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Tropical Floristics Extinction, Causes and Diversity Composition of Non-Timber Forest Products (NTFPs) in Kazaure Emirate, Jigawa State Nigeria

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Abstract: *The study looked into the extinction of tropical tree species and the composition of non-timber forest products (NTFPs) in the emirate of Kazaure. Because of the rapid growth of the human population, trees and their products are vulnerable to human encroachment, which can lead to the destruction of natural habitats. An oral interview was also conducted, and the results indicated that 81.2% of the respondent were males, with farming occupations of 55.8% and age ranging from (46-60) recorded with 62.3%. A total of forty species (40) belonging to twenty-three (23) families and thirty-two (32) genera were recorded extinct, and the major causes of their extinction were farming expansion with 33.1%, fuel wood collection with 31.8%, medicine with 22.7%, urbanization with 7.8%, and climate variability with 4.5%. Data on the composition of NTFPs were analyzed using the Simpson index and descriptive statistics. Eighteen (18) products were found, with Gwiwa having the highest Simpson diversity index (D- 0.955), followed by Roni (D- 0.948), Yankwashi (D- 0.942), and Kazaure (D- 0.905). Environmental education and competent law enforcement are the primary approaches for restoring diversity and preventing the extinction of tropical trees and NTFPs in the emirate.*

Keywords: Tropical tree species, Extinction, Causes, Diversity, Composition, NTFPs and Kazaure emirate

I. INTRODUCTION

Tropical trees contribute to the livelihoods of communities by supplying a variety of items such as food, firewood, timber, medicine, and other functions including soil protection and water catchment (Bibianne et al., 2023). However, many parklands are vulnerable to human invasion due to the rapid rise of the human population, resulting in the degradation of natural habitats. Habitat loss endangers plant species' existence, particularly those that are endemic, sensitive, or endangered, necessitating mitigation actions to prevent extinction (Gonçalves-Souza et al., 2020). Approximately 20% of the world's plant population is under threat of extinction, with the majority of these species found in the tropics and woodlands (Razgour et al., 2020). Tropical trees support a vast range of vegetation and wildlife. Furthermore, they play an important role in climate regulation while providing a living for millions of people. In Nigeria, the use of trees and non-timber forest products affects people of all economic levels and livelihoods. Households typically use trees for firewood and charcoal to replace kerosene, whereas poor households use trees and NTFPs for medication, feed, and to sell for profit. The majority of NTFPs are harvested for subsistence, resulting in overexploitation and destruction of tropical tree species (FAO, 2018).

Non-timber forest products (NTFPs) emerged as a catchall term for products derived from various forest resources (Saka et al., 2020). Non-timber forest products are plants and/or forest products that are valuable for purposes other than timber. They have been defined as all biological materials of plant and animal origin other than wood extracted from forests for human use and primarily processed technologically (Ibrahim et al., 2016). Non-timber forest products are useful substances, materials, or commodities extracted from forests that do not require tree harvesting (FAO, 2018). More than two billion people worldwide live in forests and rely on forest resources for subsistence, income, and livelihood security (Ahenkan and Boon, 2011; Chepkoech, et- al, 2023).

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Islam (2017) defined NTFPs as forest-derived items other than timber. Extracting and collecting NTFPs, whether in part or completely, will have an impact on the ecology and environment of a particular ecosystem (Bista and Edward, 2006). According to the World Health Organization, around 80% of developing-country populations rely on non-timber forest products to meet their health and nutritional requirements. Non-timber forest products also provide numerous prospects for improving rural development and living standards (Ajake and Enang, 2012; Islam et al., 2013). Non-timber forest products are widely used across the tropics, frequently giving critical resources to individuals in areas where the state does not provide other forms of social security. (Ghosal, Z 2011).

