on ecosystems is linked to the construction of tunnels, galleries, mounds, and nests (LÓPEZ-HERNÁNDEZ, 2023). The study of the termite mounds and their associated biodiversity in ONP is justified, because termite mounds significantly influence the physical and chemical properties of soils, and even carbon storage. These parameters or indicators are crucial elements that affect human activities and overall biodiversity (TILAHUN et al., 2021; CHEN et al., 2023). Also, with the increasing threats of deforestation and habitat fragmentation in ONP, understanding the role of termite mounds in maintaining ecosystem functions could provide insights into mitigating the impacts of these threats. In Nigeria, where agriculture employs over 70% of the workforce (AKINRINOLA & TSADO, 2025), managing this involves strategies drawn from park studies to predict invasion risks.

The increase in food demand resulting from the pressures from population growth, deforestation, and climate shifts, understanding these mounds becomes essential. This study seeks to address the knowledge gap by investigating the abundance and distribution pattern of termite mounds in ONP, by assessing the structure of mounds and comparing the distribution pattern across ranges. Recognizing termite mounds as both ecological assets and management challenges offers a pathway toward park management and resilient crop production systems. This knowledge aligns with biodiversity conservation goals in Nigeria's derived savanna–rainforest transition zone (OLANIYI, 2018). The results from this study would provide baseline information on termite activities within the park and could contribute to the development of conservation strategies that leverage the ecological services provided by termites, thereby enhancing the resilience of ONP against environmental changes (OLANIYI, 2018; ASHTON et al., 2019). The aim of this study is therefore to investigate the abundance, distribution, and structural characteristics of termite mounds and their implications for farming activities within and around Okomu National Park, Nigeria. Exploring the abundance, distribution, and structural traits of these mounds offers a window into balancing ecological integrity with agricultural demands in Nigeria's humid forest ecosystems with recommendations for sustainable management amid climate pressures.

2. MATERIAL AND METHODS

2.1 Study Area

The study was carried out in Okomu National Park (ONP), located in Edo State, Nigeria (Figure 1). ONP covers an area of 181 km² and is characterized by dense tropical rainforest. It is divided into four major ranges: Arakhuan, Igwuowan, Julius Creek, and Babui Creek. Each range is 15% of the 1,200 km² Okomu Forest Reserve (OLADEJO & EGHENURE, 2021; DIGUN-AWETO, 2018). The ranges has distinct vegetation and anthropogenic influences. The park lies within a latitude of 6°15'N to 6°25'N and a longitude of 5°09'E to 5°23'E (DIGUN-AWETO, 2024).

