https://dx.doi.org/10.4314/jpb.v15i2.14
Vol. 15 no. 2, pp. 197-207 (September 2018)
http://ajol.info/index.php/jpb

Journal of
PHARMACY AND BIORESOURCES

Ethnobotanical appreciation of three common tree species in Kaltungo, Nigeria - implications for conservation

Charles A. Nsor* and Japhet J. Galaboyi

Department of Biological Sciences, Gombe State University, PMB 127, Tudun Wada. Gombe State, Nigeria.

Received 28th June 2018; Accepted 30th July 2018

Abstract
Ethnobotanical knowledge has been in use across diverse cultures, but the lack of documentation of the ethno-cultural uses of plants, constrains wide adoption of beneficial application of plants to meet the needs of people. This study was therefore focused on investigating the ethnobotanical practices, cultural values and uses of *Adansonia digitata, Parkia biglobosa* and *Tamarindus indica* among the people of Kaltungo, Gombe State, Nigeria. A cross sectional survey was conducted in Yiri, Ture villages and Kaltungo metropolis all in Kaltungo Local Government Area from April to June 2017. Data was obtained from 116 structured questionnaires while the point centered method was used to determine species abundance in the study area. Species abundance was used as a proxy for public acceptance and conservation of the three tree species surveyed. Results indicate that species abundance varied with location reflecting the level of appreciation and protection of the species in each case. The result shows that *P. biglobosa* was the most abundant species in Kaltungo, *T. indica* in Ture and *A. digitata* in Yiri. The socio cultural and ethnobotanical appreciation of the three species was relatively similar across the three localities sampled. Our results emphasizes the utilitarian approach of humans to conservation, as each species was conserved because of its periodic returns to the locals by way of food, medicine and spiritual needs.

Keywords: Ethnobotany, Kaltungo, Species abundance, Indigenous knowledge, Conservation

INTRODUCTION

Traditional people around the world possess unique knowledge of plant resources on which they depend for food, medicine and general utility [1]. Ethnobotany the study of how modern and indigenous societies view and use plants is an aspect of Ethno-ecology, which is broadly concern with the interactions of local people with the natural environment [1]. It is difficult to tell exactly when the term ethnobotany became part of modern scientific lexicon. However, its appreciation and application can be traced back to the time when humans started making conscious interactions with the environment. The use of natural products with healing properties is as old as human civilization. For a long time, minerals, organic matter and plant products were the main sources of direct medication. The World Health Organization (WHO) defines traditional medicine as practices, knowledge and belief systems, which use minerals, plants and animal based remedies, spiritual therapies and exercises to prevent, treat and maintain wellbeing [2]. In the same vein, the organization in 2002 reported that about 80% of the population of the world depends on traditional medicine, mostly

* Corresponding author. *E-mail*: charlesnsor@yahoo.co.uk *Tel*: +234 (0) 8103303073
ISSN 0189-8442

herbal remedies, for their primary health care needs.

The African continent has a long history with the use of plants and in most African countries up to 90% of the population relies on medicinal plants as a source of medication. Apart from medicinal applications, most African communities rely on the forest and its products for their basic daily needs of food, shelter and clothing [3]. However, the use of plants for medicinal purposes seems to over-shadow its other traditional applications in some rural climes. The lack of access to modern healthcare facilities/services, affordability, and cultural acceptance are identified as the main factors driving continuous dependence on traditional health care products. These factors in concert with a growing interest in the use of organic products and folk medicine have resulted to an increase in the demand for medicinal plants. This increased demand on natural remedies and products places so much pressure on the scarce natural resources.

The importance of plants transcends its nutritional and medicinal values, for in the eyes of folklorist and custodians of traditional knowledge, plants are associated with rituals, festivals and traditional worship/rites of passage. However, these perceptions and beliefs vary across cultures. In Adamawa, a study on folklore and traditional beliefs among the Bachama people of Numan Local Government Area revealed that certain trees and animals are considered sacred, thus are protected from persecution [4]. The authors went on to note that the benefits of these beliefs could be seen in the relative abundance of these "sacred trees" despite being surrounded by heavily degraded landscape. Again, it was noted that species that still thrive in the region and study area are those with economic benefits to humans and are thus conserved because of their utilitarian values [4]. It has been demonstrated by some studies [5,6], that people often treat species (animals or plants) based on how they perceive them. It is against this backdrop that we used abundance of the three focal tree species relative to other flora as a proxy of how people perceive them. We reason that the more value people attach to a species, the more likely they are to propagate them or maintain to some extend its natural distribution and abundance.

