Conserving Traditional Medicinal Plants amidst Deforestation: Insights from Fakai, Nigeria

Abstract

Deforestation and vegetation loss can trigger various environmental issues, including climate change, desertification, soil erosion, reduced crop yields, loss of vegetation cover, flooding, and other related problems. The study was conducted to examine the impact of deforestation on traditional medicinal plants in the Fakai local government area of Kebbi state. Two out of four districts in Fakai were chosen for their relevance to the study. Data was gathered through questionnaires and in-depth interviews and subsequently analyzed using frequency counts, percentages, and charts. The research findings showed that diverse plant species and their parts have been used to treat various ailments since timeimmaterial. Additionally, it was discovered that deforestation poses a significant threat to plants, particularly traditional medicinal plants in treatingmultiplediseases. This threat stems from the community's ongoing tree felling for commercial wood fuel harvesting, charcoal production, and bush burning to expand agricultural lands. The study also revealed that measures to curb deforestation were either non-existent or ineffective. The research concluded that while most of the studied community relies on traditional plants for treating health-related issues, human activities are detrimental to this practice, and there is a lack of stringent measures to address deforestation. The study recommends implementing community-based conservation efforts and promoting alternative energy sources to curb deforestation. Other interventions may include seedlings provision, poverty eradication, and legal action against illegal logging to ensure the sustainable use of medicinal plants.

Keywords: *Charcoal, Deforestation, Environment,Medicinal, Plants, Traditional*

INTRODUCTION

Deforestation is a major issue in developing nations due to its adverse effects, including biodiversity loss and increased greenhouse gas emissions. Trees, which are ancient, dependable, and versatile raw materials, are vital for oxygen production and carbon dioxide absorption (Angelsen, 2006). Forests cover 30% of the Earth's land area, approximately 3.9 billion hectares, down from an estimated original coverage of six billion hectares. Tropical forests, in particular, occupy only 6% of the planet's land surface (World Health Organization, 2015). It is believed that trees harbor between 70% and 90% of all species worldwide. The loss of forests has resulted in the daily extinction of 50 to 100 plant and animal species, many of which are crucial for human well-being, especially in medicine (FAO, 2005).

The growing pressure on forest resources negatively impacts tree species density and diversity, as well as wildlife populations. This leads to environmental imbalances, including forest degradation, biodiversity reduction, soil erosion, alterations in nutrient cycles, and greenhouse gas emissions (Yusuf, 2013). Abdul (2010) observed that population growth in Jema'a local government, coupled with rising energy and food demands, has intensified woodfuel harvesting. This threatens the sustainability of the woodfuel supply as vegetation removal surpasses its regeneration rate.

In developing countries, the widespread demand for medicinal plants has been met through uncontrolled harvesting of wild flora, including those in forests. This over-exploitation has led to the extinction, endangerment, or threat to many species. Such indiscriminate use has been ongoing for decades in developing nations, raising conservation concerns for these valuable plants (World Health Organization, 2014). Population growth in these countries has placed excessive pressure on commonly used medicinal plants and natural resources. As the market for medicinal plant products expands, wild populations continue to decline (Oladele *et al.,* 2008). A study by Rahman *et al.* (2022) identifies 134 species of medicinal plants utilized by communities living in the forests of southeastern Bangladesh. The research highlights these communities' dependence on such plants for traditional medical care while also addressing the importance of sustainable harvesting methods and conservation efforts. Agnes (2021) found out that the sustainable use of traditional plants as medicine is influenced by taboos, seasonal and societal limitations on harvesting, and adherence to principles on the collection of medicinal plants.

