Chapter

Noteworthy Threatened Plant Species in the Sahel Region, Nigeria

Abdallah Muhammad Salihu and Rusea Go

Abstract

The loss of biodiversity in Nigeria is intensifying distressingly, which happened to be more prominent in some states across northwestern as well as north eastern geopolitical regions of Nigeria and was threatened by the confrontational effect of desertification. The Sahel region and some part of the savannah region bordered which faced the menace of drought and desertification which lead to so many factors like soil erosion, distraction of the ecosystem entirely. Moreover, the plants destroyed were mostly aromatic plants which served as medicines in curing many ailments and diseases contributed to the economic status of the communities found in the Sahel. The plants species became threatened to the human practices by noticing their effects for their well-being. Consequently, among the species that were threatened include: *Neocarea macrophylla* Prance ex F.White (Gawasa), *Sclerocarya birrea* (A. Rich) Hochst. (Danya), *Detarium microcarpum* Harms. (Taura), *Prosopis africana*, (Kirya), *Acacia africana*, *Acacia nilotica* and *Azadirachta indica*. Hence, the major concern of this chapter is to assess some of the threatened species found in the Sahel region, Nigeria and to highlight the valuable medicinal plants at risk of extinction according to the guidelines of the International Union for the Conservation of Nature (IUCN).

Keywords: African, dessert plants, medicinal plants, threatened, ethnobotany

1. Introduction

The loss of biodiversity in Nigeria is intensifying distressingly ("Assessment of the threats to biodiversity" Convention on Biological Diversity [CBD]), which happened to be more prominent in some states across northwestern as well as north eastern geopolitical regions of Nigeria and was threatened by the confrontational effect of desertification, posing a substantial threat to the well-being of the populace [1]. The Sahel region and some part of the savannah region bordered with Niger Republic faced the menace of drought and desertification that leads to soil erosion and distraction of the ecosystem entirely (**Figure 1**). The confrontational effect is caused by the rampant cutting of trees, loss of ground cover and continuous overgrazing by livestock of the Fulani herdsmen. Moreover, the plants destroyed were mostly aromatic and medicinal plants gathered, traded and used by communities in Sahel as source of livelihood. Consequently, among the species that were threatened include *Neocarea macrophylla* (Sabine) Prance ex F.White