According to W.H.O [7] report about 75-90% of the rural population in the world (excluding western countries) relies on traditional medicines as their only health care system. This is not only because of poverty where people cannot afford to buy expensive modern drugs, but traditional systems are also more culturally acceptable and meet the psychological needs in a way modern medicine does not. Another factor that has fostered continuous dependence on traditional medicine is the conservative attitude of most rural dwellers.

Traditional medicine is an integral part of indigenous knowledge; which is a unique body of cumulative and dynamic knowledge built up by groups of people through generations of living in close contact with nature [8]. It builds upon the historic experiences of people and adapt to social, economic, environmental, spiritual and political change. The quality and depth of traditional knowledge differs among community members according to their gender, age, social standing, profession and intellectual capabilities [4]. For instance, a society concerned with biological diversity will be most interested in knowledge about the environment; this information must be understood in a manner, which encompasses knowledge about the cultural, economic, political and spiritual relationships with the land. This complex knowledge, beliefs and practices generally known as indigenous knowledge develops and changes with time and space. Hence, such knowledge includes time-tested practice that develops in the

process of interaction of humans with their environment [3].

It provides a distinctive worldview of which outsiders are rarely aware and at best can only incompletely grasp [9] because indigenous people of different localities have developed their own specific and unique knowledge of plant resources, uses, management and conservation [10]. Thus, systematic application of indigenous knowledge is important for sustainable use of resources and sustainable development [11].

It is a well-established fact that knowledge and use of plants is an integral part of many ethnic rural cultures in Nigeria, the extent of which has not yet been studied in depth or well documented.

Ethnobotanical surveys are made for different reasons; some of these include assessment of functions of plants, for example identification of medicinal species [12] and analysis of species diversity in a given area [13] Other reasons include determination of species conservation status [14; 4] or when trying to identify new plant species in an area that is not yet extensively studied [15]. In the light of the forgoing, this research investigates the abundance, cultural values and uses of *Adansonia digitata, Parkia biglobosa* and *Tamarindus indica* among the people of Kaltungo Local Government Area, Gombe State.

Specific objectives of the study are:

I. To use species abundance as a proxy for conservation and protection of *A. digitata, P. biglobosa* and *T. indica* in Kaltungo Local Government Area

II. To determine the ethnobotanical differences in the diverse uses of the focal tree species among the people of Kaltungo local Government Area.

III. To identify cultural practices associated with trees that could be injurious or beneficial to conservation.

MATERIALS AND METHODS

Study area. The study was conducted in Yiri, Ture villages and Kaltungo metropolis all within Kaltungo Local Government Area in Southern part of Gombe State, which lies between longitude 10º and 12º west and latitude 90º and 11º north. It covers about 881sq km. The study area enjoys tropical climate with a marked dry and wet seasons. The areas have absolute maximum temperature of 40.4^0c but drop during the raining season to about 26.7^0c. The altitude ranges between 450 to 550 meters above sea level. The area is of the Sudan Savannah vegetation type. It is dominated by grassland interspersed with trees that are usually stunted with hard barks to reduce the rate of evapo-transpiration. Shrubs and herbs are common characteristics of this vegetation. Common tree species include Acacia, Parkia, Desert Date, Baobab and Tamarind. The people are mainly Tula, Tangale and Kamu tribe with few Waja, Dadiya, Hausa and Fulani people who live in the area. However, the people have rich culture and almost 80% of them are farmers who depend solely on agriculture. The farmers grow wide variety of crops such as beans, maize, soya beans and groundnut in some parts of the district.

Study species. *Adansonia digitata* (Baobab) is a multi-purpose tree species native to Africa. *A. digitata* belongs to Order Malvale, and Family Malvaceae. Seeds contain appreciable quantities of crude protein, digestible carbohydrates and oil [16]. Baobab leaves are superior in nutritional quality to fruit pulp, and contain significant levels of vitamin [17; 18]. The leaves are staple for many populations in Africa, and are eaten fresh or dried. Several plant parts have interesting antioxidant and anti-inflammatory properties, and have been used extensively since ancient times in traditional medicine.

Parkia biglobosa commonly known as locust bean is a Pan tropical genus of evolutionary

interest with centers of distribution in Africa, South East Asia and South America. It is a primitive group within Leguminosae plants and consists of nearly 70 species [19].

P. biglobosa belongs to Fabales taxonomic Order and the family Fabaceae. This multipurpose tree has different ethnic uses that may vary from place to place. The identified uses of various fields include medicinal, food, commercial, handicraft, veterinary and cultural.