In Nigerian, healthcare has long combined traditional medicine, which boasts the use of indigenous plants to treat various health conditions (Ajewole, 2024). Indigenous healing methods, deeply embedded in cultural traditions, form the basis of traditional medicine. These

practices play a crucial role in meeting healthcare needs, particularly in rural areas with limited access to modern medical facilities (Michael, *et al.,* 2024). While these traditional approaches hold great cultural significance, they face ongoing challenges related to their safety and effectiveness. Additionally, there is a pressing need for regulatory improvements to govern these practices more effectively. Many communities place significant importance on cultural relevance, regarding traditional healers as crucial providers of healthcare services (Modibbo*et al.,* 2024). The significance of plants is becoming increasingly evident in today's threatened environment. Consequently, this study will concentrate on how deforestation affects traditional medicinal plants, given the persistent forest loss and growing interest in plant-based remedies in the region.

MATERIALS AND METHODS

Study Area

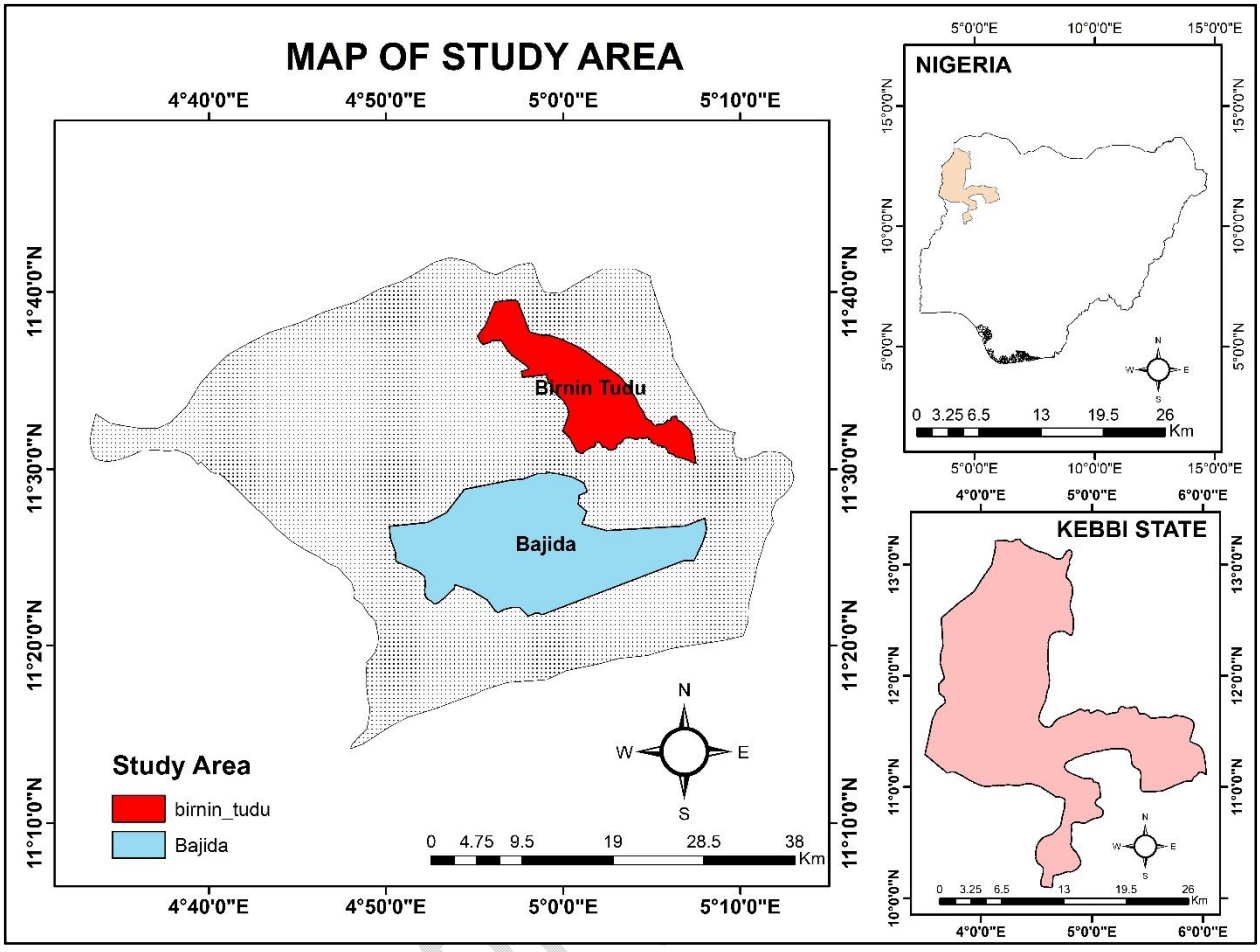
Fakai Local Government has a total land area of 2,247km2 and it is geographically located in the South-Eastern part of Kebbi State, between longitudes 4°30'E and 5°10'E of the prime meridian and latitudes 11°10'N and 11°40'N of the equator. It shares boundaries with Zuru and Danko Local Governments to the East, Koko, and Shanga Local Governments to the West, while Kebbe Local Government Area of Sokoto State to the North, and the Rijau Local Government of Niger State to the South. Fakai has a population of about 121,212 at the 2006 census (National Population Commission, 2006). (KBSG, 2008).