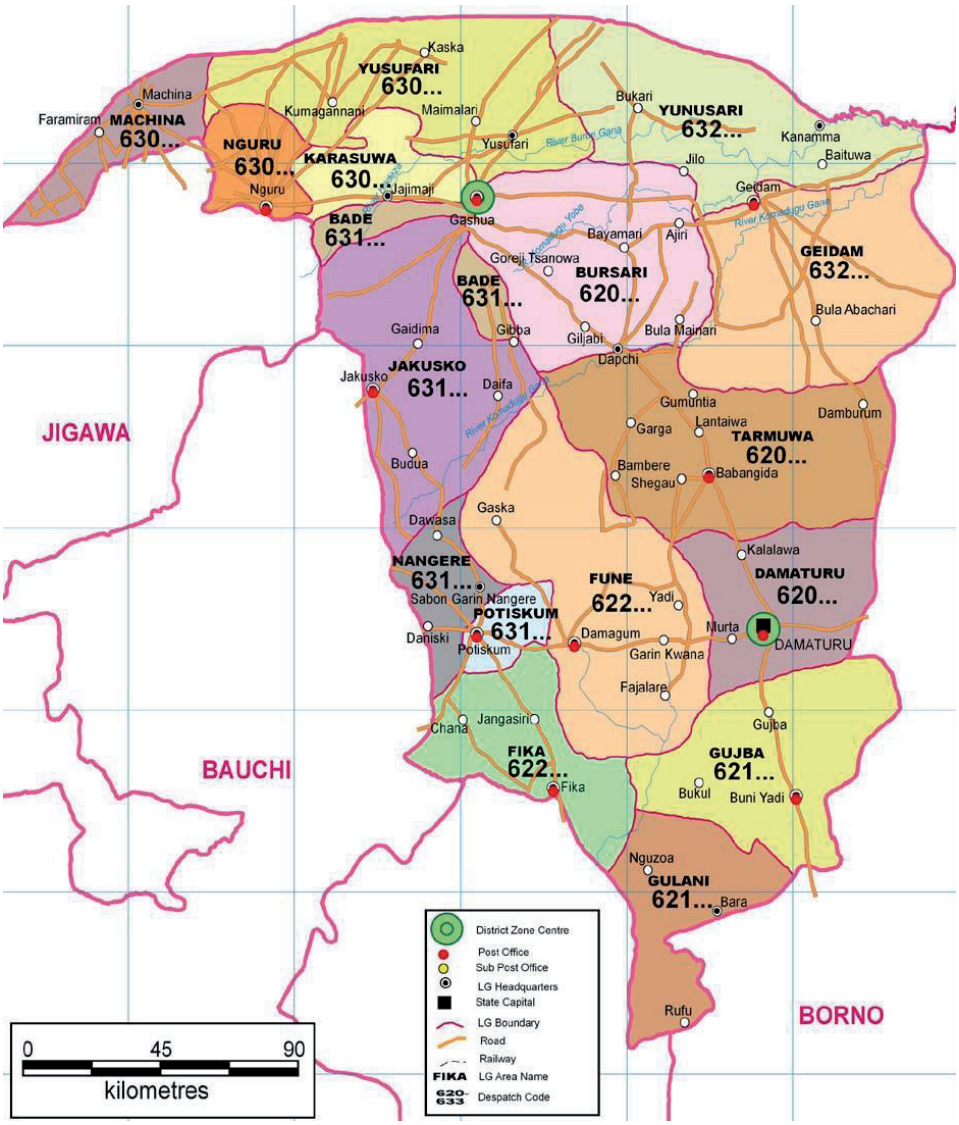

Figure 1.
Map of Yobe State, Nigeria (Sahel region).

(Gawasa), *Sclerocarya birrea* (A. Rich) Hochst. (Danya), *Detarium microcarpum* Harms. (Taura), *Prosopis africana* (Guill. and Perr.) Taub. (Kirya), *Acacia africana*, *Acacia nilotica*, *Azadirachta indica* [2]. Though numerous international and national summit have been conducted towards ways to tackle the menace of desertification but apparently failed in the Sahel regions, notably because majority of the populace relied on the natural resources for their well-being. The genus *Acacia* with about 1380 species is widely distributed from Australia to rest in tropical and subtropical regions of the globe is called "*bagaruwa*" by the Hausa tribe (Sudan and Nigeria). It is used to treat many ailments by utilizing its leaves, stem and pods simply because the abused of many commercially made antibiotics has led to many antibiotic resistances in human pathogens [2]. Consequently, *S. birrea* considered to be native African tree and widely distributed across the continent. Its stem-bark, roots, leaves and fruits are contained a myriad of chemical components, which attributed to its utilization as food and traditional medicine for many ailments. Its fruits were

regarded as wild fruits for their uniqueness of nutritional attributes of ascorbic acid and other hydrocarbons. The seeds possessed essential acids and oil used as anti-inflammatory, antidiabetic, analgesic, anti-parasitic, antimicrobial and antihypertensive [3]. Hence, *S. birrea* (marula) is commercially valuable as many tribes in Africa used its stem-bark for making inks. The wood part of "marula" mainly used for dishes, mortars, drums, toys, curios and cosmetics oil [4]. It has become a challenge to Nigerian Ministry of Health over many years because both rural and urban communities opted to medicinal plants as complementary and alternative medium of curing their ailments, and over cutting unsustainably and lack of enforcement caused some species into verge of extinction [5].