Tamarindus indica, (Tamarind), a tropical tree found in Africa and Asia is highly valued for its pulp. Tamarind belongs to the order Fabales and family Fabaceae. Tamarind fruit pulp has a sweet acidic taste due to a combination of high contents of tartaric acid [20]. The pulp is used for seasoning, in prepared foods, to flavor confections, curries and sauces, and as a major ingredient in juices and other beverages. Tamarind kernel powder is an important raw material in textile, paper and jute industries [1]. Seeds are gaining importance as an alternative source of proteins, and are also rich in some essential minerals. Seed pectin can form gels over a wide pH range. Tamarind leaves are a fair source of vitamin C and mineral content. Anti-oxidant, anti-inflammatory, anti-microbial and anti-fungal activity has been documented from several plant parts [20]. Tamarind is also extensively used in traditional medicine in most parts of Africa.

Methods of data collection. Data was obtained through primary and secondary sources. Primary data was obtained from the respondents, through contact method (i.e. personal interview), questionnaires and field survey methods. While secondary information was sourced through textbooks, journals, seminar reports, government reports.

Qualitative information was recorded and organized around major villages. Key responses were recorded and translated into English from local dialects. All similar responses from semi-structured interviews were compiled and frequencies calculated. Responses from focus group discussions and key interviewees were organized around the major groups. A total of 116 questionnaires were distributed across the three localities with each receiving 38. However, not all were returned. Kaltungo returned 36, Ture 31 and Yiri 33.

Abundance estimate was conducted in each of the three study area to extrapolate the density and abundance of each focal tree species in the area. We used the point centered method to count the number of each species within a 200 x 200 m quadrant. We replicated this at random in each study site. For each of the three sites we surveyed three (200 x 200 m quadrant). Data were processed using MS Excel and analyzed using SPSS (Statistical Package for Social Sciences version 16). Quantitative data on key variables was analyzed and expressed using descriptive statistics (frequencies and percentages).

RESULTS

Species abundance varied within and between the three study sites. Interestingly, no single species was found to be the most abundant in all the three sites surveyed (Fig 2). However, the three species were each dominant in one of the three study sites; *P. biglobosa* for Kaltungo, *T. indica* for Ture and *A. digitata* for Yiri (Table 2). Our results revealed that the level of perception and application of the various tree species differed across the three locations.

Medicinal applications. In Kaltungo metropolis majority of the respondents (39.5 %) viewed *P. biglobosa* as highly medicinal, followed by *T. indica* and *A. digitata* as indicated by 36.8% and 23.7 % of the respondents respectively. Ture respondents were of the view that *T. indica* had the most medicinal value with 50 % representation, *P. biglobosa* with 30 % and *A. digitata* with 20

%. In Yiri, *P. biglobosa* was considered the species with the most medicinal value by 56.3 % of the respondents, *while A. digitata* and *T. indica* were touted by 31.3% and 12.5% of the respondents respectively. (Fig 3).

Application as bio-fuel. In Kaltungo metropolis 56.3% of respondents were of the view that *T. indica* is the most used as bio fuel while 31.5% and 15.7 % rooted for *P. biglobosa* and *T. indica* respectively. In Ture the most used tree species was *P. biglobosa*, *T. indica* and *A. digitata* with 50 %, 40 % and 10 % of respondents respectively attesting to this. In Yiri, the most used as bio-fuel is *P. biglobosa* with 62.5 %, followed by *T. indica* with 31.2 % and *A. digitata* with 6.3 %.

Food resources. In Kaltungo metropolis *A. digitata* was highly appreciated as a food resource followed by *P. biglobosa* and *T. indica by* 39.5%, 36.8 % and 23.7 % respondents respectively However, In Ture the perception of respondents was reversed, *T. indica* was the most used as food, followed by *P. biglobosa* and *A. digitata* by 56.7 %, 30% and 13.3% of respondents respectively. In Yiri, *A. digitata P. biglobosa* and *T. indica* by 62.5 %, 25. 2 % and 13.3% of respondents respectively. Based on these results, *A. digitata* had an all-round high (62. 5%) with regards to respondents' use of the three tree species as food resources. Interestingly, this view was held in two (Kaltungo and Yiri) of the three study locations (Table 2).

Shade. In Kaltungo metropolis, *P. biglobosa*, *A. digitata* and *T. indica* were the most appreciated as shade trees by 47.4 %, 31.6 % and 21.1 % respectively by the respondents. The results for Ture, showed that *A. digitata, T. indica* and *P. biglobosa*, were considered useful as shade trees, with 50 %, 33.3 % and 16.7 % respectively of respondents attesting to this.

Table 1. Summary of ethnobotanical applications of plant parts in treatment of diseases and ailments among the people in the study areas.