Rainfall in the arealasts for about four to five months annually, mostly starting from May and lastinguntil October with the heaviest rainfall in August (Abubakar *et al.,* 2020). The length of the rainy season as well as the amount of rainfall are noted to decrease, northwards from the

southern part of Kebbi State. The soils are subject to stripping by erosion as a result of topographic characteristics typical of the area. Soil is rich in nutrients which makes it suitable for agriculture (KBSG, 2008).

The vegetation is Sudan savanna, which consists of an almost continuous grass cover of not less than one meter in height (Udu, 1991), with abundant shrubs when compared to the northern part of Kebbi State which has less vegetation cover. Trees appear green in the rainy season but shed their leaves in the dry season. While grasses turn brown, both the grasses and trees have many ways of adapting themselves to the environment. Examples of such trees are *Lanneaacida, Dichrostachyscinera, Pilostigmareticulatum, Butyrospermum paradox, Diospyros mespiliformis, Danielliaoliveri, Khaya senegalensis, Acacia senegalensis, Parkiabiglobosa, Vitellaria paradoxa, Adansoniadigitata and Balanitesaegyptiaca* etc. (KBSG, 2008).

The major economic activities in Birnin Tudu and Bajida are farming and rearing of animals. The people of these communities are often referred to as “passionately devoted to soil and crop” farmers.



Source: Cartography Lab Department of Geography BUK (2024)
Figure 1: *The map of Fakai Local government showing study areas.*

Data Collection and Analysis

This research is a field survey thatinvolves Questionnaire Administration and In-Depth Interviews. The preliminary fieldwork of this research found out that the Fakai local government area constitutes four districts but only Birnin Tudu and Bajida were selected for this study. The sampling was drawn from the selected districts of the study. A total of hundred respondents was drawn, fifty from each district. A questionnaire was administered to 100 respondents in the study area. The purposive sampling technique has been used in selecting the respondents. An interview was conducted with the Village heads, Farmers, Traditional healers, and Charcoal producers.

Theyhave provided adequate knowledge of their environment and detailed information on the effect of deforestation on traditionally used plants and also validated the information acquired from the use of questionnaires.

The information generated using a questionnaire was tabulated and descriptive statistics such as frequency counts, and percentages were used to analyzevariables of interest.

RESULTS:

A hundred questionnaires (100) have been randomly distributed. Eighty-two (82) out of one hundred which represented 82% have been completed and returned while unfortunately 18% of the total questionnaires distributed were not returned due to one reason or the other. Key informant Interviews were conducted.

