



MEDICINAL PLANTS CONSERVATION: A STRATEGIC METHOD TO MITIGATE CLIMATE CHANGE

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Abstract

Forestry is very essential to human life as it involves the activities that sustain humanity with various ecological services. Forest is the source of non-timber products, particularly medicinal plants which include trees, shrubs, herbs, grasses, and lianas. These plant types have been engaged in varieties of uses for medicinal purposes from ancient times till the present age and yet preferred to modern medicine by many people – especially in regions characterized by tropical climates on the globe, including Sub-Saharan Africa – because of their ready accessibility, supposed low toxicity, cheapness, and effectiveness, among others. Their demand for diversified utilization among large populations tends to over-exploitation and forest biodiversity loss which leads to climate change. Climate change, associated with temperature extremities, may further lead to the extinction of valuable medicinal plants. Conservation through the cultivation of medicinal plants is of utmost importance as forestry, involving forest resources management, contributes immensely to the development of safe remedies, a clean environment, and organic-based drug for the management of health conditions and diseases.

Keywords: biodiversity, forest management, cultivation, herbal medicine, over-exploitation

Introduction

Forest cover is arguably the first phenomenon in existence on the earth. The scriptures give credence to the fact that early men of the human race interacted with the forest and relied on its resources. Thus, forest activities predate history. Forestry is very essential to human life. The reduction in human life expectancy rate has been attributed to adverse health conditions emanating from massive industrialization and deterioration of the forest (Ajiola and Ilesanmi 2017) which perform the great function of purifying the environment. Forest trees remove toxins from the air through their various parts such as the leaves and bark. They absorb these toxins through their leaves' pores and also convert the carbon dioxide we exhale into fresh oxygen through photosynthesis. Absorption of volatile organic compounds and removal of metabolized toxic compounds in the soil water and air are brought about by the action of trees. Forests also can degrade heavy metals in polluted soil through the bioremediation process. It can be said that a safe environment depends on the availability of trees. Sustainable life and increased life expectancy rate could be ascertained in a less polluted environment.

The livelihood of people in most rural communities is dependent on forest resources. Forests also provide essential needs for humans including life-saving pharmaceutical agents. The strategies mostly used by many rural households to overcome food insecurity and health problems are the use of non-timber forest products (NTFPs).

While considering the unsustainable utilization of the forest resources and indiscriminate forest mining practices, Appanah (2004) highlighted those forests go far beyond timber with market value into influencing local and regional climate, protecting soil, providing potable water, and mitigating floods to mention a few. Shah *et al.* (2015) and Guga *et al.* (2015) argue that population growth can instigate a huge pressure on natural resources and contribute to environmental problems such as rising levels of atmospheric carbon dioxide, biological diversity loss, global warming, and pollution. Appanah (2004) further noted that we are finally confronted with reality. The forests have gone, mostly, the governments are not richer, the environment has deteriorated, and people are impoverished. The problem caused by the taking away of the forest can be resolved by restoring the forest and utilizing it sustainably.

Forest Ecosystem Services

The Millennium Ecosystem Assessment (2005) suggested that ecosystem services can be classified into four categories:

- i. **Provisioning services** provide goods such as food, fresh water, timber, and fibre as well as medicinal plants for direct human use.
- ii. **Regulating services** maintain a world in which it is biophysically possible for people to live and provide benefits such as pollination of crops, water damage mitigation, and climate stabilization.
- iii. **Cultural services** make the world a place in which people want to live; they include recreation as well as aesthetic, intellectual, and spiritual inspiration.
- iv. **Supporting services** are the underlying ecosystem processes that produce direct services such as nutrient cycling, soil formation, etc.

Medicinal Plants as Provisioning Service Item

A very important and inevitable provisioning service made available by the forest ecosystem is the medicine that is widespread across the forest ecological community and its environment ranging from the extraction of animal parts, materials, and fluid to tree roots, bark, leaves, fruit, pod, flowers, etc., and herbs from non-tree forest products (NTFPs) in the forest. All of these have greatly contributed to traditional medicine in Africa and the world at large which is gradually gaining traction and renown as an effective therapy and viable alternative medicine.

