

UTILIZATION POTENTIALS OF FOREST FRUITS TREES FOR WOOD PRODUCTION

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Abstract:

The utilization of forest fruits for wood production is an important aspect of sustainable forestry and natural resource management. Forests play a critical role in supporting the biodiversity of our planet, providing habitat for wildlife, carbon sequestration, employment opportunities, revenue generation, and valuable non-timber forest products, such as fruits, nuts, and medicinal plants, which have been used by local communities for centuries. However, forests are also important sources of timber, and the demand for timber has led to unsustainable logging practices and deforestation in many parts of the world. This has resulted in the loss of biodiversity, degradation of ecosystem services, and negative impacts on local communities that depend on forests for their livelihoods. The utilization of forest fruits for wood production has emerged as a potential solution to balance the demand for timber with the need to maintain healthy and productive forests. By harvesting fruits from trees that also produce valuable wood, local communities can generate income and meet their basic needs without resorting to unsustainable logging practices. The significance of this study lies in the potential to promote sustainable forest management practices that integrate both timber and non-timber forest products. Conclusively, the utilization of forest fruit trees for wood production can contribute to the goal of sustainable forest management and the conservation of forest biodiversity.

Key words: sustainability; forest fruits tree; wood production; carbon sequestration; resource.

INTRODUCTION

Forests have been crucial to the advancement of human societies when compared to other energetical resources. Wood (timber), fuel-wood, pulp, and paper are the primary commercial products derived from most forests, providing a global estimated timber equivalent of 3.4 billion cubic meters annually. Although worldwide wood consumption experienced a 60% growth between 1960 and 1990, it has been fluctuating since then. The recycling of timber and paper has been efficient, and this has contributed to the lack of a significant increase in global wood consumption in the 1990s. It is widely recognized that wood is the most versatile raw material ever known to humankind (Owoyemi *et al.* 2016).

Throughout history, humans have depended on wood for a multitude of purposes, including farming tools, building materials, fuel, and weapons for hunting and warfare. Until the latter half of the 19th century, wood was primarily used as the main material for construction and energy generation. In Nigeria, the industries based on wood include timber logging, sawmilling, the production of wood-based panel products (such as plywood, fiberboard, and particle board), furniture manufacturing, paper production, matchstick manufacturing, and the creation of various wooden goods, such as tool handles, sports equipment, weaving tools, and wooden toys (Sekumade and Oluwatayo 2011). The excessive reliance on wood for various purposes has exerted immense pressure on forests (Ciolacu *et al.* 2022). Moreover, the few known species that are utilized are now seriously endangered, while numerous lesser-known tree species could serve as good substitutes and alleviate the pressure on overexploited known species. Although wood usually comprises the stem of a tree, not all plants possess woody stems. Furthermore, not all woody stems produce

timber suitable for industrial use. Presently, it is estimated that the Earth contains around one trillion tonnes of wood, which grows at a rate of 10 billion tonnes per year. Woody plants that produce merchantable timber are generally categorized into two groups: softwoods and hardwoods. Softwoods also referred to as conifers or gymnosperms, are cone-bearing trees that typically have needle-like or scale-like evergreen leaves. On the other hand, hardwood trees (deciduous trees or angiosperms) usually have broad leaves that shed annually, Olorunnisola (2013). The future of the wood industry in Nigeria in terms of raw material supply is contingent upon the management of forest resources moving forward (Van Noordwijk *et al.* 2014).

To expand the raw material base for the various sectors of the industry, there is a necessity to establish large-scale timber, bamboo, and rattan plantations. Additionally, utilizing more of the lesser-used but proven timber species, such as forest fruit trees, could assist in building construction, furniture production, charcoal manufacturing, and other wood utilization (Olorunnisola 2022).

A fruit tree is a type of tree that produces fruits that are consumed or used by humans and some animals (Van Noordwijk *et al.* 2014). All flowering plants produce fruits, which are the ripened ovaries of flowers that contain one or more seeds (Baughner and Singha 2003). More than any other region on Earth, the tropics are rich in diverse fruit tree species that have provided humans with essential food and nourishment for ages, ever since the domestication of beneficial wild plants (crop species) (Lovrić *et al.* 2020).

The tropical continents of the world possess a wide array of fruit trees, with approximately 1000 species identified in the Americas, 1200 species in Africa, and 500 species in Asia, (Ciolacu *et al.* 2022: Paul and Duarte 2011).

OBJECTIVE

The objective of the review aims at looking into the utilization of forest fruit trees for wood production in sustainable ways as the best alternatives to endangered commercial timbers.