Table 1: Demographic Characteristics of Respondents

Variable	Category	Frequency	Percentage
a. Gender	Male	52	63.4%
	Female	30	36.6%
Total	**82**	**100%**	
b. Age Range	18-25	07	8.54%
	26-35	13	15.85%
	36-45	17	20.73%
	46-55	23	28.05%
	56-Above	22	26.83%
Total	**82**	**100%**	
c. Religion	Islam	61	74.4%
	Christians	07	8.5%
	Traditional	13	15.9%
	Others	01	1.2%
Total	**82**	**100%**	
d. Occupation	Civil servant	12	14.6%
Housewife	17	20.7%	
	Farmer	45	54.9%
	Business	08	9.8%
	Total	**82**	**100%**
e. Level of	Primary	23	28%
Education	Secondary	15	18.3%
	Tertiary	12	14.6%
	None	32	39.1%
	Total	**82**	**100%**

Source: Fieldwork, 2024

The above table shows the demographic variables of the respondents which include; gender, age, religion, occupation, and level of education. Table 1 item "a" which is gender shows that 52

representing 63.4% are male while 30 representing 36.6% are female. Item "b" on the table is the age of the respondents where most of the respondents (23) are between the ages of 46-55 representing 28.05%, and those between the ages of 18-25 havea frequency of 07 (8.54%) followed by those within the range of 26-35 having a frequency of 13 (15.85%) followed by those within the range of 36-45 having the frequency of 17 (20.73%) while those having the frequency of 22 (26.83%) are of 56 and above years are the second highest respondents.

Item "c" on the table shows the religion of the respondents which indicates that most of the respondents are Muslims having a frequency of 61 (74.4%), Christians have a frequency of 7 (8.5%), Traditionalists have a frequency of 13 (15.9%) while Others have the frequency of 1 (1.2%). Item "d" shows the occupation status of the respondents where 12 (14.6%) are Civil servants, 17 (20.7%) are Housewives, 45 (54.9%) are Farmers and 8 (9.8%) are Business people.

The item "e" indicates the educational level of the respondents, in which primary has 23 (28.0%), secondary has 15 (18.3%) tertiary has 12 (14.6%) and those that didn't attend school have 32 (39.1%).

Table 2: Plant Types and Parts used in treating various Ailments.

Ailment/Disease Treatment	**Species Names**	**Local Names**	**Part used**
High blood pressure, skin lesions, toothache, skin diseases	*Mangiferaindica*	Mango	Leaves, bark, roots
Elephantiasis, leprosy	*Calastropisprocera*	Tumfafiya	Leaves, root latex
Cancer, skin diseases,	*Guiera senegalensis*	Sabara	Whole plant

postnatal birth			
Urinary disorder, snake venom	*Boswellia dalzielli*	Hano	Bark, roots
High blood pressure, stomach disorder, diabetes, malaria, typhoid fever, rashes	*Vernonia amygdalina*	Bitter leaf	Whole part
Rheumatism, malaria fever	*Psidium guajava*	Guava	Leaves
Skin diseases	*Anogeissuslelocarpus*	Marike	Bark, leaves, seed
Gonorrhoea, syphilis, mental disorder, pile, fever	*Carica papaya*	Gwanda	Leaves, fruits, seeds
Arthritis, pile, diarrhea, dysentery, malaria	*Khaya senegalensis*	Mahogany	Leaves, bark
Fungal diseases	*Cucumis melo*	Burji	Leaves, root
Tapeworms	*Cucurbita maxima*	Kabewa	Fruits, seeds
Menstrual disorder, Gonorrhoea	*Cochlospermumplanchorii*	Rawaya	Stem, bark, roots
Turbacuulosis, yellow fever, cough	*Acanthospermumhispidum*	Kashinyawo	Whole plant
Stimulant, syphilis	*Ambrosia maritime*	Makarfo	Whole plant
Skin rashes, cleaning	*Aspilla Africana*	Kalankuwa	Flower, leaves