II. MATERIALS AND METHODS

The Study Area

Kazaure emirates comprises of four local government areas i.eKazaure, Gwiwa ,Roni and Yankwashi and the head quarter is in the ancient city of Kazaure situated in Jigawa State of north-western Nigeria (Coordinate of Latitude $12^0 39'10''N'8^0$ 24' 43'' E and longitude $8^0 41'94''E$ $12^0 65'27''N$ with a population of approximately 500, 000. It falls within the Sudan Savannah zone NPC 2006. The minimum and maximum temperature ranges from 15.85°C and 42°C and fall as low as 10°C during the Hamatan season between December and January. The emirates has two seasons: rainy and dry Seasons. Temperatures during the Dry Season can be as high as 42°C except in December and January when temperature could be as low as 15°C, and average temperature in the rainy season is 25°C. Annual rainfall ranges from 500mm to 1,200mm SOA, (2024). The people of the emirates are predominantly farmers who engage themselves in both rainy and dry season farming (irrigation). Kazaure has total area of 690sq mi (1,780km^2). Abdullahi*et al.,* (2016).

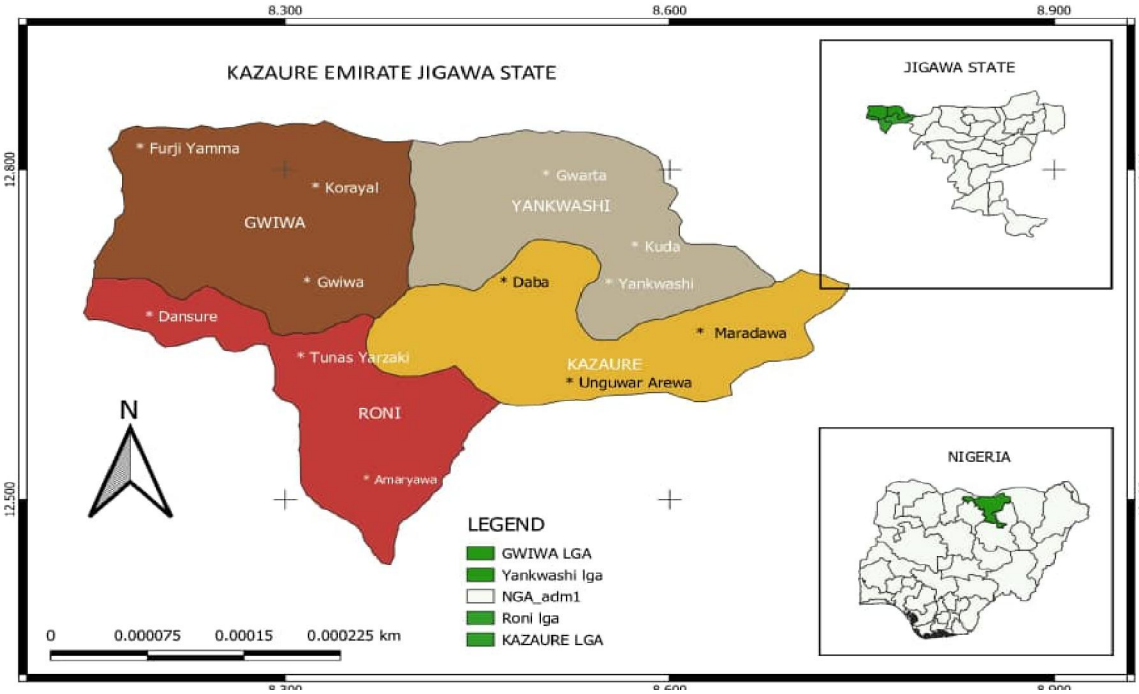

Figure 1: Map of the study area.

Source: GIS Laboratory, Urban & Regional Planning Department, HAFEDPOLY, Kazaure, (2024)

Sampling Procedures

Reconnaissance survey was made in the emirate councils, catchment areas were identified. Stratify sampling method was adopted for the study according to existing local government areas (LGAs) viz Kazaure, Gwiwa, Roni and Yankwashi. One hundred and eighty (180) questionnaires was used, forty-five (45) each distributed to every LGA in

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three randomly selected locations from each LGAs. Oral interview was also conducted. Data collected was effectively use with clear expression and recorded for further analysis.