Medicinal plants in Forests

Medicinal plants cover a wide range of plant types such as trees, shrubs, herbs, grasses, and lianas. Forest trees and other plants contain a wide variety of bioactive compounds with potential as anticancer drugs, anti-atherogenic compounds, and antioxidants. Forest animals also provide a source of medicines, including toxins purified from venomous snakes, spiders, insects, and scorpions. There is a wealth of indigenous and local knowledge on forest medicines. Lawal *et al.* (2018) demonstrated that plants (found in the forest) serve as a reservoir for the storage of several classes of compounds; these compounds act as a defense mechanism against foreign bodies and therefore help in the management and cure of several ailments and health conditions in humans and animals. Their use in traditional medicine dates back to time immemorial and has contributed immensely to health care delivery in rural communities as their main source of medicines (Ahmad *et al.* 2009). Commonly used ethnomedicinal species in the forest are *Adansonia digitata*, *Albizia spp*, *Alstonia boonei*, *Morinda lucida*, *Anarcadium occidentale*, *Anona muricata*, *Vernonia amygdalina*, *Senna alata*, *Sansevieria liberica*, just to mention a few.

Preferential Utilization of Medicinal Plants

The use of traditional herbal medicine is very common in most parts of the countries of world, despite modern development in the treatment of the human body, herbal remedies have been continuously used. Modern medicine, in the beginning, depended on herbal remedies because plants were the fundamental sources of therapeutic products (Kelly 2009; Petrovska 2012) for professional and non-professional healers of the earliest times. Over 25% of prescribed medicines in industrialized countries are derived directly or indirectly from plants, despite the remarkable progress in synthetic organic medicinal products of the twentieth century (Newman *et al.* 2000). The efficacy of herbs has been confirmed in different disease conditions all over the world. Herbs have succeeded where conventional or synthetic medicine has failed, especially in chronic infectious diseases. An example, as reviewed by Ju-Young *et al.* (2018), is the herbal antiviral targets that were found to inhibit the replication of influenza strains resistant to oseltamivir – a standard antiviral drug also known as Tamiflu. Apart from this efficacy, it is very important to mention the little or no side effects in the treatment of diseases because they act as foods and as medicines.

Akerele (1998), elucidated that the high cost of allopathic drugs and side effects led to the highest popularity of medicinal plants in rural areas. In the treatment of hypertension, for instance, the herb is used first to lower the blood pressure; clean the arteries, slow and regulate the heart rate, improve blood circulation, and relax the mind, unlike the conventional ones that will dilate the arteries or the veins until they reach their maximum elastic point which may suddenly burst and cause a vascular accident, causing stroke or death (Nakano *et al.* 2002; Ben *et al.* 2006; Tabassum and Ahmad 2011). There are a few or no synthetic drugs that will do all of the above.

Medicinal Plants Diversified Uses

The use of herbs for the treatment of different kinds of diseases is popular in African countries. In Ghana, for example, more than 800 wild plants and many other herbaceous species are known for their medicinal properties (Burhan *et al.* 2006). The history of how long herbs have been in use is as far back as man's history. The properties of herbs show clearly that they have direct relevance to the chemistry of the body and are therefore used to repair and activate the system more effectively without side effects. The body's acceptance and assimilation of herbs show that herbs are natural needs of the body. Some essential elements required by the human body are found in fruits, vegetables, and herbs. Deficiency in any of these minerals in the body can result in one type of disease or the other (Ogboru *et al.* 2017). Medicinal plants are engaged in the following diverse use:

