

Endangered Trees, Herbs and Shrubs in Nigeria, Why They Are Endangered and Conservation Approaches

Mohammed Inusa Nguru and Rabi Sabo

School of Sciences, Department of Science Laboratory Technology,
Mai Idris Aloomo Polytechnic P.M.B. 1020 Geidam, Yobe State, Nigeria.
Email: ngurumuhammad@yahoo.co.uk

Abstract

Plants are crucial to the life of man as agents of primary production. Man relies on them for food, shelter and medication. As human population is increasing more pressure is put on the forest and forest products. There is massive felling of trees for farmland expansion, urbanization and domestic use of firewood as source of energy for heating and cooking. This enormous pressure makes some species to become endangered with some disappearing from the globe totally (extinction). The level of exploitation of plant resources is becoming bigger than production. This article highlights some ways that could be followed to conserve the endangered species from total extinction. Some of the conservational approaches include knowledge creation and awareness, provision of alternative sources of energy, value adding to local forest products, massive afforestation, plant tissue culture to increase production and improve upon the existing species by adding some desirable qualities, Government policies and laws to restrict bush burning and indiscriminate cutting down of trees, agroforestry practices to save trees at the same time produce food.

Key words: Endangered species, Conservation, approaches, trees

Introduction

Endangered trees, herbs and shrubs in Nigeria, why they are endangered and conservation approaches

A well-managed tropical forest is constantly self-renewing resource. It produces several benefits among which are high quality timber, rattan and rubber, fuel wood, fruits, nuts, spices and other foods, and numerous “minor” products of high economic value such as dyes and medicines. These multiple products can sustain the basic needs of local communities as well as providing goods and services for outside markets (Okunlola & Akinyele, 2015). Nigeria has a total land area of about 99.3 million hectares and only 10 percent of that is estimated to be a forest land. This is very small when compared with countries like Ghana with 41%, Liberia with 48% and Sierra Leone with 26% (Okunlola & Akinyele, 2015). According to 1997 IUCN Red list of threatened plants over 12.5% of the World's plant species has been identified as globally threatened. These threatened species cover around 34,000 species which are facing the danger of extinction if no any effort is made to conserve them (Walter, K.S. and Gillett, 1997). In Canada wild medicinal plants are already threatened by harvesting of medicinal plants, land clearing and development, logging, and invasive weedy species (Westfall & Glickman, 2004). An estimated US \$60 million have been realized from the global sales of medicinal herbs in the year 2000 (Idu et al., 2010). A total of commonly used plants from 56 genera, belonging to 31 families were used among the traditional healthcare practitioners in Abeokuta (Idu et al., 2010). As reported by World conservation and monitoring centre (WCMC) about 8000 tree species are endangered worldwide (Choudhury & Khan, 2010).

Estimates shows that two thirds of the World population use plants and their related products for medical care (Agyemang et al., 2021). In Ethiopia the Boosat people collected medicinal plants from the wild, with only few under cultivation. they are obtained from woodlands, roadsides, farmlands and spiritually protected areas. Depending on the part of the plant collected some of these plants are unsustainably collected posing a threat to their habitat (Debela et al., 2006). medically important plants are some of the victims of indiscriminate and wanton destruction

of tropical forests by man. These plant species are disappearing at a very alarming rate. half of the World's plants lies within the tropical forests are in danger as they are declining by about 16.8 million hectares per annum as reported by FAO (2012) (Adeniran & Daramola, 2018). The world health organization (WHO) estimates that about 80% of the population of the developing world countries use traditional medicine, particularly herbal medicine for their health care needs (WAHO, 2013; Duguma & Mesele, 2019; Ekor, 2014). This is because an assessment by FAO and UNEP in the forest resources showed that in 1980 about 11.4 million hectares of closed and open forests were being cleared annually, 3.7 million hectares in tropical Africa, 5.7 million hectares in tropical America and 2.0 million hectares in tropical Asia (UN reports, 1991). This report shows that the causes of deforestation in the late 1970's varied according to region with the expansion in agriculture accounting for the highest rate of deforestation. Apart from agricultural expansion, the rate of deforestation through road construction, timber logging, cutting of fire wood and charcoal, carving of mortar and pestle and other domestic utensils, is far more greater than the rate at which the trees are planted or replaced hence making them to become endangered species (Naziru, Z. M. and Habu, 2017; U.C., 2019). Senegal and Mauritania, like most countries in sub-Saharan Africa, face two crucial challenges: the need for energy for development, and climate change, to which these countries are particularly vulnerable. In this region, the lack of access to energy directly affects 70% of the population, and 85% in rural areas. In addition, about 730 million people use solid fuels for cooking (firewood and charcoal), harmful fumes and whose exploitation puts strong pressure on the forest resource. In places such as Africa and Asia, herbs are even used as the first line of treatment for diseases such as malaria, diabetes, hypertension, sickle cell anaemia, dermatological disorders, and most recently, HIV/AIDS opportunistic infections. In fact, over 120 pharmaceutical products currently in use are plant-derived, and most of these originate from the tropical regions of the world including Africa.

Endangered trees, herbs and shrubs in Nigeria, why they are endangered and conservation approaches

Endangered species of trees, shrubs and herbs in Nigeria.