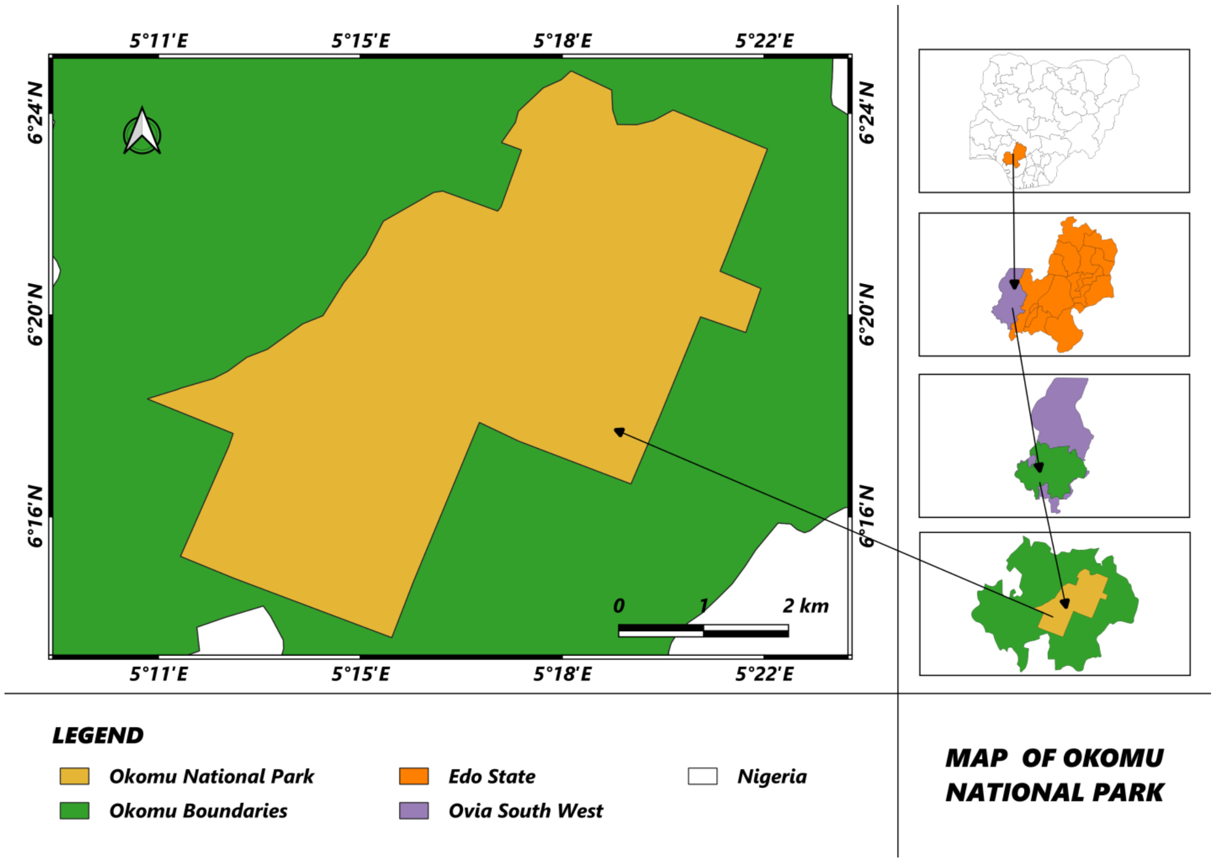

Figure 1. The map of Okomu National Park

It is also recognized as a highly biodiverse region, providing habitat for a variety of endangered species, including the African forest elephant (*Loxodonta cyclotis*), the white-throated monkey (*Cercopithecus erythrogaster pococki*), and the Nigerian-Cameroon chimpanzee (*Pan troglodytes ellioti*) (AJIBOLA-JAMES et al., 2024). Despite its protected status, ONP faces threats from human activities, including deforestation, illegal logging, agricultural expansion, and industrial noise pollution (ISIKHUEMEN & IKPONMWONBA, 2020).

2.2 Data Collection

This study employs a descriptive and comparative research design to evaluate termite mound type, assess mound structures. The distribution of mounds across the four different ranges within ONP were compared. Two 100 m × 2 m standardized belt transects protocol, subdivided into twenty (5 by 2 m) were established in each of the four ranges using GPS. Sampling was conducted in both the rainy and dry seasons to capture seasonal variability. At each 5 m interval along the transects, termite mounds were identified, counted, and categorized based on:

- Height (measured from base to apex)
- Circumference (measured at base and midpoint)
- Structural type (e.g., cone-shaped, cylindrical, cathedral)
- Attachment to trees (freestanding or tree-attached)

Measurements were taken during morning (7:00–10:00 am) and evening (3:00–6:00 pm) sessions for consistency. At each 5 m of the belt transects, termite mounds were identified and assessed for all parameters.

Soil samples from the study area were collected using a steel coring tube. The pH was determined with the aid of a digital electronic pH meter using a ratio of 1:2 soil-water medium.

2.3 Data Analysis

Descriptive statistics (means, frequencies) were used to summarize mound characteristics. One-way ANOVA tested differences in abundance of termite mound structure across the ranges and between seasons using Statistical Package for the Social Sciences (SPSS 26).

3. RESULTS

A total of 162 mounds were recorded during the rainy season across the four ranges. Cylindrical mounds (Plate 1) with covers were the most prevalent across all ranges, with Arakhuan having the most (32 mounds) (Table 1). Cylindrical mounds attached to trees were missing in Igwuowan but recorded in other locations, with Julius Creek having the most (5 mounds). Cone mounds structures (Plate 2) were present in all locations, with the highest number in Julius Creek (8 mounds). Mushroom-shaped mounds were present in three locations but absent in Julius Creek, while mushroom-shaped mounds attached to trees were only present in Arakhuan and Igwuowan.