1. **Vegetables:** Quite a large number of African indigenous leafy vegetables have long been known and reported to have health-protecting properties and uses. Several of the indigenous leafy vegetables continue to be used for prophylactic and therapeutic purposes by rural communities (Igoli *et al.* 2002). Some herbs are common and others are not common. The common ones have become so well known that they are daily used as vegetables, it is a well-known fact that the body's requirement is more in what we get from vegetables, herbs, and fruits than in any other food. Because of this, it is easier and more natural to repair worn-out organs, cleanse the blood, and keep the body fit by the use of herbs.
2. **Dietary supplements:** People all over the world have used herbs in the form of dietary supplements to cure and control different diseases that are peculiar to their sub-regions.
3. **Tea:** Preparation from leaves, roots, bark, flowers, fruits, and seeds are employed for curing elements in various ways, some are cooked together and taken as a tea. These are commonly used for ailments such as fever, piles, and dysentery.
4. **Strong drinks:** Some herbs may be cut into pieces such as roots, stems, fruits, and infused; seeds are soaked in cold water for strong drinks.

5. **Floss:** *Vernonia amygdalina*, *Garcinia kola* powdered form is used to treat toothache. Roots of *Cola nitida* and *Cola acuminata* are excellent chewing sticks. They clean the teeth, disinfect the mouth and strengthen dental gums (Farombi *et al.* 2005).
6. **Soup:** Some medicinal plants are cooked as soup especially for pregnant women. These plants are traditionally employed in a variety of ways: anti-infection, molluscicides, anti-malaria, laxative, and cardiovascular nervous disease treatment.

Medicinal Plants Harvesting: Its Demand and Utilization

Human beings have depended on nature for their simple requirements as being the sources for medicines, shelters, foodstuffs, fragrances, clothing, flavours, fertilizers, and means of transportation throughout the ages. The development and recognition of medicinal and financial aid for these plants are on the rise in both industrialized and developing nations (WHO, 1988). According to WHO, around 21,000 plant species have the potential for being used as medicinal plants. Plants and plant extracts, which are more than 30% of the entire plant species, are depended on by over three-quarters of the world population mainly for their health care needs as per data available (Khan 2016).

Based on the importance and diversified use of medicinal plants, much harvesting pressure is being exerted on them. To compete with the growing market, there is the urgency to expeditiously utilize and scientifically validate more medicinally useful plants while conserving these species, which seems a difficult task ahead.

Over-exploitation: A Threat to Forest Biodiversity

Many of the threats to medicinal plant species are similar to those causing endangerment to plant diversity generally. The most serious proximate threats generally are habitat loss, habitat degradation, and over-harvesting (Hamilton 1997). As far as a collection for medicines is concerned, there is general agreement that it is the collection for commercial trade rather than home use that is overwhelmingly the problem. Another reason why medicinal plants have become increasingly threatened has been the weakening of customary laws that traditionally have regulated the use of natural resources. Such laws have often proved to be easily undermined by modern socio-economic forces (Pant 2002).

The major threats to plant diversity include habitat loss, fragmentation and degradation, overexploitation, invasive species, pollution, and anthropogenic climate change (Harrison *et al.* 2013; Kettle and Koh 2014; Sharrock *et al.* 2014; Buse *et al.* 2015; Specht *et al.* 2015; ter Steege *et al.* 2015; van Kleunen *et al.* 2015). Destructive harvesting of medicinal plant parts such as the uncontrolled collection of barks and roots of trees and shrubs is another major concern. Human activities are already impairing the flow of ecosystem services on a large scale and if the current trends continue, humanity will dramatically alter virtually all of the remaining natural ecosystems within a few decades. Many of the human activities that modify or destroy natural ecosystems may cause deterioration of ecological services whose value, in the long term, dwarfs the short-term economic benefits.

For example, Brenan (1978) noted that about 205 species of plants found in Nigeria are endemic such that they are not found anywhere in the world. This places uniqueness on some of the plants' biological resources endowed in the country. Federal Environmental Protection Agency (1992) in their survey revealed that over 848 algal species have been identified in the marine and freshwater habitats while a few less than 200 lower plant species have been identified. The wide diversity of plant species found in Nigeria and some parts of the world is a function of many factors, namely, the diversity of ecosystems and varying habitats. However, today, the population explosion is a great threat to plant biodiversity. The past has threatened today while today may threaten the future following the current population growth rate. Therefore, there is an urgent need for sustainable ecosystem management. This involves growing and sustaining natural assets according to the principles of sustainable development. This will help to keep the balance between ecological, economic, and social-cultural components of sustainable development.