sores			
Skin diseases, yellow fever	*Balanitesaegyptiaca*	Aduwa	Fruits, stems, roots, bark
Smallpox, stimulant	*Aframomunmelegueta*	Citta	Seeds, leaves
Fever	*Lantana camara*	Kimba	Leaves
Ease labour, boils, fever	*Grewiavenusta*	Dargaza	Bark, leaves, stem
Nasal decongestion, fever	*Butyrospermumparadoxum*	Kadanya, kade	Seeds, leaves
Colds, antipyretic	*Citrus limon*	Lemu	Whole plant
Jaundice, malaria, syphilis	*Azadiractaindica*	Dogon yaro, delbejiya	Leaves, bark, seeds, stem
Inflammatory diseases, paralysis, asthma, sexual desire, Diabetes, blood tonic	*Moringa oleifera*	Zogale	Whole plant
Blood tonics, lung diseases	*Cissampelosowariensis*	Damargaji	Whole plant
Cough, diuretics, dressing wounds	*Hibiscus sabdariffa*	Sobo (Red millet)	Flowers, leaves
Diuretic, cough	*Allium cepa*	Albasa	Leaves, bulbs
Toothache, skin diseases, fungal infections, wound cut	*Acacia nilotica*	Bagaruwa	Bark, fruit, leaves

Obesity, diabetes, tonic, mental disorders	*Parkiabiglobosa*	Doruwa	Whole plant
Dysentery, fever	*Bauhinia caesalphiniaceae*	Jinga	Root
Newborn skin management	*Lycopodium cemuum*	Kuje-kuje	Whole plant
Skin diseases, jaundice	*Lawsoniainermis*	Lalle	Flowers, bark, leaves
Ulcer, wounds	*Detaruynnucricaroyn*	Taura	Leaves, bark
Piles, night blindness, gonorrhoea	*Albiziaadiarthifolia*	Tsintsiyarkurmi	Bark
Cough, the shape of the breast, asthma	*Euphorbia hirta*	Nononkurciya	Whole plant
Malaria fever, typhoid fever	*Cassia occidentalis*	Sanga-sanga	Whole plant
Malaria and typhoid fever	*Eucalyptus camaldulensis*	Tulare	Leaves
Dysentery, measles	*Vitex doniana*	Dunya	Leaves, roots, fruit
Mouth ulcers, wounds	*Prosopis Africana*	Kiriya	Stem, bark
Dysentery, blood tonic	*Khaya ivoreansis*	Gawo	Stem, bark
Wound, liver disorder, venereal diseases, scurvy	*Ziziphusmauritiana, Ziziphusabyssinica*	Magarya	Bark, leaves, fruit
Skin cancer,	*Tamarindusindica*	Tsamiya	Leaves, seeds

stomachache, dysentery, cough			
Typhoid, malaria, chicken pox, cancer	*Jatropha curcas*	Chini da zugu	Leaves, root
Whitlow, measles	*Solanum nigrum*	Gautankaji	Whole plant
Miscarriage, menstrual disorder	*Leptadania hastate*	Yadiya	Latex, leaves, root

Source: Fieldwork, 2024

The above table indicates that certain ailments are treated with plant parts ranging from roots, stems, latex, leaves, fruit, and flowers. Some of the plants are used independently, while some illnesses require mixtures and combinations of other plants. 73 (89%) of the study population asserted that most of the plants are used in the treatment of more than one illness, as shown in the table above. The interview complemented this result as it attested that these plants have proven effective in treating many diseases.

Table 3: Availability of Traditional Medicinal Plants in the Study Area

S/N	Variable	Response	Percentage
1	Yes	17	20.7%
2	No	65	79.3%
	Total	**82**	**100%**

Source: Fieldwork, 2024

The above table indicates that deforestation has affected most of the medicinal plants in the study area. 65 (79.3%) of the responses confirmed that traditional medicinal plants are no longer in

abundance, while 17 (20.7%) said that some traditional medicinal plants are still available in their area.

Table 4: Traditional Medicinal Plants that are no longer in Abundance in the StudyArea.