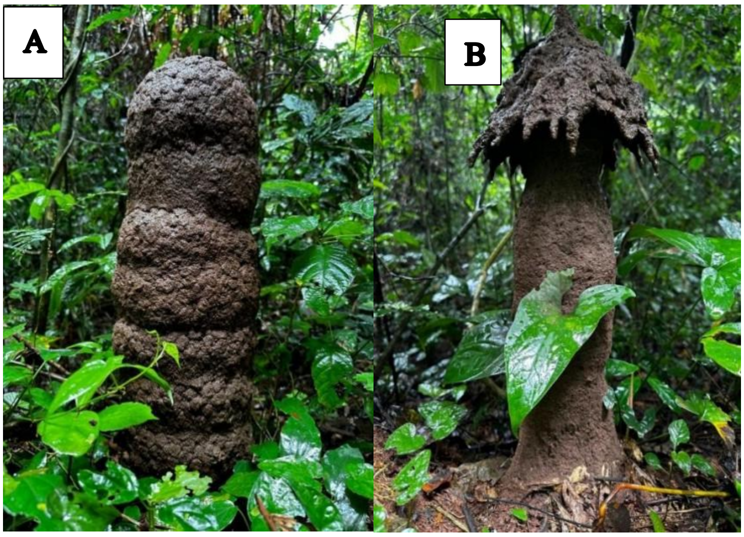

Plate 1. Termite mound structures identified from study sites in Okomu National Park (A = Cylindrical; B = cylindrical with cover)

During the dry season, the total mound count slightly decreased, with 137 termite mounds recorded (Table 2). Cylindrical mounds with cover dominated again, but their numbers declined slightly while the mean height and circumference remained relatively stable. Cylindrical mounds attached to trees (Plate 3) were recorded in three locations except Igwuowan, with Babui Creek having the highest count (6 mounds). Cone Mounds remained consistent across sites but showed a slight reduction in height and circumference, particularly in Arakhuan (MH: 0.33 m, MC: 0.29 m). Cathedral Mounds followed the same trend as in the rainy season, appearing only in Babui Creek (2 mounds). Mushroom-shaped mounds were present in three locations but absent in Julius Creek. The highest number appeared in Babui Creek (11 mounds), showing an increase from the rainy season. Mushroom-shaped mounds attached to trees were only present in Igwuowan (1 mound) and absent elsewhere.

Table 1. Termite mounds structures at different sites in Okomu National Park during the rainy season, indicating shape, abundance, mean height, and mean diameter

Mound structure	Arakhuan			Igwuowan			Julius Creek			Babui Creek		
	TA	MH	MC	TA	MH	MC	TA	MH	MC	TA	MH	MC
Cathedral	0	0	0	0	0	0	0	0	0	2	1.95	2.45
Cone	6	0.37	0.32	7	0.30	0.24	8	0.64	0.42	2	0.49	0.37
Cylindrical	2	0.38	0.64	4	0.99	0.50	4	0.76	0.55	2	0.34	0.35
Cylindrical attached with tree	3	0.38	0.41	0	0	0	5	0.87	0.81	2	0.35	0.41
Cylindrical with cover	32	0.41	0.38	26	0.56	0.43	17	0.39	0.37	21	0.44	0.44
Mushroom-shaped	3	0.53	0.33	5	0.47	0.52	0	0	0	9	0.46	0.48
Mushroom-shaped attached with tree	1	0.30	0.55	1	0.42	0.38	0	0	0	0	0	0
Total		**47**			**43**			**34**			**38**	

TA = Total Abundance; MH = Mean Height; MC = Mean Circumference (m)

Plate 2. Termite mounds structures identified from study sites in Okomu National Park (C = Cone; D = Cathedral)

Table 2. Termite mounds structures at different sites in Okomu National Park during dry season, indicating shape, abundance, mean height and mean diameter