Endangered species: is a population of an organism which is at risk of becoming extinct because it is either few in numbers, or threatened by changing environmental or predation parameters(Nadeen Sadeq Abdullah Hinnawi, 2010). Fasola et al define a threatened plant as plant in which the worldwide population is below 1000 or is found in less than 100 locations(Ogunshe & Onyeachuchim, 2004). The world conservation union (IUCN) has developed a criteria for evaluating the extinction probability of species(IUCN 1994), it contains five criteria of vulnerability : Extinct, critical endangered, Endangered, vulnerable and Near threatened(Sapir et al., 2003). Nigeria is rated highest in terms of deforestation in the World considering its large population and on economy

based largely on extensive, land based agriculture and extraction of natural resources(Isichei, 2010). In 2016, Asian countries imported about 1.4 million m3 of rosewood from West Africa, of which 58 per cent came from Nigeria(Jaya, 2019). The rate of deforestation in Nigeria was 1.8%per annum which was higher than any other country of the world. In Osun state a study was conducted using GIS and remote sensing and the result showed that the average rate of deforestation of 3.1%was shown(Asifat et al., 2019). Global forestry is battling with the problem of forest depletion, culminating into desertification and famine and extinction of species. Research indicated that there are over 4,600 plant species in Nigeria ranking the country the eleventh in Africa in terms of diversity of species(Haastrup et al., 2019). The developmental challenges of the country can only be tackled if the environment is protected and restored(Jaya, 2019).

Fig. 1 Causes of deforestation in a forest. Source Isichei, A. O. (2015).

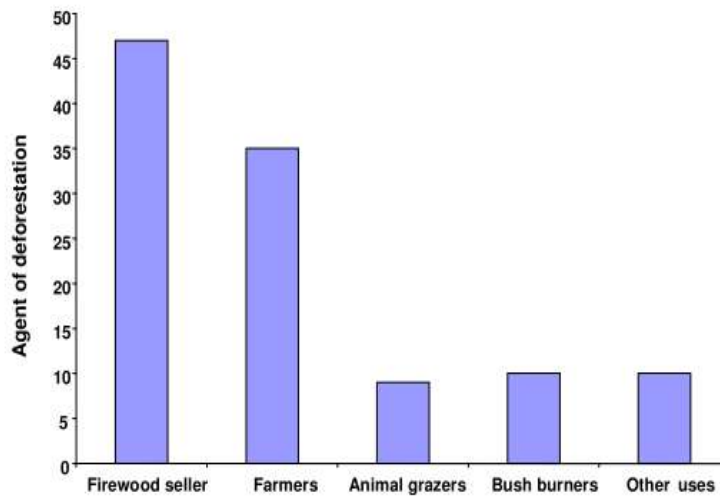


Figure 2. Agents of deforestation in the study area.

Source Isichei, A. O. (2015).

The value of wood and non-wood forest products is enormous even though there is no clear

statistics to that. Studies have shown that forest reserves occupy about 10 million ha in Nigeria

Endangered trees, herbs and shrubs in Nigeria, why they are endangered and conservation approaches

which accounts for about 10% of a land area of approximately 96.2 million ha (Alamu, L.O. and Agbeja, 2011). Native species of trees such as *Milia excelsa*, *Entandrophragma spp*, *Khaya senegalensis* were highly exploited for their quality timber and they are severely threatened and almost extinct in Nigeria (Onefeli & Adesoye, 2014).

In South Eastern Nigeria about 30 plant species belonging to 19 different families were identified as endangered species. Four are climbing dicotyledons, two are monocots and the nineteen are tree species (Meregini, 2005). In the Sahelian region habitat loss has been attributed to human clearance for fuel wood, grazing and conversion to intense agriculture (Cresswell et al., 2007).

In Nigeria a gradual loss of the traditional knowledge about plants due to oral transmission has been reported. Similarly medicinal plants are at the risk of extinction through unsustainable exploitation (Mukaila et al., 2021). Traditional medicine is simply accessible, effective in treatment and has an affordable cost compared to modern medicine (Duguma & Mesele, 2019). A species is said to be endangered if there is a reduction in the number of that species at a given time (estimated to be less than 2,500 mature individuals). An endangered species is facing the danger of extinction if the threatening factors persist. By projection extinction of 20% within 20 years (Abubakar et al., 2018; Isichei, 2010). In Igonigoni and Abo Mkpang villages in Cross River state a comparison study was conducted to identify the relationship of the villagers' life with tree and tree products. Tree and tree products make a significant contribution to the food security of many rural households. They are used

as a source of wood for construction, firewood, medicine, as a source of food (fruits, edible seeds and edible leaves) and miscellaneous tree use (Justine, D. and Damian, 1992). North eastern and north western Nigeria is threatened by the confrontational effect of desertification. The phenomenon is distressingly intensifying as a result of exploitation without replacement. The Sahelian region bordering Niger Republic is facing a huge cutting down of trees subsequently exposing the ground cover coupled with overgrazing by cattle (Go, 2020). Trees and other valuable plants have undergone different levels of depletion due to rapid increase in human population, this led to cutting of trees for firewood, charcoal production, and infrastructural developments (Ogwu, M.C., Osawaru, M.E. and Obayuwana, 2016). In the Sahelian region the plants destroyed were mostly aromatic and medicinal plants gathered, traded and used by communities as a source of livelihood (Go, 2020). Overharvesting has placed many medicinal species at risk of extinction (Roberson, Emily, 2008).

Exploitation of plant for medicine.

A medicinal plant is any plant which, in one or more of its organs, contains substances that can be used for therapeutic purposes or which are precursors for the synthesis of useful drugs. This description makes it possible to distinguish between medicinal plants whose therapeutic properties and constituents have been established scientifically, and plants that are regarded as medicinal but which have not yet been subjected to a thorough scientific study (Sofowora et al., 2013).