1.1 Loss of biodiversity

Evidences showed that the biodiversity has been unprecedentedly lost at a higher rate in many parts of Nigeria, which are mostly human related factors such as industrialization, technological advancements and settlements for urbanization. Biodiversity loss in Nigeria is mainly due to poor law enforcement, high demand for forest products and cultural practices. In addition, clearing of vegetation haphazardly leads to loss in biodiversity. However, biodiversity loss may also due to some agricultural and livelihood practices such as firewood cutting and gathering, bush burning, logging and overgrazing. Since 1990s, some large farm has caused enormous deforestation of the natural habitats depicting as the major source of loss. Thus, drastic depletion of fire-wood species like neem tree, *Acacia nilotica*, *Acacia seyal* was very prominent [6]. Consequently, the Sahel region is characterized by small, widely disseminated, small-leaved trees, mainly *Acacia* species such as *Acacia tortilis subsp. raddiana*, *Acacia seyal*, *Acacia nilotica* and *Acacia senegal*. Equally high percentage of the trees was deciduous in the dry season. Some species were *Anogeissus leiocarpus*, *Sclerocarya birrea* (**Figure 2a**), *Combretum micranthum* and *Guiera senegalensis*. Interpretation of radar imagery distinguishes the following (predominantly) shrub vegetation types: "Dense shrub grassland" and "shrub grassland" which offer a woody cover of shrub like *Combretum* spp., *Guiera senegalensis*, *Acacia* species, *Calotropis senegalensis* and *Boscia senegalensis*, adequately classified them as wooded formations [6].

1.2 Plants species utilization patterns

Northern Sahel region of Nigeria nutritional habits are equivalent with slight variations influenced by traditional backgrounds. All the trees selectively protected in the parklands provide one or combinations of the following concrete and immaterial services: food items (edible fruits, nuts, leaves, flowers, livestock fodder, fuel wood, medicine, esthetics, shade, agricultural tools and cooking utensils, avenues, and other services such as ropes, fibers, tannin, manure, latex gums and oils). Patterns of exploitation are quite similar for the entire region. However, additional trees were protected based on their medicinal values and food, Fire wood (fuel energy and heating) stand equally of importance, with the exception of *Adansonia digitata* and *Calotropis procera*, all species were utilized as fire wood obtained from prunings, complete felling or pollarding [6]. All the constituent parts of the tree featured regular and often in the food security and nutritional resources for the people and with some quantity sole in the market as sources of income. Many of the cattle farmers still rely substantially on those trees for chopped forage, while the fruits, shells were also fed to the livestock. Shade provision was unique with *Parkia biglobosa, Adansonia digitata* and *Tamarindus indica* alongside with *Mangifera indica* due to their broad canopies. Currently, income from the sales