Mound structure	Arakhuan			Igwuowan			Julius Creek			Babui Creek		
	TA	MH (m)	MC (m)	TA	MH (m)	MC (m)	TA	MH (m)	MC (m)	TA	MH (m)	MC (m)
Cathedral	0	0	0	0	0	0	0	0	0	2	1.95	2.44
Cone	6	0.33	0.29	6	0.26	0.21	7	0.55	0.40	6	0.47	0.37
Cylindrical	0	0	0	2	1.26	0.48	4	0.68	0.51	8	0.44	0.40
Cylindrical attached to tree	2	0.32	0.39	0	0	0	5	0.78	0.75	6	0.40	0.35
Cylindrical with cover	28	0.36	0.35	21	0.51	0.39	14	0.33	0.34	2	0.43	0.47
Mushroom-shaped	2	0.49	0.31	4	0.41	0.49	0	0	0	11	0.55	0.42
Mushroom-shaped attach with tree	0	0	0	1	0.38	0.35	0	0	0	0	0	0
Total		**38**			**34**			**30**			**35**	

TA = Total Abundance; MH = Mean Height; MC = Mean Circumference (m)

Plate 3. Termite mounds structures identified from study sites in Okomu National Park (E = Cylindrical attached with tree; F = Mushroom-shaped attached to tree)

Mound abundance was greater in the rainy season compared to the dry season. Structural parameters such as height and circumference also tended to be larger during the rainy season, suggesting seasonal influences on mound construction and visibility (Figure 2).

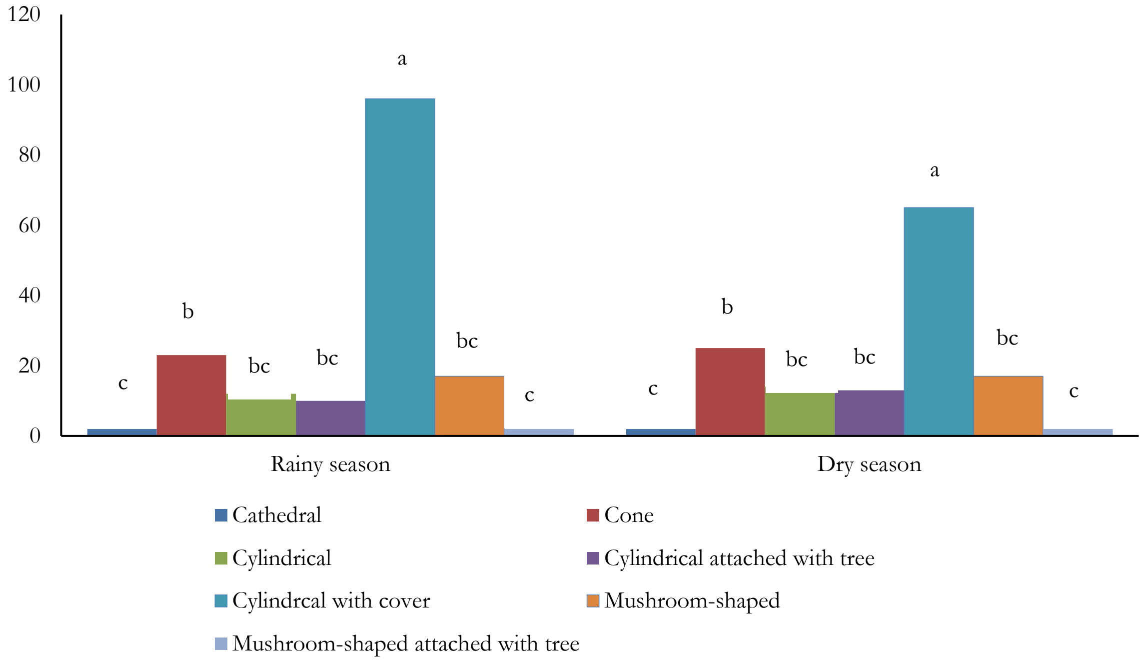

Figure 2. Seasonal variation in the abundance of termite mound structures

In the rainy season, distribution of 'Cylindrical Mounds with Cover' across the four ranges recorded the most dominant structure in across all the ranges, comprising 50% - 68% of the total mounds, with the highest mound densities in the Arakhuan and Igwuowan ranges (Table 3). Cylindrical mounds attached to trees were notably present in Julius Creek (14.71%) but absent in Igwuowan. Cone Mounds were the second most abundant mound type, particularly in Julius Creek (23.53%) and Igwuowan (16.28%). Cathedral Mounds were found only in Babui Creek (5.26%), implying that the conditions in this region are more suitable for larger, taller mounds. Mushroom-Shaped Mounds were significantly more frequent in Babui Creek (23.68%) compared to the other ranges, where they were almost absent. This suggests that environmental factors in Babui Creek favor this mound structure. Mushroom-shaped mounds attached to trees were rare, occurring only in Arakhuan (2.13%) and Igwuowan (2.33%).