Tree Species	Parts used	Disease or ailment treated
Adansonia digitata	Leaves	Dysentery, pile and covering of broken skin or injuries
	Bark	Blood tonic, toothache and stomach upset.
Parkia biglobosa	Leaves	Fever, skin disease, abscesses, eyesore, toothache, fever, wound, ulcer, snakebite and jaundice.
	Bark	Used for bathing during fever, as hot mouthwash to relieve tooth ache, wound and ulcer, Cure bronchitis, pneumonia, diarrhea, digestive ailments, hypertension and hemorrhoids in humans.
	Seeds	Cure dysentery in cattle, sheep and goats. Anti-platelet activity, tooth ache, jaundice
Tamarindus indica	Leaves	Diarrhea, dysentery and food poisoning.
	Bark	Joint dislocation, wound healing and rashes
	Seed	Wounds and scabies

Table 2: Summary and distribution of ethnobotanical application of the three tree species in the study sites. Values are counts and frequencies.

Study Sites	Tree species	Food	Shade	Bio-fuel	Local Perceptions	Abundance rank
Kaltungo	*P. biglobosa*	15	18	6	Positive	1st
Kaltungo	*A. digitata*	14	12	12	Positive/Negative	3rd
Kaltungo	*T. indica*	7	6	18	Positive	2nd
Ture	*P. biglobosa*	4	5	3	Positive	2nd
Ture	*A. digitata*	9	15	15	Positive/Negative	3rd
Ture	*T. indica*	17	10	12	Negative/Positive	1st
Yiri	*P. biglobosa*	20	20	2	Positive	2nd
Yiri	*A. digitata*	8	10	20	Positive	1st
Yiri	*T. indica*	4	3	3	Negative	3rd

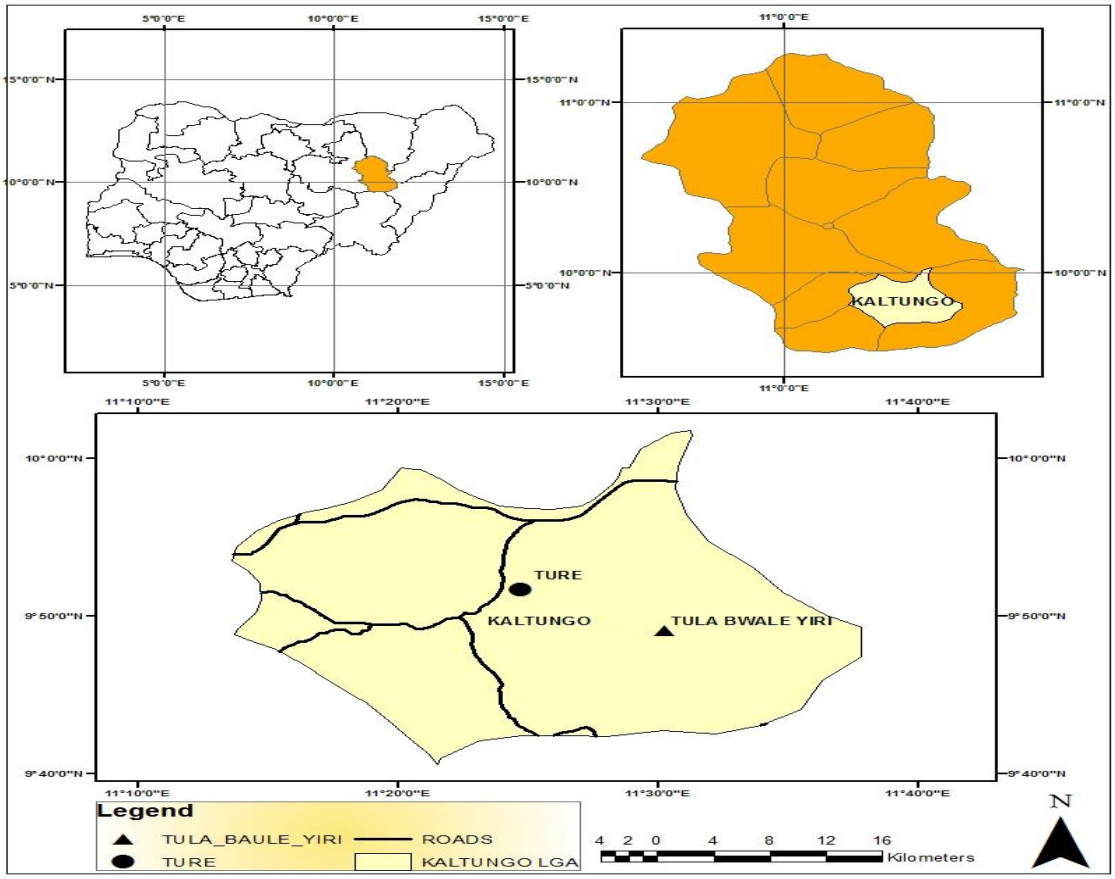

Figure 1: Location of the Study Area. (Source: GIS Lab Gombe State University)