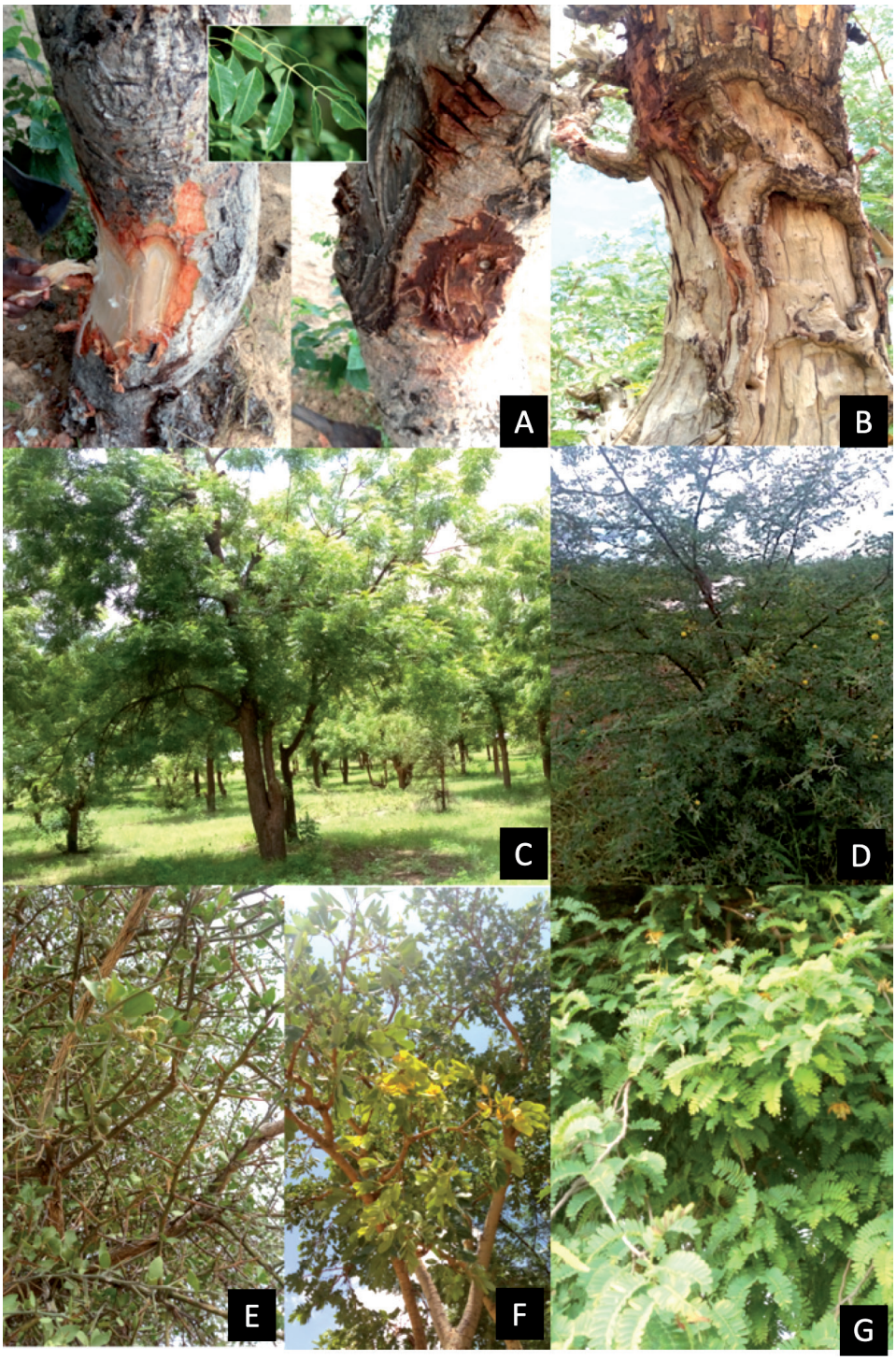

Figure 2.
Threatened useful plants from the Sahel region in Nigeria. (a) Sclerocarya birrea, *(b)* Acacia seyal, *(c)* Azadirachta indica, *(d)* Acacia nilotica, *(e)* Balanites aegyptiaca, *(f)* Detarium microcarpum, *and (g)* Tamarindus indica.

of fruits of *Parkia biglobosa*, *Vitellaria paradoxa*, *Adansonia digitata*, *Tamarindus indica*, *Balanites aegyptiaca* and *Acacia seyal* (**Figure 2b**) accounted for 30-45% of the farmers' income. Common known exotics like *Mangifera indica*, *Anacardium*

occidentale and *Azadirachta indica* (**Figure 2c**) were on a balance with most the indigenous trees and were equally threatened. Soil fertility nourishment happened to be secondary role from some of these trees through litter falls. The Sahel savannah covers an area of 31,468 km^2, where some of the species were also threatened in parks and fetish channels arising from remarkable reasons, which bans the cutting down of some species such as *Adansonia digitata*, *Tamarindus indica*, *Acacia senegal* and *Faidherbia albida* [6].

Nevertheless, small number of both species was assessed due to the fact that, many were threatened, deteriorated as a result of human and edaphic factors. Many were not assessed in the IUCN Red list due to the aforementioned factors that pressurized on them to be disappeared or not even listed in the whole list [7]. All stakeholders showed consistent preference for the following species: *Adansonia digitata*, *Acacia seyal*, *Acacia nilotica* (**Figure 2d**), *Acacia senegal*, *Anogeissus leiocarpus*, *Azadirachta indica*, *Anacardium occidentale*, *Balanites aegyptiaca*, *Borassus aethiopum*, *Ceiba pentandra*, *Combretum microcarpum*, *Eucalyptus camaldulensis*, *Diospyros mespiliformis*, *Faidherbia albida*, *Guiera senegalensis*, *Gmelina arborea*, *Hyphaene thebaica*, *Lawsonia inermis*, *Lannea acida, Khaya senegalensis*, *Moringa oleifera*, *Mangifera indica*, *Parkia biglobosa*, *Piliostigma thonningii, Pterocarpus erinaceus*, *Pinus* spp., *Salvadora perica*, *Senna siamea*, *Tamarindus indica*, *Vitellaria paradoxa*, *Vitex doniana* [8]. Highly valued naturalized exotic fruits trees including *Mangifera indica*, *Psidium guajava*, *Anacardium occidentale*, *Azadirachta indica* and *Citrus* spp. Nevertheless, *Acacia senegal* has been exploited commercially for gum Arabic with plantations existing in Yobe state, other plantations were mainly for afforestation and shelterbelts planted up with exotics including *Pinus* spp., *Eucalyptus* spp., *Gmelina arborea*, *Azadirachta indica* and *Senna siamea* [9, 10].