Table 3. Comparative analysis of mounds' distribution rainy vs. dry season

Mound Type	Arakhuan (Rainy vs. Dry)	Babui Creek (Rainy vs. Dry)	Igwuowan (Rainy vs. Dry)	Julius Creek (Rainy vs. Dry)
Cathedral	0 → 0 (No change)	5.26% → 5.71% (Slight increase)	0 → 0 (No change)	0 → 0 (No change)
Cone	12.77% → 15.79% (Increase)	5.26% → 17.14% (Increase)	16.28% → 17.65% (Stable)	23.53% → 23.33% (Stable)
Cylindrical	4.26% → 0% (Decline)	5.26% → 22.86% (Increase)	9.30% → 5.88% (Decrease)	11.76% → 13.33% (Stable)
Cylindrical Attached with Tree	6.38% → 5.26% (Slight decrease)	5.26% → 17.14% (Increase)	0% → 0% (No change)	14.71% → 16.67% (Stable)
Cylindrical with Cover	68.09% → 73.68% (Increase)	55.26% → 5.71% (Major decrease)	60.47% → 61.76% (Stable)	50.00% → 46.67% (Slight decrease)
Mushroom-Shaped	6.38% → 5.26% (Stable)	23.68% → 31.43% (Increase)	11.63% → 11.76% (Stable)	0% → 0% (No change)
Mushroom-Shaped Attached with tree	2.13% → 0% (Decline)	0% → 0% (No change)	2.33% → 2.94% (Stable)	0% → 0% (No change

During the dry season, 'Cylindrical mounds with Cover' continued to dominate, but their proportion declined in all locations except in Igwuowan. Cylindrical Mounds were absent in Arakhuan but increased in Babui Creek (22.86%). Cylindrical Mounds Attached to Trees increased in Babui Creek from 5.26% to 17.14%, indicating a shift in mound-building behavior. Cone Mounds remained relatively stable, with slight increases in Arakhuan (15.79%) and Julius Creek (23.33%). Cathedral Mounds were only present in Babui Creek (5.71%), similar to the rainy season. Mushroom-Shaped Mounds increased in Babui Creek from 23.68% to 31.43%, reinforcing that this region favors these structures in the dry season. Mushroom-Shaped Mounds Attached to Trees remained rare, with only one recorded in Igwuowan (2.94%).

The soil pH observed for the four major ranges varied from 5.58 - 5.80. The lowerst soil pH was observed in Julius creek and the highest at Babui creek. The soil pH across the ONP ranges were moderately acidic soil at the Arakhuan and Igwuowan.