Climate Change effects

The documentation of medicinal uses of African plants is becoming increasingly urgent because of the rapid loss of the natural habitats of these plants due to human activities. The African continent is reported to have one of the highest rates of deforestation in the world. This loss is all the greater because the continent has a high rate of endemism, with Madagascar topping the list at 82% (Green and Sussman, 1990). As demand for medicinal plant values rises with increasing population, and over-exploitation resultantly transpires, man will be faced with a very high risk of loss of biodiversity and climate change which are caused by anthropogenic activities (deforestation and forest degradation). Climate change is associated with temperature extremities (Buse *et al.* 2015; Ge *et al.* 2015) which can further lead to the loss or extinction of some valuable medicinal plants. Researchers have found that due to the rise in temperatures, some cold-adapted alpine species are migrating upward until there are no higher areas to inhabit, at which point they may be faced with extinction (Salick *et al.* 2009).

Conservation of Medicinal Plants

The conservation (in-situ and ex-situ) of plant genetic resources has long been realized as an integral part of biodiversity conservation. The threat of over-collection (to meet the rising demand for medicines) could be addressed by the cultivation of some medicinal plants, or by a system of certification to make wild harvesting sustainable (Kling 2016). Recommended management strategies are as follows:

Medicinal plant reserve: The creation and development of medicinal plants reserve is the main component of the management strategy. Pal and Samant (2005) suggested that medicinal plant reserves will go a long way to protect the existing genetic diversity and help in the rational exploitation of medicinal plant resources in the Himalayas for overall economic development. This strategy has been adopted in some agricultural and forestry institutions in sub-Saharan Africa and more can be achieved.

Cultivation as a means of conservation: Conservation practices include domestication; beliefs in the sacredness of trees; beliefs in sacred forests; respect of cultural forests; protection of plants at the burial sites; selective harvesting; secrecy; a collection of deadwood for firewood; and use of energy saving traditional stoves. Cultivation has pharmacological advantages over wild collection. In cultivation, the variation and the resulting uncertainty of therapeutic benefit are much reduced (Amujoyegbe *et al.* 2012).

The urgent need to conserve tropical forests as biological resources for sustained availability of known and yet undiscovered medicinal substances for future generations as noted by Brian (2002) prompted the Forestry Research Institute of Nigeria (FRIN) through the Biomedical Research Centre (BMRC) to establish a herbal garden for *ex-situ* conservation of endangered medicinal floras especially indigenous plant species, for herbal drug development and training.

Conservation developments by the Forestry Research Institute of Nigeria (FRIN)

One of the efforts (initiatives and actions in the form of strategies, programs, activities, and interventions) of the Federal Ministry of Environment toward ensuring environmental protection and sustainable development is the execution of relevant forestry research projects through the activities of the Forestry Research Institute of Nigeria (FRIN).

FRIN has successfully substantiated its vision to be the foremost research centre of excellence in terms of knowledge-based forestry activities in the areas of forest management and biodiversity conservation by establishing conservation areas, nurseries for indigenous tree seedlings, and Sustainable Forest Management department. The institute also established the Biomedical Research Centre alongside herbal gardens to ensure sustainable plant research for the better advancement of herbal medicine in Nigeria, and conserve medicinal plants for laboratory-based standardization of herbal-based drugs.

Conclusion

Forest is the home of ecological materials and sources of products and services that sustain human life, especially the medicinal plants which provide remedies to several health conditions. However, uncontrolled exploitation aggravated by human population pressure on these plant species poses a serious threat to their sustainability. Over-exploitation leads to biodiversity loss and climate change. These effects further bring about temperature extremities which may lead to the extinction of valuable medicinal plants. Conservation through the cultivation of medicinal plants is of utmost importance as forestry, involving forest resources management, contributes immensely to the development of safe remedies, a clean environment, and organic-based drugs for the management of health conditions and diseases.

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