1.3 Other threatened species

A considerable numbers of indigenous species were reported to have declined in some years back. The focus groups credited the decline of these species due to some activities (land degradation) occurred [11]. Certain percentages have shown that the species faced a lot of problems (Ranging 36%-60%) of all the species found in the Sahel. The common plants species involved across the towns and villages were *Acacia tortilis, Ficus glumosa*, *Balanite aegyptiaca* and *Sclerocarya birrea,* whereas, some disappeared including *Albizia chevalieri*, *Acacia senegal, Ficus thonningii* and *Khaya senegalensis,* many factors have contributed towards the disappearance of those species. Furthermore, some exotic species were present and also served many roles in the environment without the much existence of those threatened species especially *A. indica* which has been proclaimed to cause a setback on the farm produce due to some negative impacts on the farm lands. The level of poverty has tremendously attributed towards the negative actions across the threatened plants species, for the search of food, shelter and other agricultural practices and very poor planting and management of trees across the region [12].

2. Methodology

Survey was conducted across the region in collating the reliable information in conjunction with search engines for the peer reviewed journals and books in getting sound and reliable information with regards to the threatened species found in Sahel region. Information on the uses of plants especially those with medicinal properties were carried out by using a survey form and interviewing traditional medicine practitioners, herbs gatherers and sellers. Images of the plants mentioned

were taken in the natural habitat and voucher specimens were collected and preserved following the standard herbarium technique.

2.1 Collection of plant materials and identification

Plant species collected were organized as complete herbarium specimens and identified as outline by the rules of herbaria. Plant materials were identified

No.	Botanical name	Family	Common name	Local name	Habit	Part(s) used	Voucher no.
1.	*Adansonia digitata*[***]	Malvaceae	Baobab tree	Kuka	Tree	Stem, leaves	MSA36
2.	*Anogieeossus leocarpa*[**]	Combretaceae	African birch	Marke	Tree	Stem, leaves	MSA29
3.	*Azadirachta indica*[*]	Meliaceae	Neem	Darbejiya	Tree	Stem, leaves	MSA348
4.	*Balanites aegyptiaca*[*]	Zygophyllaceae	Desert tree	Aduwa	Tree	Stem	MSA359
5.	*Cassia singueana*[**]	Fabaceae	White or winter cassia	Runhu	Herb	Leaves	MSA316
6.	*Detarium microcarpum*[*]	Fabaceae	Sweet dear	Taura	Tree	Leaves	MSA71
7.	*Gueira senegalensis* [****]	Combretaceae	Senegal Gueira	Sabara	Shrub	Leaves, root, gall	MSA32
8.	*Khaya senegalensis* [**]	Meliaceae	Mahogany	Madaci	Tree	Stem	MSA116
9.	*Leptadania hastate* [***]	Apocynaceae	Kayila	Yadiya	Herb	Leaves	MSA248
10.	*Piliostigma reticulata*[***]	Fabaceae	Camel's foot	Kargo	Tree	Stem	MSA72
11.	*Prosopis africana* [***]	Fabaceae	Iron tree	Kirya	Tree	Stem	MSA193
12.	*Psidium guajava*[**]	Myrtaceae	Guava	Goba	Tree	Leaves	MSA336
13.	*Sclerocarya birrea*[****]	Anacardiaceae	Marula	Danya	Tree	Stem	MSA435
14.	*Senna italica*[***]	Fabaceae	Italian thorn	Filasko	Herb	Leaves	MSA68
15.	*Tamarindus indica*[***]	Fabaceae	Tamarind	Tsamiya	Tree	Stem, leaves	
16.	*Vachellia nilotica* [****]	Fabaceae	Arabic gum	Bagaruwa	Tree	Pods	MSA74
17.	*Zizyphus mauritania*[***]	Ramnaceae	Chinese Apple	Magarya	Tree	Leaves	MSA186