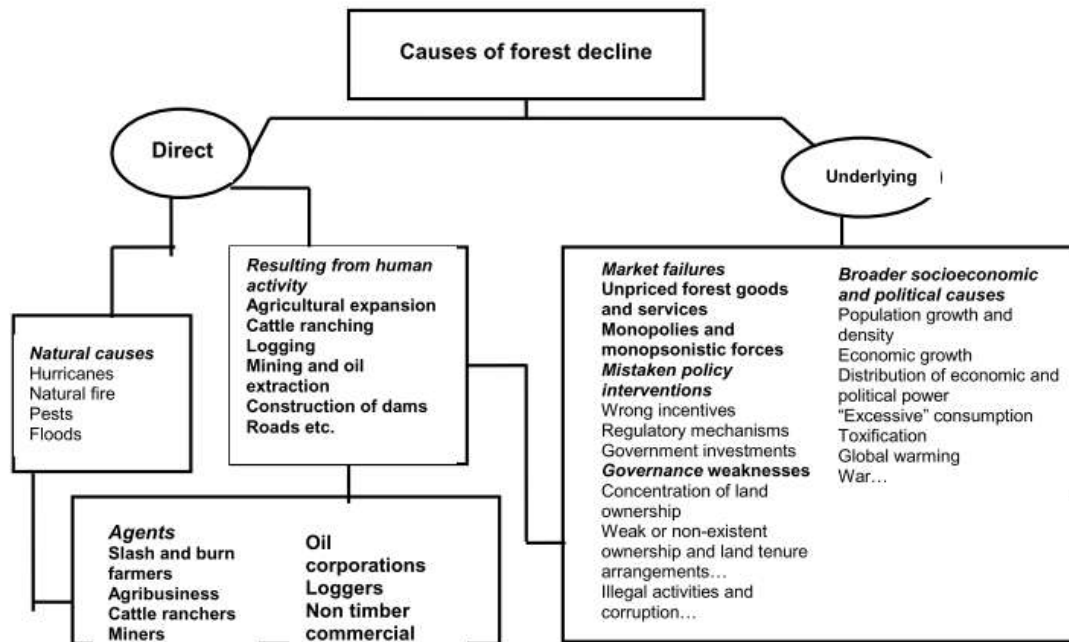


Fig. 3 Causes of Forest decline. Source Isichei, A. O. (2015).

According to IUCN and WWF there are between 50,000 and 80,000 flowering plant species used for medicinal purposes worldwide (Chen et al., 2016). Many economic and effective medicinal plants have disappeared resulting from unsustainable harvest and destruction of tropical forest for farmland expansion and urbanization (Oni, 1993). Osemeobo studied on the capability of the rain forest of Nigeria over sustaining the commercial harvest of medicinal plants. The study shows that under common resources management with no plan and sustainable harvest of the medicinal plant over harvesting or over exploitation is due to occur as the level of harvest is greater than regeneration, hence conservation action must be included to sustain the trade in forest resource (Osemeobo,

2010). In Katsina state prominent medicinal plants are endangered seriously subjecting them to threat of total extinction. Plant species such as *Neocarea macrophylla* (Gawasa), *Sclerocarya birrea* (Daniya), *Detarium microcarpum* (Taura) and *Prosopis africana* (Kirya) (Bello, A., Jamaladdeen, S., Elder, M.T., Yaradua, S.S., Kankara, S.S., Wagini, 2019). Medicinal plants therefore constitute a vital resource that can be harnessed for both health and socio-economic benefits. Nevertheless, but for the high cost of modern medicines, limited national health budgets and inadequate health facilities, which have compelled many governments to reconsider the advantages of traditional health care systems, the sector has remained largely ignored.

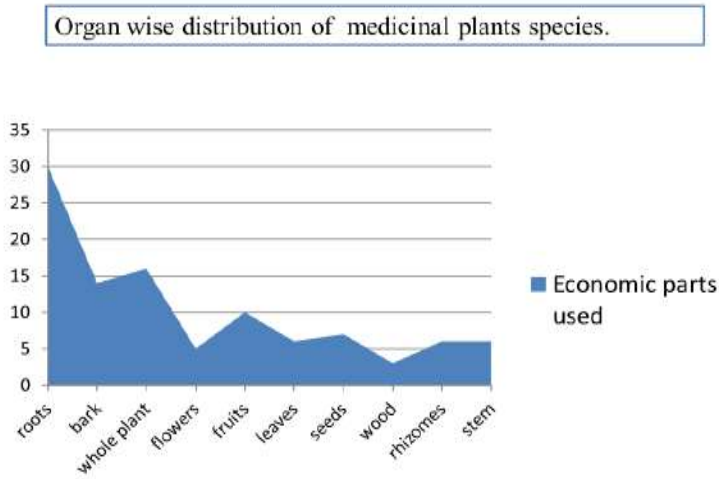


Fig 4. Parts of plants used. Source Isichei, A. O. (2015).

Exploitation of plant for timber

In developing countries Nigeria inclusive fuelwood is the major source of energy as poor masses cannot afford conventional cooking gas or kerosene. The over reliance on fuel wood brings about environmental degradation particularly desertification as result of indiscriminate cutting down of trees for firewood(Mukhtar, A.A. and Abdullahi, 2020). *Milicia excelsa* is a fast - growing forest trees species native to tropical

Africa, especially west and East Africa. The tree is classified as “lower risk but near threatened” in the international union for conservation of nature (IUCN) red list of threatened species. This is as a result of threat from habitat loss and degradation due to expanding agriculture, overexploitation of the wood. It produces one of the World's most valuable commercial timbers(Babalola et al., 2013; U.C., 2019).