PLANTS NAME	MEDICINAL USE
Acacia albida, Anogeissusleiocarpus, Burji, Eucalyptus tereticornis,	Malaria fever, Typhoid fever, Ulcer, Headache, convulsion
Adina microcephala, Fiscus platyphylla,	Pile, dysentery, diarrhea, stomach ache, Fever
Guiera senegalensis, Tamarindusindica, Ziziphusabyssinica	Skin diseases, post-natal birth, cancer
Boswellia dalzielii	Stomachache, skin rashes
Prosopis Africana	Mouth odour, toothache

Source: Fieldwork, 2024

75 (91%) of the study population postulated that these plants are no longer in abundance or are on the verge of extinction. It also indicates that soon there will be no plants to treat some illnesses as some species are no longer proximate to the community.

Table 5: Life without Traditional Medicinal Plants

S/N	Variable	Response	Percentage
1	Ok	6	7.3%
2	Very ok	3	3.7%
3	Bad	20	24.4%
4	Very Bad	53	64.6%

	Total	**82**	**100%**

Source: Fieldwork, 2024

The above table indicates that those who were seriously affected bythe absence of some medicinal plants have the highest responses of 53 (64.6%), they feel very bad as this has affected the use of these traditional plants in the treatment of some ailments. Those that are not seriously affected by that lack of these traditional plants have the least responses of ssssss3 (3.7%), followed by those that are Ok which represents 6 (7.3%) while those that feel Bad have the second highest responses of 20 (24.4%). This clearly shows that traditional plants have medicinal value to the people of this study Community.

Table 6: What do you think has caused the Extinction of Medicinal Plants?

S/N	Variable	Response	Percentage
1	Bush burning	15	18.3%
2	Charcoal production	30	36.6%
3	Extension of farmlands	25	30.5%
4	Lack of alternative/cheaper energy source	7	8.5%
5	Climate change	5	6.1%
	Total	**82**	**100%**

Source: Fieldwork, 2024

The above table presents the interest of the respondents on what has caused the extinction of traditional plants. Most of the respondents believed that charcoal production is the major variable in causing deforestation in the area, representing 30 (36.6%) of the responses, followed by the clearing of more lands for agriculture which represents 25 (30.5%) responses, bush burning

which represents 15 (18.3%), then lack of other energy sources 7 (8.5%) while climate change also caused the extinction of plant species which represents 5 (6.1%).

Table 7: MeasuresPut in Place to Mitigate Deforestation in the Study Area

S/N	Variable	Response	Percentage
1	Yes	11	13.4%
2	No	71	86.6%
	Total	**82**	**100%**

Source: Fieldwork, 2024

The above table indicates that 71 (86.6%) responded that there is no measure on the ground to mitigate deforestation in the area while only 11 (13.4%) responded that there is a measure in place to mitigate deforestation in the area.

DISCUSSION

The findings of this research indicate that the study community is aware of deforestation's impact on traditional medicine. Community members utilize various plant components, including bark, roots, leaves, stems, seeds, latex, fruits, flowers, or entire plants, to treat a wide range of ailments such as malaria, typhoid fever, ulcers, headaches, convulsions, piles, dysentery, diarrhea, stomach pain, fever, skin conditions, post-natal issues, menstrual disorders, cancer, skin rashes, bad breath, and toothaches. To buttress this, Oloyede, (2023) said that traditional medicinal use in Nigeria particularly for malaria treatment, is prevalent, with 80% of the population relying on it. This also aligns with Bekalo*et al.* (2009) assertion that medicinal plants play a vital role in global healthcare, particularly in developing nations where approximately 80% of the population relies on traditional plant-based remedies. The community has also retained the knowledge of

these plants,whichconformsto the study conducted by Arjona-García *et al.*, (2021) which stated that the people of rural communities have maintained the knowledge of the wild plants.

Despite the significance of traditional medicines, the study shows that many of these plants have been eradicated or are nearing extinction, with some species becoming increasingly scarce. Examples of such threatened plants include Acacia albida, Anogeissusleiocarpus, Burji, Eucalyptus tereticornis, Adina microcephala, Fiscus platyphylla, Guiera senegalensis, Tamarindusindica, Ziziphusabyssinica, Boswellia dalzielii, and Prosopis africana. This finding supports Babalola's (2012) statement that numerous species with significant medicinal value are on the brink of extinction. Additionally, Oladele *et al.* (2008) noted that the high demand for medicinal plants in developing countries has led to indiscriminate harvesting of wild flora, resulting in many species becoming extinct, threatened, or endangered. Chinedu *et al.* (2017) suggest that the future availability of herbal medicines is uncertain, despite their widespread acceptance.