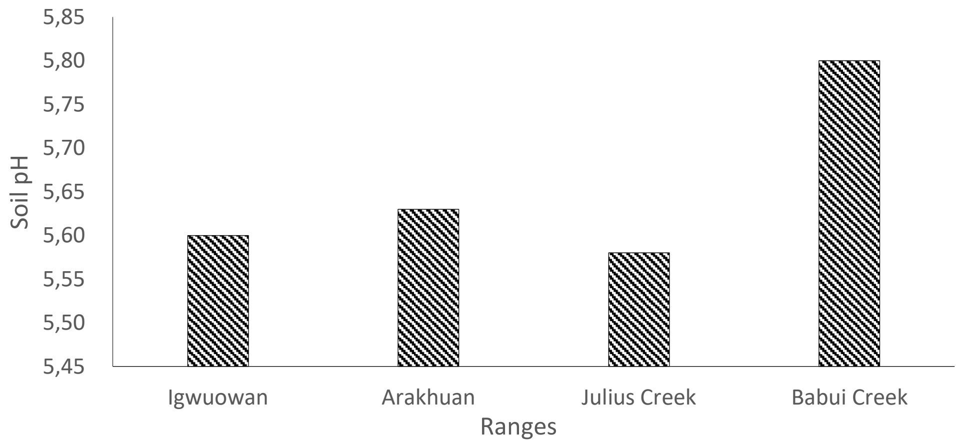

Figure 3. Average soil pH across the ranges at Okomu National Park, Nigeria

4 DISCUSSION

4.1 Abundance, Distribution, and Ecological Impact of Termite Mounds

This study investigated the abundance, distribution, and ecological impact of termite mounds in Okomu National Park, Nigeria. The termite mound density varies across different habitat ranges, with the highest mound counts observed at Arakhuan and Igwuowan ranges. Additionally, termite mound structure showed seasonal variations, with 'cylindrical mounds with covers' dominating most locations, while cathedral mounds were only recorded in Babui Creek.

The termite mounds' distribution pattern indicate that termite mounds are not randomly distributed but are influenced by habitat type and environmental conditions. Their distribution tends to cluster around decaying wood and high-humidity zones, reflecting the park's biodiversity hotspot status. Cylindrical mounds with covers were the most abundant mound type across all sites, particularly in Arakhuan (68.09%) and Igwuowan (60.47%) during the rainy season. However, Babui Creek had a higher frequency of mushroom-shaped and cathedral mounds. The mushroom-shaped mounds had higher frequency in Babui Creek (23.68%), a range that also features riparian vegetation and agricultural activities in the buffer zone, confirming that certain termite species build mounds in response to tree density and root structures (ASHTON et al., 2019). The distribution of termite mound types across ONP demonstrates that termite activity generates small-scale fertility gradients that can directly influence crop production in adjoining agricultural zones. Cylindrical mounds with covers, which dominated Arakhuan and Igwuowan ranges, are associated with enhanced concentrations of nitrogen, phosphorus, and organic matter compared with surrounding soils (DAVIES et al., 2014; AHMAD et al., 2021). These nutrient islands are particularly relevant for cassava, a crop that thrives in moderately fertile, well-drained soils. Farmers who plant cassava along mound skirts rather than within the compacted mound core can exploit these fertility patches to improve root establishment and early canopy development (LÓPEZ-HERNÁNDEZ, 2023).

A slight decline in mound abundance was observed during the dry season, particularly for 'cylindrical mounds with covers', which decreased in Babui Creek from 55.26% to 5.71%. This reduction could be linked to moisture availability, as termites are known to be more active in constructing and maintaining mounds during the wet season when soil moisture is higher (CHEN et al., 2019).

Termites are known as ecosystem engineers, influencing soil structure, nutrient cycling, and habitat formation for various organisms (OLANIYI, 2018; AKINRINOLA et al., 2022; LÓPEZ-HERNÁNDEZ, 2023). Therefore, the presence of diverse mound structures in ONP suggests that termite activity contributes to habitat heterogeneity, which in turn supports biodiversity. Study by BONACHELA et al. (2015) suggest that termite mounds enhance ecosystem resilience to climate change by stabilizing soil structure and improving water retention. The seasonal decline in mound abundance, particularly the reduction of cylindrical mounds at Babui Creek during the dry season, affirmed the sensitivity of termites to soil moisture conditions. Termite reworking improves soil aggregation and infiltration, processes that can buffer cassava against short-term drought stress during the establishment phase (WIKIFARMER, 2024). This function is particularly valuable in the derived savanna–rainforest transition zone, where rainfall distribution is increasingly erratic due to climate variability. Aligning cassava planting with the onset of the rainy season would allow farmers to capitalize on the hydrological advantages of mound-modified soils, reducing the risk of crop loss during early growth stages (CHEN et al., 2019).