III. Data Analysis

The checklist of theextinct tropical Tree species diversity was presented and causes of their extinction in the study areas in a tabular form and graph.

Simpson diversity index was employed to assessing the compositions of non- timber forest products (NTFPs) in the study areas.

Simpson index $D = 1 - \left(\frac{\sum n(n-1)}{N(N-1)}\right)$

D = Diversity index

Where n = total number of organism of a particular species,

N = the total number of organisms of all species Saka et-al, (2020).

The widely use NTFPs were also presented in a chart respectively.

IV. RESULTS

Table 1: Tropical floristic diversity and possible causes of their extinction in kazaure emirate

S/N	Scientific Name	Family	Local name(hausa)	Possible causes of their extinction
1.	*Adansonia digitate*	*Malvaceae*	Kuka	Extensive exploitation for food, feeds and medicinal Uses.
2	*Anogeissuslieocarpus*	*Combretaceae*	Marke	Exploitation for construction, fuelwood implements production such as pestle and mortar and poor coppicing capacity of the species
3.	*Balaniteaegyptiaca*	*Zygophyllaceae*	Aduwa	Overexploitation for medicine and implement production such as woody handles of different local tools and livestock feeds.
4.	*Borassusaethiopum*	*Arecaceae*	Giginya	As construction, fuel wood, local roofing materials and fruits is utilized as food and livestock feed
5.	*Boswelliaodorata*	*Burseraceae*	Hano	Overexploitation for traditional medicine, fuelwood and implement production such as mortar, charcoal production and poor coppicing capacity.
6.	*Cassia singuena*	*Fabaceae*	Runhu	Destruction of the plant reduces it capacity and they are critically endangered species.
7.	*Celosia argentea*	*Amaranthaceae*	Rimi	The species had long gestation period, but overexploitation may lead to disappearance.
8.	*Combretumglutinosum*	*Combretaceae*	Tarauniya	Agricultural exploitation
9.	*Combretummicranthum*	*Dioscoreaceae*	Geza	Overexploitation coupled with the fact that the plant is implements production such baskets for storage of agricultural products
10.	*Deuterium microcarpum*	*Fabaceae*	Taura	They are critically endangered

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				species. More pressure are mounted on this species.
11.	*Diospyrosmespiliformis*	*Ebenaceae*	Kanya	Overexploitation for medicinal, fuelwood and other purposes like Charcoal production and poor coppicing capacity.
12.	*Faidhebiaalbida*	*Fabaceae*	Gawo	Farming and Urbanization in the area over the years help in their disappearance because they cannot withstand the environmental stresses.
13.	*Ficuspolita*	*Moraceae*	Durumi	Over exploitation for Agricultural expansion and climate variability may be the reason for it disappearance.
14.	*Ficusptatyphylla*	*Moraceae*	Gamji	Overexploitation for medicinal and other uses.
15.	*Ficussycomorus*	*Moraceae*	Ɓaure	Extensive exploitation for medicinal Uses and Agricultural expansion
16.	*Ficusthonningii*	*Moraceae*	Cheediya	The plant cannot withstand changes in the environment in terms of climate variability.
17.	*Ficusvallis- choude*	*Moraceae*	Lubiya	It is habitat specific, it is found in moist places like riverbank, over exploitation reduces it capacity.
18.	*Gardenia aqualla*	*Rubiaceae*	Gaudɛ̀	Due to expansion of economic activities like road construction and other infrastructural development, we lose them
19.	*Guierasenegalensis*	*Combretaceae*	Sabara	They are critically endangered species. More pressure are mounted on this species for medicinal purposes.
20.	*Hippocrateaguineensis*	*Celastraceae*	Gwadàyi	The plant cannot withstand changes in the environment in terms of climate variability and has a poor coppicing capacity
21.	*Hyphaenethebaica*	*Arecaceae*	Goruba	Destruction of the plant reduces it capacity
22.	*Khayasenegalensis*	*Maliaceae*	Madachi	Use for medicinal and lack of available seeds of the species within the study location
23.	*Lanneamicrocarpa*	*Anacardiaceae*	Faru	Agricultural exploitation
24.	*Neocaryamacrocapum*	*Chrysobalanaceae*	Gawasa	Overexploitation coupled with the fact that the plant are critically endangered.
25.	*Parkiabiglobosa*	*Fabaceae*	Ɗorowa	As fuel wood, roofing materials, for preparation of local food, medicinal and livestock feeds
26.	*Parkiasoniaacculeata*	*Fabaceae*	Sharannabi	Due to the poisonous substance in the latex people arbore this plant because