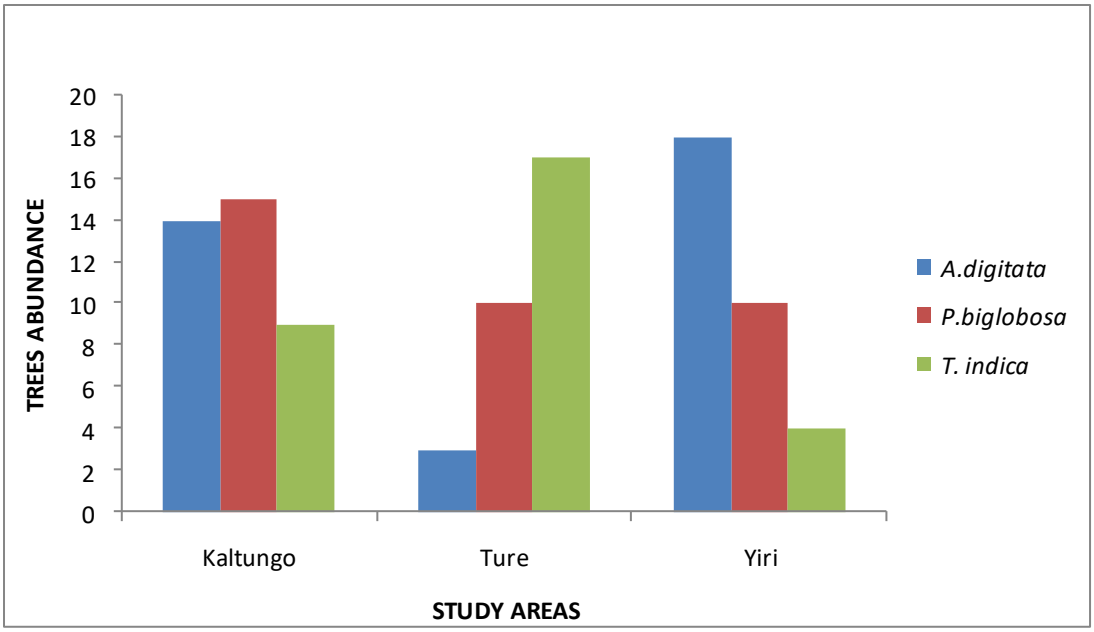

Fig 2: Tree Species abundance in the various study sites in Kaltungo. Bars represent frequencies or counts.

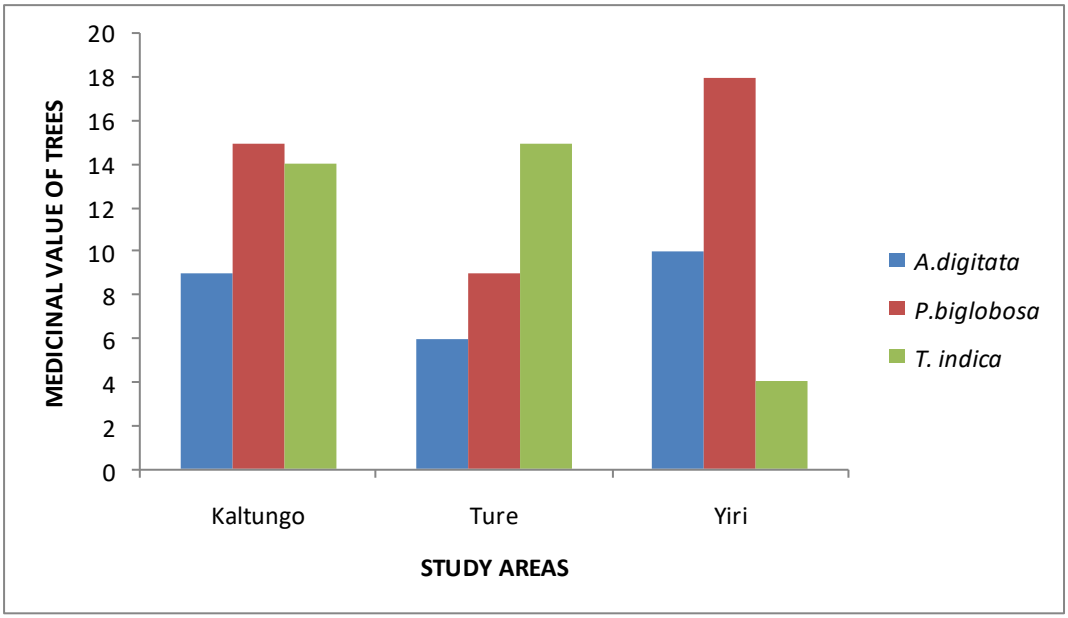

Fig 3: Medicinal application of focal tree species among people living in the study areas. Bars represent counts and frequencies.