The study also identifies bush burning, agricultural expansion, charcoal production, lack of alternative energy sources, and climate change as primary factors contributing to the extinction of traditional medicinal plants. This corroborates Ladan's (2013) observation that high demand for woodfuel has led to extensive deforestation in southern Nigeria, transforming once-forested areas into derived savanna vegetation. Similarly, Adewuyi and Olofin (2014), in their study on woodfuel harvesting sustainability in Afaka Forest Reserve, Kaduna State, Nigeria, reported that commercial woodfuel harvesting has significantly impacted the forest ecosystem, resulting in increased tree spacing and discontinuous canopy cover in many areas.

CONCLUSION

In addition to their widespread acceptance, traditional medicinal practices have also been established as the foundational elements of contemporary medical science. The scholarly community employs either specific parts or entire specimens of botanical species in the management of various health conditions, which has been demonstrated to yield effective results. Although the future viability of traditional medicines appears to be uncertain, recent investigations have illuminated their extensive acceptance within the populace. This uncertainty is primarily attributable to the contemporary challenges presented by deforestation. Deforestation constitutes a significant threat to the sustainability of traditional medicinal practices, with numerous plant species having been eradicated or being on the brink of extinction.

The findings indicate that the rate of deforestation has markedly escalated in recent years, leading to the inference that, should the current alarming rate persist without intervention, traditional medicinal plants may swiftly become extinct. Regrettably, the research has disclosed that the strategies implemented to mitigate deforestation are largely ineffective. The implications this may have on public health are profound, as it will leave a considerable segment of the population, who lack access to modern medical care, with no alternative but to endure their health conditions. From a broader context, this will also result in a substantial decline in the pace of novel drug discovery and development. Consequently, corrupt governmental officials responsible for forestry regulations and policies must be prosecuted alongside illegal logging enterprises. The government should initiate a comprehensive tree-planting initiative while educating the public on the singularity of our planetary ecosystem, providing incentives to local communities that engage in afforestation efforts on their agricultural lands and residential properties, by supplying them with superior varieties of trees and collaborating with local leaders

to establish regulations governing forest conservation, for example, implementing a "cut one, plant three" policy. There is an urgent need for a vigorous public awareness campaign directed at rural populations regarding the significance of utilizing healthcare facilities rather than relying solely on traditional medicinal practices.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

REFERENCES

Abdul J. (2010). *Impact of Man Activities on the Vegetation of Nindem and Tsonje Forest Reserve, Kaduna State, Nigeria:* Unpublished Undergraduate Project Submitted to the Department of Geography, BUK.

Abubakar, MY, Zankan, J. A. A and Isah, M. N. (2020). Impact of Small Scale Mining on Rural Livelihoods in some parts of Yauri and Fakai local government areas of Kebbi state, Nigeria.*Scientific Research Journal (scirj),* volume 8 (4).

Adewuyi T and Emmanuel Olafin (2014) Spacio-Temporal Analysis of Flood Incidence in Nigeria and its Implication for Land Degradation and Food Security. *Journal of Agricultural Science 6(2).*

Agnes Rankoana Sejabaledi, (2024). A Review on the Use of Indigenous Knowledge for Medicinal Plants Conservation. *Natural Resources and Sustainable Development*, 14(1), 141–152. https://doi.org/10.31924/nrsd.v14i1.156.

Ajewole, Stephen (2024). The Role of Medicinal Plants in Nigerian Traditional Medicine, *Journal of Medicinal Plants Research,* 8 (3).

Angelsen, A. (2006). *A stylized model of incentives to convert, maintain, or establish forest.* Background Paper for World Bank Policy Research Report entitled "At Loggerheads: Agricultural Expansion, Poverty Reduction and Environment in the Tropical Forests-2007".