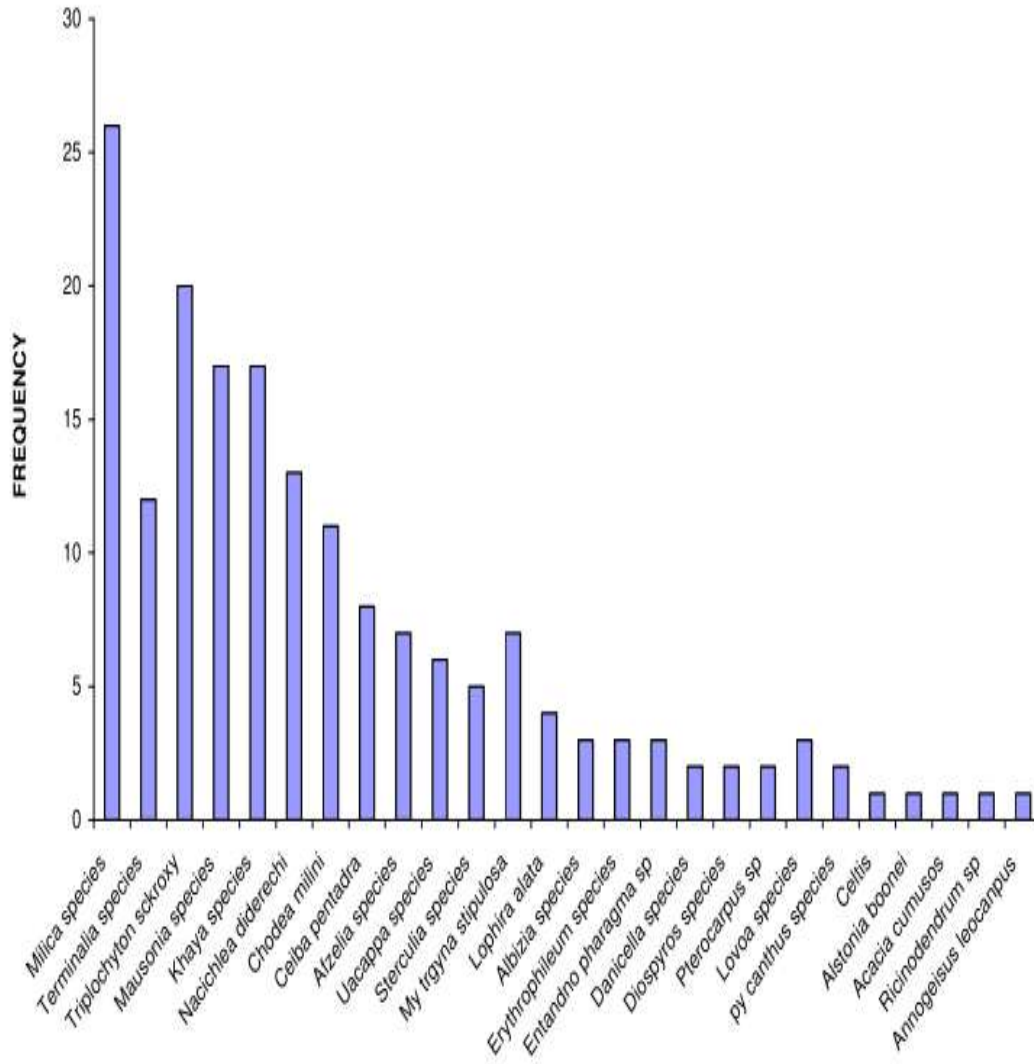


Fig 5. Indigenous endangered tree species experiencing deforestation Source Isichei, A. O. (2015).

Exploitation of plant for firewood and other uses.

In sub-Saharan Africa more than 90% of the households rely on firewood, charcoal and waste for cooking in about 25 countries(Iglesias et al., 2018). In Nigeria 94% of the population rely on firewood and charcoal for cooking. Traditional cooking using firewood is related to health risks arising from smoke , causes deforestation and climate change in addition to being very expensive(Iglesias et al., 2018). Using firewood in cooking is the major causes of deforestation in Nigeria burning p to 90% more wood than is necessary making families to spend more money that could be put in health, education and

nutrition(Iglesias et al., 2018). In South eastern Nigeria the demand for and consumption of the fruits and seeds of indigenous and wild species has no age limit boundary, standards of living or literacy level. mention of the feeding habit of the people will be incomplete without mentioning them(Meregini, 2005). In South western Nigeria, disappearance of indigenous trees from urban areas is taking place in alarming rate and the contributions of the existing trees are not adequately formalized(Babalola et al., 2013). Other species of trees that are threatened by agricultural expansion and urbanization includes:

Endangered trees, herbs and shrubs in Nigeria, why they are endangered and conservation approaches