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				of certain superstition and suspicion
27.	*Paulliniapinnata*	*Lauraceae*	Farundaula	Climate variability in the area over the years help in their disappearance because they cannot withstand the environmental stresses.
28.	*Pericopsislaxiflora*	*Fabaceae*	Makarho	Exploitation for construction and implements production such as pestle and mortar and poor coppicing capacity.
29.	*Piliotigmarecticulatum*	*Leguminosaceae*	Kalgo	Due to expansion of economic activities like road construction and other infrastructural development we loss them.
30.	*ProsopisAfricana*	*Leguminasae*	Kirya	As fuel wood, medicinal, local roofing materials, fruits is utilized as food and as livestock feeds, it has a poor copping capacity.
31.	*Pterocarpuserinaceus*	*Fabaceae*	Madobiya	Exploitation for construction and implements production such making rope, medicinal and for preparation of food, livestock feed
32.	*Securidacalongepedunculata*	*Polygalceae*	Sanya	Due to the poisonous substance in the latex people arbore this plant because of certain superstition and suspicion.
33.	*Sterculiasetigera*	*Sterculiaceae*	Kukkuki	They are critically endangered species. More pressure are mounted on this species.
34.	*Strychnos spinose*	*Loganiaceae*	Koƙiya	As fuel wood, making rope, medicinal and for preparation of food, livestock feed
35.	*Tamarindusindica*	*Fabaceae*	Tsamiya	As fuel wood, roofing materials, for preparation of fermented local food, medicinal and livestock feeds.
36.	*Terminalia macroptera*	*Combretaceae*	Kandare	The species had long gestation period, but overexploitation may lead to disappearance
37.	*Vitellaria paradox*	*Sapotaceae*	Kaɗanya	Urbanization, medicine and fruits is utilized as food and as livestock feed
38.	*Vitexdoniana*	*Verbenaceae*	Dinya	Over exploitation, for firewood and charcoal production may be the reason for it disappearance and species haven a poor coppicing capacity.
39.	*Ziziphusmauritiania*	*Rhmnaceae*	Magarya	As fuel wood, medicinal and for preparation of food, livestock feed
40.	*Ziziphusspinsa- Christi*	*Rhamnaceae*	Kurna	As fuel wood, medicinal and for preparation of food, livestock feed

Source: Field survey 2024

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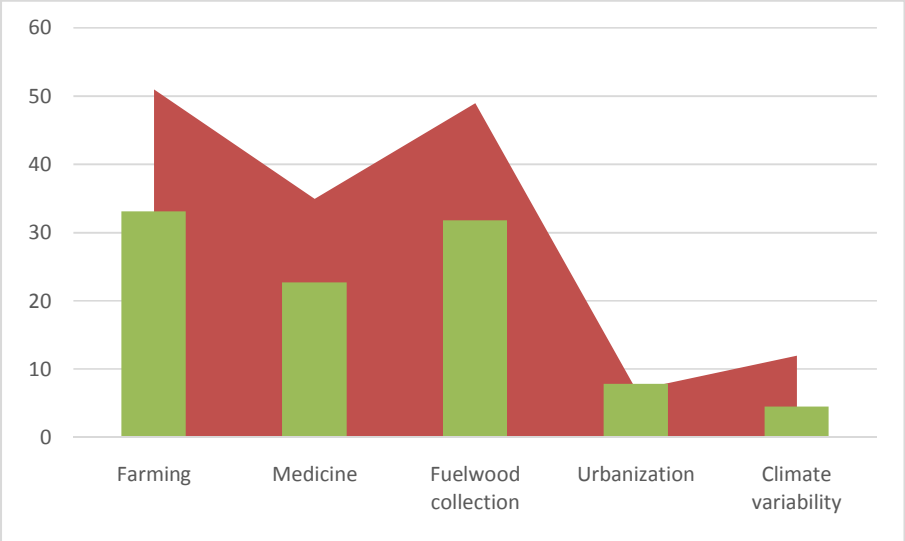