Arjona-García, C., Blancas, J., Beltrán-Rodríguez, L., López Binnqüist, C., ColínBahena, H., Moreno-Calles, A. I., ... & López-Medellín, X. (2021). How does urbanization affect perceptions and traditional knowledge of medicinal plants? *Journal of Ethnobiology and Ethnomedicine*, *17*(1), 48.https://doi.org/10.1186/s13002-021-00473-w.

Babalola, F. D. (2012). *Charcoal business hurting forest communities*. Retrieved from http://premiumtimesng.com http://premiumtimesng.com/metro/5020.

Bekalo, T.H., Woodmatas, S.D and Woldemariam, Z.A. (2009) An Ethnobotanical Study of Medicinal Plants Used by local people in the Lowlands of Konta Special Woreda, Southern Nations, Ethiopia. *Journal of Ethnobiological and Ethnomedicine, 5, Article No. 26.*

Chinedu E, Arome D, Solomon FA. (2017). *Herbal plants are a reliable source for drug discovery and development.*Pharmatutor Art. http://www.pharmatutor.org/articles/herbal-plants-reliable-source-drug-discovery-development.

Food and Agriculture Organization. (2005). *Annual Rate of Deforestation*. Retrieved from http://green.wikia.com/wiki/Deforestation_in_Nigeria.

Iloeje, N.P (2001) *A New Geography of Nigeria*. New Revised Edition, Longman Nig. Ltd., Lagos, 200 p.

Kebbi State Government, (2008). *Kebbi State Government Official Diary*. Directorate of Information, Kebbi, Nigeria.

Ladan. S.I (2013), "An appraisal of the status and consequences of encroaching into forest reserves in Katsina urban environment, Katsina State" *DanmarnaInternational Journal of multidisciplinary studies* 5(1):91-101.

Modibbo, M. R., Ibrahim, H., Sulaiman, M. Y., & Zakir, B. (2024). MaganinGargajiya: Assessing the Benefits, Challenges, and Evidence of Traditional Medicine in Nigeria. *Cureus*. https://doi.org/10.7759/cureus.71425.

Michael AlurameEruaga, Esther OleiyeItua, & James TabatBature. (2024). Exploring herbal medicine regulation in Nigeria: Balancing traditional practices with modern standards. *GSC Advanced Research and Reviews, 18*(3), 083–090.

Oladele, A.T., S.A. Adesanya and O.R Omobuwajo. 2008. Effects of two inorganic fertilizers on volatile oil and biomass yields of Cymbopogon citratus (DC). Stapf. Ile-Ife, Nigeria. *Nigeria Journal of Natural Products and Medicine* vol.12. 2008: 9-12.

OloyedeOladeji, M. (2023). Knowledge, Perception, and Utilization of Herbal Medicine in Treatment of Malaria in Southwestern Nigeria. *Texila International Journal of Nursing*, *9*(2), 1–13. https://doi.org/10.21522/TIJNR.2015.09.02.Art001.

Rahman, M. H., Roy, B., Chowdhury, G. M., Hasan, A., &Saimun, M. S. R. (2022). Medicinal plant sources and traditional healthcare practices of forest-dependent communities in and around Chunati Wildlife Sanctuary in southeastern Bangladesh. *Environmental Sustainability*, *5*(2), 207-241.

Udu R.K., (1991). *Geographical regions of Nigeria, Longman Ltd. pp. 21-27.*

World Health Organization. (2014). WHO*Traditional Medicines Strategy 2014-2023.* Geneva: WHO.

World Health Organization (2015). *Promoting the Role of Traditional Medicine in Health Systems:* a Strategy for the African Region 2001–2010. Harare.

Yusuf, M.A. (2013). Farmed Parkland Vegetation Changes, density and composition in Southern parts of Kano State, Katsina. *Journal of National and Applied Sciences*3(1); 98-113.