- The Baobab tree (*Adansonia digitata*), Dum or Ginger bread palm (*Hyphaene theibaca*), Silk cotton tree (*Ceiba pentandra*), Tropical tulip tree (*Spathodea campanulata*), *Prosopis africana* (Kirya), Indian tamarind tree (*Tamarindus indica*), Desert date (*Balanites aegyptiaca*), *Anogeissus schimperi* (marke), Dry zone ebony tree (*Diospyros mesfiliformis*). These tree species are regarded as endangered species. Odoligie and Wisdom (2019) noted that poverty, population growth, invasive alien species, habitat fragmentation are some of the prominent factors for depletion of biodiversity in Nigeria (Imarhiagbe & Egboduku, 2019). In Kano state, a total of thirty one (31) species of medical importance were said to be threatened including *Securidaca longipedunculata*, *Prosopis africana*, *Mitragyna inermis*, *Terminaliaacicenoides*, *Lamnea Microcarpa*, *Kigelia africana*, *Ficus sycomorus*, *Cissusquadrangularis*, *Ceiba pentandra*, *Burkea africana*, *Balsamodendron africanum*, *Aristolochia albida*, *Albizia chevalieri*, *Anogeissus leiocarpus*, *Acacia seyel*, *Acacia nilotica*. Loss in plant species is attributed to Urbanization, deforestation, expansion of agricultural activities and unsustainable collection of plants with a very few effort of conserving or cultivating the species (Abubakar et al., 2018). Biodiversity loss is increasing in exponential rate in northern Nigeria especially across the northwest and north eastern states threatened by desertification. Plants are primary producers all other consumers depend on plants for food, fibre and energy. Environmental crises such as global warming and biodiversity loss involves plants directly (Isichei, 2010). Moreover, in these societies, herbal remedies have become more popular in the treatment of minor ailments, and also on account of the increasing costs of personal health maintenance. Indeed, the market and public demand has been so great that there is a great risk that many medicinal plants today face either extinction or loss of genetic diversity. In developing countries all over the world, large numbers of people die daily of preventable or curable diseases because of the lack of even simple health care. Diseases in these countries are often associated with malnutrition. As a result, those that do survive often never recover

completely from the effects. The developing world is not a homogenous entity, but is made up of a variety of widely differing countries and areas which are at different stages of development. Nevertheless, these developing countries have certain features in common, including extremely limited resources, poor communications, vast distances, low levels of education, and individual and community poverty. These factors act together to keep these countries in a perpetual state of poverty. Yet, their populations continue to rise, especially in the rural regions which usually account for about 80 per cent of the total population.

Discussion, conclusion and recommendation.

In Nigeria the total forest estate which covers around 10% of the country's land area in 1996 is now less than 6%. This seriously calls for forest conservation practices. The synergy between human population and forest utilization is endangered as deforestation, soil erosion, flooding and pollution increases (Onwubuya, E.A., Ogbonna, O.I. and Ezeobiora, 2014). Saving the African Region's medicinal plant resources vis-à-vis promoting the use of plant medicines for the treatment of diseases needs an effective, sustainable and coordinated strategy. Concerns have also been raised about the unregulated exploitation of Africa's bio-resources, environmental degradation, deforestation, uncontrolled burning and poor agricultural practices leading to depletion of rare and threatened medicinal plant species. Going by the population of the country and economy based on agriculture and extraction of natural resources. The country will bound to have the highest deforestation rate in the world (Imarhiagbe & Egboduku, 2019; Isichei, 2010). out of the 4,600 plant species, 707 are said to be endangered and a hundreds of plants and animals species have since gone to into extinction (GUNDU, E.G. and ADIA, 2014). According to reports by NGO rain forest action network Nigeria originally had 72,000 km² of forest which is now reduced to 10,000 km². deforestation is at the rate of 14.3 percent. Agricultural expansion is one of the major causes of deforestation. As population increases demand for fuel wood also increases

Endangered trees, herbs and shrubs in Nigeria, why they are endangered and conservation approaches

demand for other forest products will increase as well including medicinal products (Isichei, 2010).

measures taken to combat deforestation include:

1. promoting the use of alternative source of energy (solar or wind)

2. Reviewing endangered species acts to include endangered plant species and special habitats. Tanyan Rosen reported that despite continued conservation efforts, the status of many endangered species remains unchanged. This is attributed to limited funding allocated to benefit species research and conservation (Rosen, 2022). Threatened and endangered species are protected in forest reserves by establishing in situ preservation of a natural reserve which is least and effective means of conservation apparatus (Ali et al., 2016). Reintroduction of rare and endangered species into their natural habitat is one of the effective ways of supplementary regeneration. A plant restoration mechanism by introducing nursery grown seedlings is very good initiative to replace the lack of natural regeneration (Choudhury & Khan, 2010).

3. Massive reforestation to give more emphasis to indigenous species. This can be achieved by establishing seed banks. A seed bank is an ex-situ conservation storehouse typically for preserving seed species by storing them in controlled environment. The purpose is to safeguard the genetic purity and viability of seeds of endangered plant species for regeneration of seedlings in the nursery (Dau, J.H.; Donald-Amaeshi, U.A. and Chu.kwu, 2018). In China the priority for conservation is on the plants with extremely small population. Conservation can be achieved through environmental education campaign aimed at local communities, information sharing on species occurrence to coordinate conservation. combination of Ex situ and Insitu approaches must be a norm in every conservation project (Volis, 2016).

The conservation of a specie in its natural habitat or in the area where it grows naturally is known as in-situ conservation. these include s gene bank/ Gene sanction, biosphere reserves, national parks, sacred sites, sacred grooves etc. (Kr et al., 2014). Some plants are difficult to propagate using conventional horticultural techniques. in view of this many botanical gardens have tissue

culture laboratories for their micropropagation. This makes it easier for distribution of material of these species to other institutions around the world without the need for quarantine (Fay, 1992).

Ex-situ conservation of plants is the conservation of plants outside their natural habitat by cultivating and maintaining plants in botanic gardens parks and other suitable sites. it can also be through long term preservation of plant propagules in gene banks (seed bank, pollen bank, DNA libraries etc.) and in plant tissue culture form (Kr et al., 2014).