[****]*Most cited plants.*
[***]*Second most cited plants.*
[**]*Partially cited plants.*
[*]*Least cited plants.*

Table 1.
Medicinal plant species collected from the survey area with their medicinal values.

and authenticated by a plant taxonomist in person of Dr. Yusuf Nuhu, from the Department of Plant Biology, Bayero University Kano, Nigeria. All identified plants specimens were given vouchers number as outline in (**Table 1**).

2.2 Data organization

The collected data was quantified using some quantitative indices such as Informant consensus factor (ICF), Relative frequency of citation (RFC) and fidelity level pinpointed by [13, 14].

2.3 Relative frequency of citations

It was used to authenticate the local benefit of each species in the study areas. Its index was determined by dividing the number of informants cited useful species (FC) by the total number of informants participated in the survey (N), as viz.: RFC = FC/N [15].

3. Results

The collated plants were identified and authenticated in line with the responses from the respondents. They were given voucher numbers as outlined in **Table 1** below, as well as the citation frequencies were procured based on the procured data as shown in **Table 2**.

No.	Species	Family	FC	RFC
1.	*Adansonia digitata*	Malvaceae	6	0.06
2.	*Anogieeossus leocarpa*	Combretaceae	4	0.04
3.	*Azadirachta indica*	Malvaceae	1	0.01
4.	*Balanites aegyptiaca* (**Figure 2e**)	Zygophyllaceae	1	0.01
5.	*Cassia singueana*	Fabaceae	4	0.04
6.	*Detarium microcarpum* (**Figure 2f**)	Fabaceae	1	0.01
7.	*Gueira senegalensis*	Combretaceae	33	0.34
8.	*Khaya senegalensis*	Meliaceae	3	0.03
9.	*Leptadania hastate*	Apocynaceae	5	0.05
10.	*Piliostigma reticulata*	Fabaceae	9	0.09
11.	*Prosopis africana*	Fabaceae	9	0.09
12.	*Psidium guajava*	Myrtaceae	2	0.02
13.	*Sclerocarya birrea*	Anacardiaceae	20	0.21
14.	*Senna italica*	Fabaceae	8	0.08
15.	*Tamarindus indica* (**Figure 2g**)	Fabaceae	5	0.05
16.	*Vachellia nilotica*	Fabaceae	26	0.27
17.	*Zizyphus mauritania*	Ramnaceae	6	0.06

Citation frequencies as far the species collated.

Table 2.
Relative frequency citations values of the surveyed medicinal plants in Yobe state, Nigeria.

4. Discussion

Ethnobotanical information gathered were quantitatively analyzed using various quantitative indices which made up of: Relative frequency of citation (RFC) and Frequency of citation (FC) [14, 16]. It has been proved that, the RFC was happened to be (0.25) for the gastrointestinal disorders among the collated medicinal plants [13], which conforms to the present study as pinpointed in **Table 2**. It has been revealed that, 80% of African populace relied on herbal/traditional medicine to treat many ailments due to the in availability and affordability of the commercial orthodox. In Northern Nigeria, people make used of combined plants formulations to get rid of gastric ulcer problem, which include *A. nilotica, Balanites aegyptiaca* and *Ziziphus abyssinica* extracts, have been concluded and validated that, using combined plants formulations showed sound activity than using individual plants in treating ulcer [17]. *Gueira senegalensis* has been in records and used by traditional practitioners as medicine in many parts of West Africa including Nigeria. The latter confirms the present study as shown in **Table 1**. Its leaves were taken for many purposes like; pulmonary and respiratory problems, colic and diarrhea, syphilis, beri-beri, leprosy, rheumatism, diuresis, impotence and expurgation [16]. Furthermore, its roots and bark have been used in treating diarrhea, dysentery and abdominal pain which was found worthy that, the whole plant has pharmacological attributes by serving as antimicrobial, analgesic, anti-inflammatory and also applicable to address animals' ailments and their supplements as diet [18]. Over utilization made some to be in an extinction due to the lack of enforced law [5], which is similar to the current study as shown in (**Figure 3**) the effect of over destruction or deforestation of plant species.