However, in Yiri the trend was reversed and shuffled with *P. biglobosa*, *A. digitata*, *T. indica* touted by 60.6 %, 30.3 %, and 9 % of respondents respectively (Table 2).

DISCUSSION

Interactions with the villagers and respondents revealed very useful information that could be harnessed in designing conservation programs as well as policy formulation. We investigated whether the abundance of trees in each of the three study locations will correspond with the level of appreciation with regards to benefits derived from the trees under investigation. This was our way of testing the perception of most conservation biologist that people tend to protect or conserve species they consider useful [4-6]. This is also in line with the popular view that if purpose is not known abuse is imminent. Our results confirmed this assertion as the most abundant tree species across the various study sites were the ones with the widest spectrum of application in the area of medicine, nutrition, aesthetics, environmental support and enhancement (shade and wind break) etc. In fact *P. biglobosa* ranked first in Kaltungo, and second in Ture and Yiri and was the only tree species was not perceived in negative light across all the localities sampled (Table 2).

Indigenous knowledge and uses of *A. digitata, P. biglobosa* and *T. indica.* The three trees were considered useful by majority of respondents. They served a variety of functions and uses including food, beverage, and traditional-medicines for humans, ethno-veterinary uses, aesthetic uses, environmental amelioration as well as cultural uses. The various trees provide shade in homes, public places, for crops and livestock. *T. indica* is appreciated for its role as wind-break for houses and crops given its strong root system and is generally seen as valuable resource which is in agreement with Bourou *et al*. [21] who observed that indigenous fruit tree species such as tamarind traditionally act to build resilience in the Sub-Saharan Africa's farming system in terms of food security, nitrogen fixation, income generation and ecosystem stability. This characteristic was reported by 57 % of the respondents in Ture as the major reason for *T. indica*'s popularity

and abundance in Ture (Table 2). The natural presence of a tamarind tree was a preferred site for house construction as expressed in the words of one of the respondents; "building your house close to a tamarind tree is advantageous since you are assured of a windbreak". The respondent went on to assert that unlike other trees, tamarinds are never blown over by wind and their branches never fall off.

All the respondents across the three study locations mentioned that they made a popular beverage from *A. digitata, P. biglobosa* and *T. indica* fruit pulp. In Kaltungo metropolis most of the respondents confirmed they use *A. digitata* fresh or dried leaves in the preparation of a popular soup; this was the case with residents in Yiri where most respondents reported that they use *A. digitata* leaves for soup making, while the seeds are processed into local seasoning. *A. digitata* and *P. biglobosa* fruits are widely eaten as snacks by majority of the respondents. These findings are in agreement with Havinga et al. [22], who report that *P. biglobosa* and *T. indica* are highly valued in West Africa and are always spared during clearing of land for crop farming. This is evident in most parts of the northern region as one travels through heavily degraded landscapes and agricultural areas. Ethno medicinal uses for humans and ethno-veterinary uses had the lowest percent among youths probably because such knowledge is possessed by only a few people, mostly elders, herbalists and traditional healers (See [4,5]) who stated that when people appreciate the value of biodiversity, they will be more likely to think about conservation in their day-to-day activities such as how to use the products and other natural resources for their overall benefit. The selective sparing of the seedlings of the focal species points to the high value attached to them compared to other tree species in the study area. On the other hand, focus group discussions revealed that *T. indica* and *P. biglobosa* are often felled to create space for buildings and majorly to provide building materials (timber) and for bio-fuel [23]. This is a reflection of competing land uses especially in urban areas. Urbanization has therefore indirectly contributed to reduction of *T. indica* and *P. biglobosa* population in Kaltungo metropolis.

Responses from focus group discussions revealed that young people were not as knowledgeable as the elders concerning the cultural implications and uses of three tree species [4]. Many urban youth viewed consumption of some indigenous foods as backward while youths in rural areas were more interested in earning an income from the various products with no consideration for the wellbeing and conservation of the species. However, the general attitude of the locals reflects good stewardship with regards to the tree species studied. This is mirrored in their selective planting of trees they considered useful. We were reliably informed by some stakeholders that the most common or abundant tree species in the villages were planted by the people, to complement the ones occurring naturally in the area. This revelation is encouraging and should be encouraged by the relevant government agencies, NGOs and conservation groups to optimize this healthy practice and boost the ongoing fight against desertification.