4 Boosting economy to reduce pressure on land as result of unemployment or retrenchment. Forest and its products will be given the needed attention for conservation by empowering the communities around forest reserves in the tropical forest regions so that they can have alternative sources of livelihood that are biodiversity friendly, this will definitely reduce their dependence on forest and forest products (Japheth, 2019). The impact of Global Environmental facility intervention (GEF) project on biodiversity conservation was studied by Tajudeen et al at the Kainji Lake National Park in North Central Nigeria. It was found out that poverty and illiteracy are the major drivers of the problems affecting conservation notably poaching, illegal hunting, boarder encroachment, over harvesting of firewood and medicinal herbs. The study therefore recommended training and giving proper education and training to the local people as well as awarding scholarships to deserving people and indigent youths (Azeez, 2012). Human activities resulted in the loss of habitats such as over harvesting of resources particularly timber, and more than 21 million hectare of forest have been lost since 1970 (Bc, 2020). Botanical gardens are areas set aside for propagation and preservation of plant species to ensure their continuous existence. 354,000 species of plant are found in the 1,500 botanical gardens around the world (GUNDU, E.G. and ADIA, 2014).

5. land and soil restoration as a means of increasing production rather than clearing new

Endangered trees, herbs and shrubs in Nigeria, why they are endangered and conservation approaches

land for agricultural expansion. poverty reduction through application of modern agricultural methods such as taungya farming alley cropping, improve fisheries and domestication of some wildlife species(Bc, 2020).

6. Adding value to local natural products i.e. setting up industries based on ethnobotany(Isichei, 2015). The implementation of millennium development goals putting emphasis on poverty reduction which will in return help in reversing the environmental degradation(Bc, 2020).

The extinction of plants is taking place at a very alarming rate following massive industrialization, deforestation, global warming, climate change arising from anthropogenic activities. Plants and their derivatives are harvested more than they are replaced back. Conventionally plants take a longer time to germinate and multiply and have a low rate of fruit /seed set and poor seed viability/germination

Plant Tissue culture or micropropagation is the collection of the vegetative parts of plant to grow them under In vitro laboratory condition. The root/rhizome of plants of few years old plants contains the potential of multiplying and growing to produce new plants. Using the method of plant tissue culture, a large number of plants will be produced within a short time with the desirable qualities needed since the method applied genetic principles (genetic engineering) to improve on a particular genome of plant. the generation of transgenics has helped in the manipulation of plant genomes at will(Naseem Ahmad And, 2016). Micro propagation of tree species offers a means of producing clonal planting stock for afforestation, woody biomass and conservation of elite germplasm(Mansor Ndoye, 2003).

Molecular biology and biotechnology are the major areas of science used in tissue culture research. The method is applied to preserve germplasm especially for hybrids which must be propagated vegetatively where seeds are not produced. The application of micropropagation techniques is witnessing a rapid change over the last few decades. The technique has pave way for mass-scale propagation commercially. Recent

advancement in biotechnological methodology of culturing plant cell and tissues has provided new means of rapidly propagating and conserving the endangered and other vulnerable plant species(Naseem Ahmad And, 2016)

References.

(WAHO), W. A. H. O. (2013). *WEST AFRICAN HERBAL PHARMACOPOEIA*. WEST AFRICAN HEALTH ORGANISATION (WAHO).

Abubakar, U. S., Khalifa, B. I., Sanusi, M., & Gawuna, T. A. (2018). Threatened medicinal plants of Kano Flora and the need for urgent conservation. *International Journal of Conservation Science*, 9(1), 173–178.

Adeniran, M. A., & Daramola, M. A. (2018). Trends in Preventing Medicinal Plants from Extinction in Ado Local Government Area of Ekiti State , Nigeria. *Journal of Environmental Issues and Agriculture in Developing Countries*, 10(1), 53–62.

Agyemang, A. O., Turkson, B. K., Baidoo, M. F., Amponsah, I. K., Lincoln, M., Mensah, K., Orman, E., & Bayor, M. T. (2021). Utilization of Plants for Medicinal Purposes and Concerns with Endangered Plant Species from Ghana. *Traditional and Integrative Medicine*, 6(1), 24–40.

Alamu, L.O. and Agbeja, B. O. (2011). Deforestation and endangered indigenous tree species in South-West Nigeria. *International Journal of Biodiversity and Conservation* V, 3(7), 291–297.

Ali, A. D., Elisha, E. B., Abiem, I., Habila, S., & Okeke, O. M. (2016). Hygrophytes and Wetland Angiospermic Macrophyte in Gallery Forest of Amurum Forest Reserve , Jos , Plateau State, Nigeria. *Research in Plant Sciences*, 4(1), 10–15. <https://doi.org/10.12691/plant-4-1-2>

Asifat, J. T., Oyelowo, O., Oluwapamilerin, O., & Orimoogunje, I. (2019). Assessment of

Endangered trees, herbs and shrubs in Nigeria, why they are endangered and conservation approaches