Figure 3.
Major caused of depleting plant resources in the Sahel region. (a) Demand for timber and (b) bush fire.

5. Case study: neem tree

5.1 An overview

Neem (*Azadirachta indica*) is a common tree throughout Sahel, for a worthy reason. It grows dynamically under semi-arid and humid tropical conditions as well as responds to numerous needs. Its dispersed canopy provides shade from the tropical sun. In the Sahel region, neem tree of many uses including as source of fire wood, it protects millet, sorghum and other crops from desert wind and insect pests as it possessed insecticidal properties, and myriads of medicinal importance. Neems in the Sahel region of both Nigeria and Niger do lacked some minerals in certain period in a year; this resulted to yellowish leaves and stunted growth in the end, appeared unhealthy. Many trees have died due to the lack of those vital

minerals [6]. Moreover, Neem trees are attractive broad-leaved evergreens that can grow up to 30 m tall and 2.5 m in girth. Their dispersal divisions' form rounded crown as much as 20 m across. They continue in leaf except during life-threatening drought, when the leaves may fall off. The short, usually straight trunk has a moderately thick, strongly furrowed bark. The roots enter the soil deeply, at least where the site permits, and, particularly when injured, they produce suckers. This suckering has a habit of to be especially prolific in dry localities. Neem can take significant abuse. For example, it easily withstands pollarding and its topped trunk resprout robustly. The small, white, bisexual flowers are borne in axillary clusters. They attract many bees for honey. Neem honey happened to be popular, and in fact contains no trace of azadirachtin. The fruit is up to 2 cm long, when developed, it became yellow or greenish yellow and comprised a sweet pulp enfolding a seed. It is the kernel that was used most in pest control (The leaves also contain pesticidal ingredients, but as a rule they are much less effective than those of the seed). A neem tree normally start bearing fruit after 3-5 years, became fully productive in 10 years' time and from then, can yield up to 50 kg of fruits annually. It may live for more than two centuries [6].

5.2 Neems characteristics

Shade is not the only appreciated characteristic of neem. It has so many uses and potentialities for future usage, that was why it considered as miraculous, it is used for furniture, fuel and in construction, it also attract bees and honey flavor. Neem has been declared as local pharmacy. In India, people use neem twig to prevent from teeth damage. It also cured skin disorders, enhanced tonic, treats infectious diseases and fevers [19].

5.3 Neem as part of the West African trees

Neem was brought to West African region through Ghana in the year 1919 and 1927. It became familiar and well spread across towns, villages and cities including Sahel regions. Neems have been declined due to some biotic and abiotic factors which lead to its deterioration in the whole region; it served as a great set back in the development of the Sahel region [20]. Moreover, certain factors also lead to neem declination such as; defoliation by insects, drought or an exposure to pollutants at times certain microbes' infestation may lead to decline in the neem population as well, similar case has been reported on *Acacia nilotica* in Sudan which shared same peculiarities with the Sahel parts of Nigeria [19]. Nevertheless, Sahel normally has a very long dry periods, (July–September rainy season), neem has been reported widely adapted to the arid and semi-arid tropics, long-term stress could result from the developing of neem in plantations where trees compete for available moisture, a narrow genetic base with little variability in susceptibility to stress, poor planting techniques and localized soil nutrients deficiencies in combination with a long dry period as well. Furthermore, other factors such as soil compaction also leads to the declination of neem especially areas of much human and livestock activities resulted to some fungi such as *Nigrospora* and *Curvilaria* as well as cruising by some livestock [21].

5.4 Uses of neem tree in the Sahel

Native to India and Myanmar, the neem being a member of the family Meliaceae together with the mahoganies. It does possessed compound leaves of nine to 15 leaflets which are dark green in color. The fruits are yellow-green to green, smooth, olive-shaped and about 2 cm in length, with a sweet pulp enclosing a seed. Consequently, Neems can grow up to 30 m in height and 70 cm in diameter, with

broad, dispersal pinnacles that retain their foliage all year round. Neem due to its attributes, it is highly valued [19].