This study recorded moderately acidic soil pH (5.58 - 5.80) across all study sites, which is consistent with findings from tropical ecosystems where termites prefer slightly acidic soils for mound construction (OLANIYI, 2018). The spatial variations observed suggest differences in soil chemical conditions across the locations. Several studies have documented that termite mounds act as nutrient hotspots, supporting enhanced plant growth compared to surrounding soils. In tropical ecosystems, termite activity increases nitrogen, phosphorus, and organic matter in mound soils, leading to increased plant biomass (TILAHUN et al., 2021; CHEN et al., 2023). The slightly lower soil pH indicated higher soil acidity, affirming the observed reduction in total mound structures at at Igwuowan and Julius Creek. According to Havlin et al. (2014), higher organic matter decomposition rates could result in soil acidity. Leading to fixation by aluminum and iron oxides limiting microbial activities. Measured soil pH values (5.58 - 5.80) across Okomu sites align with cassava's optimum growth range, generally considered between 5.2 and 7.0 (TILAHUN et al., 2021; NWOKORO et al., 2021). Slightly acidic soils are favorable for cassava root bulking, suggesting that natural conditions already support productive cultivation. However, localized patches with pH values below 5.5 may require modest liming to prevent growth constraints. This observation suggest the need for site-specific soil management strategies that consider both mound-enhanced fertility and background soil chemistry. Effective strategies such as planting along mound shoulders, adopting Integrated Soil Fertility Management (ISFM), and synchronizing planting with seasonal moisture availability can help farmers harness the ecological benefits of termite activity, while minimizing production risks.

For smallholders cultivating cassava in buffer zones adjacent to ONP, termite mounds represent both a resource and a risk. According to Tilahun et al. (2021), Bonachela et al. (2015) and López-Hernández (2023), they provide natural fertility hotspots that can enhance crop establishment, improve soil moisture retention, and reduce vulnerability to rainfall variability. However, high termite populations associated with larger mounds or dry season foraging behavior can directly damage cassava stems and storage roots, leading to stand losses and reduced yields (AHMAD et al., 2021). Mitigating strategies for risk aversion would include the following: (i) planting cassava cuttings along mound shoulders rather than mound tops; (ii) synchronizing planting with the onset of reliable rains; (iii) applying ISFM practices to strengthen plant resilience; and (iv) recycling biomass and organic matter across fields to distribute the fertility benefits of mound soils without degrading mound structures. These strategies would enable farmers to leverage the ecological services of termites while minimizing associated production risks.

4.2 Implications for Cassava Management Near Okomu.

Termite mound structures support various plant species, create microhabitats for other organisms, and improve soil aeration and water retention (BONACHELA et al., 2015; TILAHUN et al., 2021; LÓPEZ-

HERNÁNDEZ, 2023). However, according to Ashton et al. (2019) and Olaniyi (2018) reports, external factors such as habitat fragmentation, deforestation, and seasonal climatic changes significantly influence termite populations and mound distribution. The decline in mound density during the dry season indicates that moisture availability plays a crucial role in termite colony establishment and growth (CHEN et al., 2019). Future research should further explore the interactions between termite mound characteristics, soil properties, and plant biodiversity to develop comprehensive conservation and land management policies. In addition, field trials should compare cassava growth and yield at varying distances from mounds (AHMAD et al., 2021) The monitoring of termite foraging pressure across wet and dry seasons should be considered.

5. CONCLUSIONS

This study provided a comprehensive assessment of termite mound diversity, distribution patterns, and structural characteristics within Okomu National Park. The results revealed considerable variations in mound structures across different ranges and seasons. The cylindrical mounds with covers were the most dominant structure, particularly in Arakhuan and Igwuowan ranges, whle cathedral and mushroom-shaped mound structures' were prevalent in Babui Creek. Mound abundance and dimensions were generally higher during the rainy season reflects the influence of moisture availability on termite foraging activities. The observed have direct implications for agricultural activities in adjacent buffer zones, where landscapes are strongly influenced by termite activity. Termite mounds function as important ecological assets by creating nutrient-rich patches and enhancing soil heterogeneity in a moderately acidic environment suitable for cassava cultivation. For resource-constrained smallholder farmers in these zones, termite mounds present both opportunities and challenges. To optimize these opportunities, farmers could adopt strategic site-specific management practices. The integration of mound-enhanced fertility such as planting along mound shoulders, synchronizing planting time with the rainy season, and adopting Integrated Soil Fertility Management can help harness the benefits of termite activity, while minimizing crop damage. These results provide baseline data for park conservation and-resilient farming in Nigeria's rainforest-savanna transition.

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