- Tree Diversity and Abundance in Selected Forest Reserves in Osun State , Southwestern Nigeria. *Open Access Library Journal*, 6, 1–16. <https://doi.org/10.4236/oalib.1105806>
- Azeez, T. O. A. and A. W. A. (2012). IMPACT ASSESSMENT OF GLOBAL ENVIRONMENT FACILITY (GEF) INTERVENTION ON BIODIVERSITY CONSERVATION IN KAINJI LAKE NATIONAL PARK, NIGERIA. *Journal of Sustainable Development in Africa*, 14(2), 77–91.
- Babalola, F. D., Borokini, T. I., Onefeli, A. O., & Muchie, M. (2013). Socio-Economic Contributions of an Indigenous Tree in Urban Areas of Southwest Nigeria. *African Journal of Science, Technology, Innovation and Development*, 5(6), 479–489. <https://doi.org/10.1080/20421338.2013.820449>
- Bc, A. (2020). Biodiversity Conservation in Nigeria : Perception , Challenges and Possible Remedies. *Current Investigations in Agriculture and Current Research*, 8(4), 1109–1115. <https://doi.org/10.32474/CIACR.2020.08.000293>
- Bello, A., Jamaladdeen, S., Elder, M.T., Yaradua, S.S., Kankara, S.S., Wagini, N. H. et al. (2019). Threatened medicinal and economic plants of the Sudan Savanna in Katsina State , northwestern Nigeria. *Bothalia- African Biodiversity & Conservation*, 49(1), 1–17.
- Chen, S. L., Yu, H., Luo, H. M., Wu, Q., Li, C. F., & Steinmetz, A. (2016). Conservation and sustainable use of medicinal plants : problems , progress , and prospects. *Chinese Medicine*, 1–10. <https://doi.org/10.1186/s13020-016-0108-7>
- Choudhury, B., & Khan, M. L. (2010). Conservation and Management of Endangered Plant Species : A Case Study from Northeast India. *Bioremediation, Biodiversity and Bioavailability*, 4(1), 47–53.
- Cresswell, W. R., Wilson, J. M., Vickery, J., Jones, P., & Holt, S. (2007). Changes in densities of Sahelian bird species in response to recent habitat degradation. *Ostrich*, 78(2), 247–253. <https://doi.org/10.2989/OSTRICH.2007.78.2.20.100>
- Dau, J.H.; Donald-Amaeshi, U.A. and Chu.kwu, O. (2018). SEED BANKS AS CONSERVATION TOOL FOR ENDANGERED WILD PLANT SPECIES IN ECOZONES OF NIGERIA. *Journal of Research in Forestry, Wildlife & Environment*, 10(3).
- Debela, H., Hunde, D., Asfaw, Z., Ph, D., Kelbessa, E., & Ph, D. (2006). USE OF TRADITIONAL MEDICINAL PLANTS BY PEOPLE OF ‘ BOOSAT ’ SUB DISTRICT , CENTRAL EASTERN ETHIOPIA. *Ethiopia Journal of Health Science*, 16(2), 1–15.
- Duguma, I. O., & Mesele, M. A. (2019). USE AND MANAGEMENT OF MEDICINAL PLANTS BY INDIGENOUS PEOPLE IN BOJI DIRMEJI DISTRICT , WESTERN ETHIOPIA. *Ghana Journal of Science*, 60(1), 37–49.
- Ekor, M. (2014). The growing use of herbal medicines : issues relating to adverse reactions and challenges in monitoring safety. *Frontiers in Pharmacology*, 4(January), 1–10. <https://doi.org/10.3389/fphar.2013.00177>
- Fay, M. F. (1992). CONSERVATION OF RARE AND ENDANGERED PLANTS USING IN VITRO METHODS 1. *In Vitro Cell Development Biology*, January, 1–4.
- Go, A. M. S. and R. (2020). Noteworthy threatened plant species in the Sahel Region, Nigeria. In *Intech Open* (Vol. 32, pp. 137–144). <https://doi.org/DOI:> <http://dx.doi.org/10.5772/intechopen.93975>

Endangered trees, herbs and shrubs in Nigeria, why they are endangered and conservation approaches