Figure 2: Possible causes of tropical tree species extinction

Table 2: Diversity and composition of the Non-timber forest products in kazaureemirate

S/No	Products	No of products Kazaure	n(n-1)	No of products Gwiwa	n(n-1)	No of products Roni	n(n-1)	No of product Yankwashi	n(n-1)
1.	Dry leaves	20	380	07	42	10	90	00	00
2	Bark powder	14	12	18	306	23	506	11	110
3.	Dry Root	10	90	12	132	29	812	00	00
4.	Fibre	11	110	37	1,332	20	380	14	182
5.	Stems	05	20	20	380	21	420	04	12
6.	Fruits	06	06	15	210	16	240	06	30
7.	Bamboo	02	02	13	156	00	00	09	72
8.	Honey	00	00	00	00	13	156	16	240
9.	Dry Barks	07	42	16	240	32	992	33	1,056
10.	Resin	00	00	00	00	00	00	08	56
11.	Vegetables	00	00	07	42	08	56	16	240
12.	Fresh roots	05	20	13	156	16	240	13	156
13.	Bones of wildlife	11	110	29	812	16	240	09	72
14.	leaves powder	16	240	25	600	20	380	12	132
15.	Seeds	00	00	16	240	36	1,260	06	30
16.	Vegetable oil	01	00	06	30	15	210	11	110
17.	Bush meat	05	20	02	02	30	870	05	20
18.	Dry skin of wild animals	14	182	07	42	14	182	32	992
Total		**117**	**1,234**	**243**	**4,722**	**319**	**7,034**	**205**	**3,510**
Diversity Index		**0.905**		**0.948**		**0.955**		**0.942**	

Source: Field survey 2024

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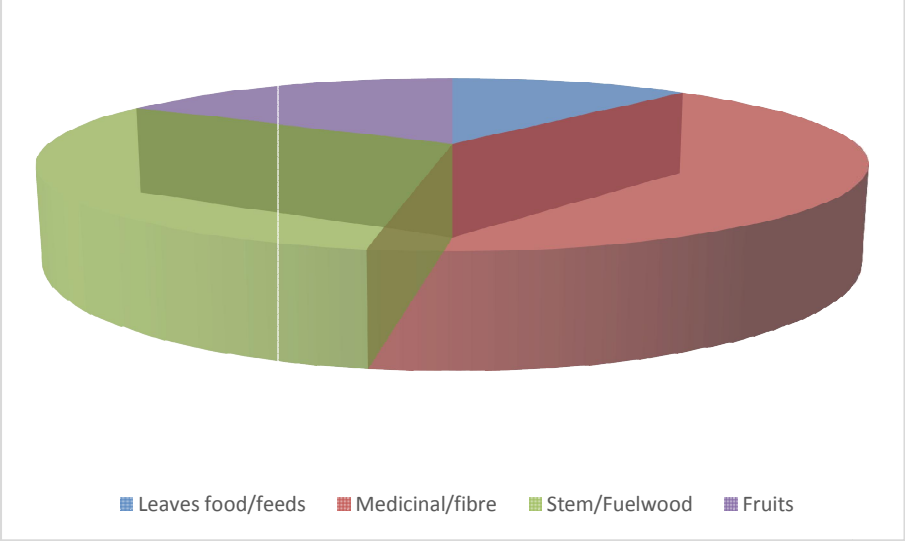