Local distribution of the focal tree species. Most of the trees were distributed around and within human settlements: compounds, home gardens, roadsides, cropland, fallow land, and schools. Approximately half of the respondents in Yiri have one or more trees of *A. digitata* within the vicinity of their compounds or in home gardens.

Majority of the trees observed appeared healthy (without disease or pest infestations). Incidences of injurious practices on the trees were minimal. The occasional damage observed was attributed to browsing of saplings by livestock, especially goats, and

removal of bark of stems and roots of mature trees for medicinal purposes.

Beliefs, taboos associated with ownership and application of the focal tree species. Beliefs, taboos and superstitions were observed to be an intrinsic part of the indigenous knowledge of the communities in the study area. For instance, a number of cultural norms, taboos, and superstitious beliefs are associated with ownership and production of various species of trees in the area. Majority of the trees and the land on which they are found were owned by men with the exception of *T. indica* (Tamarind) that is among the few owned by women. Interestingly the rest of the extant tree species are considered public property in the area. Planting of trees are not commonly practiced by women since they owned neither land nor the trees therein.

Our findings revealed that some superstitious beliefs ought to be address in the interest of the public and for effective conservation of the fast disappearing biodiversity [24]. For instance, a common belief formerly prevalent in both districts was that whoever planted *T. indica* would die before the tree matures and cannot live to taste its fruit. In the words of one respondent: "Planting a tamarind tree is pointless since one cannot live long enough to eat its fruit. You can only plant for your children and grandchildren".

In the study areas, every village had one or more unique beliefs about each of the focal tree species. The people of Yiri have a mythological view about *A. digitata*, that when someone plants this tree in front and back of his/her house that the tree repels evil spirits from afflicting people and prevents bad luck within the family. This belief is most likely the reason behind the high abundance of *A. digitata* in the village. On the contrary, they believed that *T. indica* tree is a harbinger of bad luck and as it is believed to harbor many evil spirits. This misconception places a moral burden on the locals such that wherever the tree is found growing in or near the houses, it is often cut down by the people so as to avoid attack by the evil spirits or to evade bad luck. This belief discouraged the cultivation of this tree; it only grows naturally in the area. Despite these negative perceptions, the villagers still patronize *T. indica* tree for its economic values. The fresh leaves are used in making of soup, while the fruits are used in making of local beverage and as a flavoring agent.

The people of Yiri on the other hand believe that *A. digitata* brings good-luck, while the people of Ture and few respondents from Kaltungo metropolis believed that the tree harbors evil spirits and a harbinger of bad-luck.

A. digitata, *P. biglobosa* and *T. indica* are highly valued by majority of the population, and are used for food, medicine (Table 1), cultural, social, environmental amelioration and as a source of income). Consequently, the trees are locally protected, while the population is maintained through supplemental planting. The appreciation of local indigenous knowledge across the various study location follows a similar pattern of benefits/ protection, fear/ persecution. The implication being that species that are considered evil are persecuted, while those perceived as beneficial enjoy protection [5]. The study provides insight into usage and depth of indigenous knowledge possessed by the people of this area.

Our study is the first of its kind in this location and the novelty lies in our use of abundance of tree species as a proxy and indicator of the level of appreciation or persecution by the people of the area. Several beliefs and taboos regarding the study species persist among the people of the study areas despite the dilution effect of civilization, religion and western education.

Conclusion. The high value attached to the focal trees by the locals and their natural resilience has contributed to their persistence in the study area. The low percentage of planting coupled with excessive cutting, monetary value attached to *T. indica* and *P. biglobosa* and their parts and competing land use especially where population density is high, remain major challenges to the conservation of these locally widespread and important tree species. The ethnobotanical and indigenous knowledge recorded in this study is threatened by lack of documentation, and is at the moment only preserved orally and handed down from generation to generation.

The indigenous knowledge possessed by locals was shrouded in myths and superstitions. Local communities need to be provided with clear information about the intrinsic value of trees to balance the scale with regards to current utilitarian appraisal. This can be achieved through public lectures and community engagement in intervention programs like tree planting to cushion the increasing demand for tree-based forest products.