- GUNDU, E.G. and ADIA, J. E. (2014). Conservation methods of Endangered Species. *Journal of Research in Forestry, Wildlife and Environmental*, 6(2), 76–83.
- Hastrup, N. O., Dahunsi, O. M., & Baba, G. O. (2019). Diversity and Abundance of Tree Species at Owo. *International Journal of Research and Innovation in Applied Sciences*, IV(Vii), 27–32.
- Idu, M., Erhabor, J. O., & Efijuemue, H. M. (2010). Documentation on Medicinal Plants Sold in Markets in Abeokuta, Nigeria. *Tropical Journal of Pharmaceutical Research*, 9(2), 110–118.
- Iglesias, E., Loureiro, M. L., & Escribano, F. (2018). Household perceptions on biogas as a sustainable energy source . A focus group study in Hadejia Valley , Nigeria. *Conference Workshop September 2-5 Madrid 2018, Spain*, 1–12.
- Imarhiagbe, O., & Egboduku, W. O. (2019). Conservation and Utilization of Biodiversity- Implications to the Nigerian Environment. *JOJ Wildlife and Biodiversity*, 1(4).
- Isichei, A. O. (2010). Endangered plants in nigeria: time for a new paradigm for vegetation CONSERVATION. *The Nigerian Field*, 84, 64–84.
- Isichei, A. O. (2015). *ENDANGERED PLANTS IN NIGERIA: TIME FOR A NEW PARADIGM FOR VEGETATION CONSERVATION*. January.
- Japheth, E. M. A. and H. D. (2019). Conservation and Restoration of Endangered Plant Species in the Tropical Forests. *Asian Journl of Resarch in Agriculture and Forestry*, 1–17.
- Jaya, M. and G. P. (2019). *National Strategy to combat Wildlife and Forest Crime in Nigeria*.
- Justine, D. and Damian, A. (1992). Tree Use in Igonigoni and Abo Mkpang , Cross River State , Nigeria ; a Comparison of Two Villages Located in Areas with Different Vegetation Types Author (s): Justine Dunn and Damian Agom Source : Global Ecology and Biogeography Letters , Vol . 2 , No . *Global Ecology and Biogeography Letters*, 2(6), 196–206.
- Kr, A., Sudharani, N., Anjali, K. B., & Tm, D. (2014). Biodiversity and strategies for conservation of rare , endangered and threatened medicinal plants. *JOURNAL OF PHARMACOGNOSY AND PHYTOCHEMISTRY*, 2(3), 12–20.
- Mansor Ndoye, I. D. and Y. K. G. (2003). In vitro multiplication of the semi-arid forest tree , Balanite aegyptiaca (L) Del. *African Journal of Biotechnology*, 2(11), 421–424.
- Meregini, A. O. A. (2005). Some endangered plants producing edible fruits and seeds in Southeastern Nigeria. *Fruits*, 60(3), 211–220. <https://doi.org/10.1051/fruits>
- Mukaila, Y. O., Oladipo, O. T., Ogunlowo, I., Ajao, A. A., & Sabiu, S. (2021). Which Plants for What Ailments : A Quantitative Analysis of Medicinal Ethnobotany of Ile-Ife , Osun State , Southwestern Nigeria. *Hindawi : Evidence-Based Complementary and Alternative Medicine*, 2021, 1–21.
- Mukhtar, A.A. and Abdullahi, I. L. (2020). Typha Biomass Energy for Sustainable Management of Typha domingensis L . in Affected Communities of Northern Nigeria. *Dutse Journal of Pure and Applied Sciences*, 6(4), 246–252.
- Nadeen Sadeq Abdullah Hinnawi. (2010). *An ethnobotanical study of wild edible plants in the Northern West Bank “Palestine.”* An-Najah National University.
- Naseem Ahmad And, M. A. (2016). *Plant Tissue Culture: Propagation, Conservation and Crop Improvement*. Springer. <https://doi.org/DOI 10.1007/978-981-10-1917-3>
- Naziru, Z. M. and Habu, A. (2017). Threats To Biodiversity Conservation In Yankari
- Endangered trees, herbs and shrubs in Nigeria, why they are endangered and conservation approaches***

- Game Reserve ., *International Journal of Innovative Research and Advanced Studies*, 4(11), 395–400.
- Ogunshe, T. R. F. A. A. O., & Onyeachuchim, H. D. (2004). ETHNOBOTANICAL IMPORTANCE OF ENDANGERED SPECIES IN THE ARID ZONES OF NIGERIA. *Zonas Aridas*, 8(April 1998), 57–61.
- Ogwu, M.C. , Osawaru, M.E. and Obayuwana, O. K. (2016). Diversity and Abundance of Tree Species in the University of Benin , Benin city, Nigeria. *Applied Tropical Agriculture*, 21(3), 46–54.
- Okunlola, O., & Akinyele, A. (2015). Sustainable management of the Nigerian forests for poverty alleviation. *Journal of Agriculture, Forestry and the Social Sciences*, 12(1), 176. <https://doi.org/10.4314/joafss.v12i1.19>
- Onefeli, A. O., & Adesoye, P. O. (2014). Early Growth Assessment of Selected Exotic and Indigenous Tree Species in Nigeria. *South-East European Forestry*, 5(1), 45–51.
- Oni, O. (1993). Conservation and vegetative propagation the genetic resources of some endangered medicinal woody plants of Nigeria. In *Acta Horticulture* (Vol. 331).
- Onwubuya, E.A. , Ogbonna, O.I. and Ezeobiora, O. C. (2014). Conservation of forest resources by rural farmers in Anambra state, Nigeria. *Journal of Agricultural Extension*, 18(2), 177–184.
- Osemeobo, G. J. (2010). CAN THE RAIN FORESTS OF NIGERIA SUSTAIN TRADE IN MEDICINAL PLANTS ? *International Journal of Social Forestry*, 3(1), 66–80.
- Roberson, Emily, A. M. & J. M. (2008). *Medicinal Plants at Risk*.
- Rosen, T. (2022). Protecting Endangered Species. *Earth Negotiations Bulletin*, 1–10.
- Sapir, Y., Shmida, A., & Fragman, O. (2003). Constructing Red Numbers for setting conservation priorities of endangered plant species : Israeli flora as a test case. *Journal of Nature Conservation*, 11.
- Sofowora, A., Ogunbodede, E., Onayade, A., & Dentistry, C. (2013). THE ROLE AND PLACE OF MEDICINAL PLANTS IN THE STRATEGIES FOR DISEASE. *African Journal of Traditional Complement Alternative Medicine*, 10(5), 210–229.
- U.C., I. (2019). A review of opportunities in conservation and use of medicinal and Aromatic plants in Nigeria. *International Journal of Advanced Research*, 7(4), 770–778. <https://doi.org/10.21474/IJAR01/8885>
- Volis, S. (2016). Plant Diversity How to conserve threatened Chinese plant species with extremely small populations ? *Plant Diversity*, xxx, 1–8. <https://doi.org/10.1016/j.pld.2016.05.003>
- Walter, K.S. and Gillett, H. J. (1997). *1997 IUCN Red list of threatened plants*. IUCN, Gland,Switzerland and Cambridge UK.
- Westfall, R. E., & Glickman, B. W. (2004). Conservation of Indigenous Medicinal Plants in Canada. *Species at Risk 2004 Pathways to Recovery Conference.*, 1–8.

Endangered trees, herbs and shrubs in Nigeria, why they are endangered and conservation approaches