5.4.1 Timber

Neem is a member of the mahogany family. It is moderately heavy, with a specific gravity varying from 0.56 to 0.85 (average, 0.68). With a strong smell when freshly cut. Although simply sawn, worked, refined, and glued, it must be dried wisely as it often splits and warps. It also splits easily and nailed. However, it is widely used in carts, tool handles, and agricultural implements. In South India became very common furniture wood. It is aromatic, attractively spotted, narrowly linked, and then medium to be coarse in texture. Although it lends itself to carving, it does not take a high polish. The timber appeared durable even in exposed situations. It is rarely attacked by termites, its resistant to woodworms, and makes useful fence posts and poles for house construction. Also used as pole wood especially in developing countries; the tree's capability to resprout after cutting and to regrow its canopy after pollarding makes neem highly suited to pole production. In view of the above, those rigorous activities have threatened its population as well [6].

5.4.2 Fuel

Neem became threatened due to its useful oils produced; it usually burnt in lamps throughout many countries. Its wood has long been in the practice of burning for food as well. Furthermore, husk produced by the seeds, mainly employed as fuel. Because of the tree's good growth and valued firewood, it has become the most vital plantation species in northern Nigeria. It is also grown for fuel around large towns. Charcoal made from this neem wood stands excellent quality, with a rich value only somewhat below that of coal from Nigeria's some of the eastern parts. Neem is very common, especially in towns and villages, in the northern regions despite been threatened [6].

5.4.3 Medicinal values of neem

Although masses in India insisted on the effectiveness of neem actions in treating many ailments, the pharmacological properties have hardly been threatened to severe trials with controls. It has been proclaimed that, neem trees have been in practice in curing many diseases most especially the oil extracted from it, but many findings contradict with the claim to be wise enough in curing children's at the tender age [22]. Neem being a Meliaceae family, a famous plant with medicinal attributes since time immemorial. *Azadirachta indica* have a numerous medicinal attributes. Notably, leaf and bark were used in the treatment of gingivitis, periodontitis, sores, boils, enlarged spleen and malarial fever during childbirth, measles, smallpox, head scald, as well as cutaneous affections [23]. Moreover, seed oil from neem and essential oils of both leaves and bark possessed the potentialities of curing many ailments notably; *Mycobacterium* and *Plasmodium* [24]. Neem oil was used as contraceptive (Vaginal infections) and mosquito repellent due to the fact that, nimbin, nimbinin were found and nimbidin inclusive [23].

5.5 Neem needed a tougher law of protection

Neem deterioration is increasingly appeared in large areas of Nigerian states most especially in neighboring countries like; Niger, Cameroun, Chad and Mali as a

result of inaction to the problem occurred in the areas by the government and non-governmental agencies that can curve the menace. Certain measures can lead to the solution to the neem declination which will definitely enhance the socioeconomic effects of neem deteriorations [25]. Neem tree served as an insecticide by possessing some pesticidal components, it attacks so many as widely practiced in West Africa. But in some parts of the world, such as India, Far East Asia, it defoliates and also kills the tree. Reports have been documented that an oriental yellow scale damaged several neem trees in across West African countries including North eastern Nigeria and Eastern Niger, which lead to an eminence drought in the Sahel, which turned many neem trees weak and sickly [26].

6. Conclusion

The biodiversity has been lost at a higher rate in most parts of Nigeria especially in Sahel region, where people solely depend on plants to carry out their life activities. Many factors have contributed a lot most importantly human related, such as: medicinal purposes, industrialization, technological advancements and settlements for urbanization. Moreover, direct causes of biodiversity loss in Nigeria made up of; poor law enforcement and weak laws, much demand from forest products, cultural practices which contributed tremendously in cutting down of vegetation and lead to loss in biodiversity as depicted, many plants would likely to be in extinction if care is not much taken. Proper awareness on the sustainable use of these mostly utilized species within the Sahel region should be forcefully and continuously communicated to the communities living of the resource so that they could one day be the custodian and guardian of their forests and natural resources. We believed that effective conservation and sustainable used of natural resources got to be community based, coupled with national and international law to safeguard their livelihood.

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Conflict of interest

The present book chapter contribution has no conflict of interest declared.

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