REFERENCES

1. Martin, GJ. Ethnobotany: A methods manual. Chapman & Hall, London 2005; pp. xx, 7-9, 61-63.
2. World Health Organization. WHO traditional medicine strategy 2002-2005.
3. Bassey, AE, Kanung R. A brief look at conservation ethic within the culture of people of Okwango. In: Obot E., Barker J. (Eds.): Essential Partnership- The Forest and the People. Paper presented at the Workshop on Rain Forest of South - Eastern Nigeria and South Western Cameroon held at Obudu Cattle Ranch Cross River State, Nigeria on 20th -24th October 1996.
4. Nsor, CA, Takipi ND. Folklore and traditional beliefs; Relics of the past or crucial vehicles in Biodiversity Conservation: A case study of Bachama People of Numan, Adamawa State. *Proceedings of 6th NSCB Biodiversity Conference*, UniUyo. 2018 (41-48 pp).
5. Sekhar, UN. Local people's attitudes towards conservation and wildlife tourism around Sariska Tiger Reserve, India. *J Environ Manage*. Dec; 2003. 69 (4):339-47
6. Martin, J, Maris V, & Simmberloff DS. The need to respect nature and its limits challenges society and conservation science. *PNAS* 2016. 113 (22), 6105-6112.
7. World Health Organisation, The promotion and development of traditional medicine. World Health Organisation. Technical report series 1979. 622 WHO Geneva.
8. Saka, OJ, Emmanuel, TI, Abideen, AA, Emeka, EO, & Adesoji, AA. The Role of Traditional Laws and Taboos in Wildlife Conservation in the Oban Hill Sector of Cross River National Park (CRNP), Nigeria.. *J of Human Ecol*, 2012. 39(3): 209-219
9. Balick, M. J, and Cox, P. A. Plants, people and culture: Science of culture: *Science of Ethnobotany*. 1996. New York, USA.
10. Cotton, CM. Ethnobotany: Principles and Application. John Wiley and sons, New York 1996. 412 pp.
11. Thomas, H. Indigenous knowledge, Emancipation and Alination. *J of knowledge transfer and util* 1995. 8(1): university of Washington.
12. Jouad H, Haloui M, Rhiouani H, El Hilaly J, Eddouks M. Ethnobotanical survey of medicinal plants used for the treatment of diabetes, cardiac and renal diseases in the North central region of Morocco (Fez-Boulemane). *J. Ethnopharmacol*., 2001. 77(2-3): 175-182.
13. Ando, A, Camm, J., Polasky, S, & Solow, A. Species distributions, land values, and efficient conservation. *Sc*, 1998 *279*(5359), 2126-2128. DOI: 10.1126/science.279.5359.2126.
14. Schemske DW, Husband BC, Ruckelshaus MH, Goodwillie C, Parker IM, Bishop JG. Evaluating Approaches to the Conservation of Rare and Endangered Plants. *Ecol*., 1994. 75(3): 584-606.
15. Hen, L. Indigenous knowledge and biodiversity conservation and management in Ghana. *J. of Hum. Ecol*, 2006. 20(1): 21-30.
16. Yazzie, D, VanderJagt, DJ, Pastuszyn, A, Okolo, A, Glew, H. *The Amino Acid and Mineral Content of Baobab (Adansonia digitata* L.)*Leaves. J. of Food Composition and Anl*, 1994. 7, 189-193.
17. Gebauer, J, El-Siddig, K., Ebert, G. *Baobab* (*Adansonia digitata* L.): *A Review on a*

Multipurpose Tree with Promising Future in the Sudan. Gartenbauwissenschaft, 2002. 67, 155-160.

18. Scheuring, JF., Sidibé, M., Frigg, M. Malian agronomic research identifies local baobab tree as source of vitamin A and vitamin C. *Sight and Life*, 1999. 1, 21-24.
19. Burkill, HM. The Useful Plants of West Tropical Africa. Royal Botanic Gardens, Kew. Volume: 5. Hardback | Nov *2000* | #49856
20. El-Siddig, K., Ebert, G., Lüdders, P. *Tamarind* (*Tamarindus indica* L.): *A Review on a Multipurpose Tree with Promising Future in the Sudan. J. of App. Bot*. – AngewandteBotanik, 1999. 73, 202-205.
21. Bourou S, Bowe C, Diouf M, Van Damme P. Ecological and human impacts on stand density and distribution of tamarind (Tamarindus indica) in Senegal. *Afr. J Ecol*. 2012; 50(3):253–380.
22. Havinga RM, Hartl A, Putscher J, Prehsler S, Buchmann C, Vogl CR .Tamarindus indica L. (Fabaceae): patterns of use in traditional African medicine. *J Ethnopharmacol*. 2010; 127:573–588. doi: 10.1016/j.jep.2009.11.028.
23. Nsor, CA, Abiram, DD. Fuel wood Preference: A matter of choice or an economically constraint alternative; an assessment of alternative energy preferences in Gombe Metropolis. *Bima J. of Sc. and Tech*. (BIJST) 2018. (Accepted July 2018)
24. Akindele, SO. Forest Restoration through Traditional Institutions in Nigeria: Challenges and Prospects. 2010. From http://www.cfc2010.org/papers/session13/Akindele-s13.pdf