Figure 3: The widely used Non-timber forest products (NTFPs) in the study areas

V. DISCUSSION

Diversity provide vital information regarding the composition and extinction status of floristic species. Trees and their products are prone to human invasion due to the rapid rise of the human population, leading to deforestation and the destruction of natural habitats. Findings on tropical tree species diversity and extinction revealed that the Kazaure emirates has a large diversity of tropical/indigenous tree species, with a total of forty (40) species belonging to twenty-three (23) families and thirty-two (32) genera recorded, along with scientific and local names for each species, as shown in table 1. The findings also revealed that farming was the leading cause of their potential extinction at 33.1%, followed by fuelwood collection at 31.8%, medicine at 22.7%, and climate variability at 4.5%, as shown in (table 1 and figure 2), respectively. According to the oral interview, respondents also stated that overexploitation of tropical trees through pruning/shading leads to their extinction, despite the fact that they all know that the species of the study areas have very poor coppicing capacity and insufficient seeds for regeneration. This could be due to population growth in the emirate, which leads to rises in their demands on the species for their livelihood and economic activities such fuelwood collecting, farming, road construction, and other infrastructural development, and this contributes to the extinction.

However, many tree species are prone to human encroachment due to the rapid growth of human population, leading to deforestation and the destruction of natural habitats. This study is in line with Bibianne et al, (2023) in their recent research on plant species composition, abundance, diversity, and threats affecting their survival, and Gonçalves-Souza et al, (2020) in their finding on habitat loss, extinction predictability, and conservation efforts in the terrestrial ecosystem.

According to the study conducted across the emirate, approximately 96.7% of respondents are aware of NTFPs, and 89% of the people in the emirate use the products in various ways. The major NTFPs are leaves (33.1%), fruits (31.8%), bark (22.7%), roots (7.8%), and fiber (4.5%), as shown in (Figure 3). The diverse composition of NTFPs also demonstrated that the emirate has a wide range of the products, with eighteen (18) detected. The diversity was great throughout the emirate's four local government areas; namely Kazaure, Gwiwa, Roni, and Yankwashi, were disproportionately distributed among NTFPs, across the LGAs indicates that Gwiwa had the highest Simpson diversity index of D- 0.955, followed by Roni D- 0.948, Yankwashi D- 0.942, and Kazaure D- 0.905, as shown in (table 2). As per Aramde et al. (2017)The value of D runs from 0 to 1, with 0 signifying considerable diversity and 1 representing no diversity. The lower the value of D, the greater the abundance diversity. This finding indicates that the emirate is diverse in terms of NTFPs because the diversity of all habitats spans between 0.905 and 0.955. Perhaps the even distribution of non-timber forest products contributed to a uniform habitat structure in the research locations. This is

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consistent with the findings of Saka et al. (2020), who reported diversity values of (94, 1464, D-0.981), (63, 842, D-0.970), and (60, 805, D-0.969) with a similarity index of 78.5%. Suraj (2016) also reported that the Simpson of diversity index among the three different sites were 0.988 (Control site3), 0.328 (Site 1), and 0.213 (Site 2), indicating that (Site3) has higher diversity values than Sites 1 and 2.

VI. CONCLUSION

Many researchers have revealed the exploration of tropical floristic extinction and the composition of NTFPs. The preceding study shows that an increase in human population and poverty creates a high demand for insufficient renewable resources such as trees in the savannah region. Overreliance on this resource (topical trees) has resulted in the extinction of several important species, including *Tamarindusindica, Adansoniadigitata, Parkiabiglobosa, Vitellariaparadoxa, Hyphaenethebaica, Farderbiaalbida, Khayasenegalensis*, and *Borassusaethiopica*. Environmental education and proper law enforcement are the preferred methods for restoring NTFPs and endangered tree species and preventing their extinction.

Conflict of Interests

The authors have not declared any conflict of interest.

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