The specific objectives of this paper on the utilization of forest fruits tree for wood production are:

1. To provide an overview of forest fruits and their value as non-timber forest products. This will include examples of popular forest fruits and their uses.
2. To identify trees that produce both fruits and wood and to discuss their characteristics and uses.
3. To identify the challenges of utilizing fruit trees wood in Nigeria.

FOREST FRUIT TREES

Throughout history, rural inhabitants of tropical countries have relied on forests for their food and other livelihood needs by gathering and processing produce from trees (Van Noordwijk *et al.* 2014). In the rural areas of many developing nations, wild fruits are frequently the only fruits consumed because people cannot afford commercially grown fruits such as apples, grapes, avocados, oranges, or bananas. (Makurji 2005: Lovrić *et al.* 2020). Africa is home to approximately 3000 species of wild fruit trees, which represent a significant and largely unexplored natural resource as shown in Table 1 (Pye-Smith 2010). Fruit trees are essential biological resources in numerous agroecological and forest ecosystems worldwide, as demonstrated by the long-term economic and ecological impacts of these tree species in nature (Awodoyin *et al.* 2015, Omotayo *et al.* 2020).

In Nigeria, various tree species produce both fruits and wood, making them valuable resources that provide economic benefits through the production of both timber and non-timber forest products such as fruits, nuts, and leaves.

African Star Apple (*Gambeya albida*) – *Gambeya albida*, commonly known as the African Star Apple, is a well-known fruit tree in Nigeria. It bears round purple fruit that is juicy and sweet with high nutritional value. The tree is of medium size and its timber is utilized for various purposes such as furniture, household items like bowls and spoons, fuel wood, and construction materials. In addition to being consumed fresh, the fruit can also be processed into juice and jam according to (Egwunatum *et al.* 2020).

Shea tree (*Vitellaria paradoxa*) - The Shea tree, a native species to Africa, is extensively found across Nigeria. Its nuts are rich in fats and are processed to produce Shea butter, a widely popular product. Furthermore, the tree's wood is of high quality and is utilized for crafting household items such as stools and mortars, as well as for construction and fuel wood purposes (Sandwidi *et al.* 2006).

African Mango (*Irvingia gabonensis*) - The African mango tree is a well-known fruit tree in Nigeria, and its fruit is a popular food item. Additionally, the seeds of the fruit are used to produce a type of butter called dika butter. The tree's wood is also utilized for fuel wood and for creating household items such as mortars and pestles (Edouard *et al.* 2017).

Baobab (*Adansonia digitata*) - The baobab tree is frequently seen in Nigeria and is valued for its multipurpose uses. The fruit produced by the tree is high in nutritional value and is often used to make a popular drink known as Kuka. The wood of the tree is utilized for fuelwood, construction, and to create of various household items like drums and bowls (Bishnu *et al.* 2015).

African pear (*Dacryodes edulis*): The African pear, also referred to as safou, is a tree that produces an edible fruit with high oil content and is typically small to medium in size. The timber from this tree is utilized for furniture and construction, whereas the fruit's oil serves as a cooking ingredient and a component of cosmetics (Edeoga *et al.* 2005).

Breadfruit (*Artocarpus altilis*): *Artocarpus altilis* is a Moraceae species that are not commonly used commercially for wood. However, it was selected for evaluation due to its impressive height, reaching up to 25 meters (82 feet) or more. This species is typically planted as a fruit tree in agro-forestry systems and is now gaining popularity as construction timber. Recent surveys of timber markets in Nigeria's southwest zone indicate that these emerging species are well-represented. Knowledge of the wood's physical properties is essential for its proper utilization (Areo *et al.* 2020).

Bush Mango (*Irvingia wombolu*): Also known as "ogbono" in Nigeria, the bush mango is a fruit tree that is native to West and Central Africa. The fruit is similar in size and shape to mango but has a green skin when unripe and a yellow skin when ripe. It is a good source of fiber, vitamins, and minerals. The seeds of the tree are also used for medicinal purposes, particularly for their potential cholesterol-lowering effects (Njintang *et al.* 2012) as presented in Table 1.

Table 1

Forest fruits tree with wood products from the trees				
S/N	Forest fruits tree	Botanical name	Family	Wood products from the tree
1.	Bush Mango	<i>Irvingia wombolu</i>	Irvingiaceae	Fuelwood and for creating household items
2.	Breadfruit	<i>Artocarpus altilis</i>	Moraceae	Construction timber
3.	African pear	<i>Dacryodes edulis</i>	Burseraceae	Furniture and construction
4.	Baobab	<i>Adansonia digitata</i>	Bombacaceae	Fuelwood, construction, and to create of various household items
5.	African Mango	<i>Irvingia gabonensis</i>	Irvingiaceae	Fuel wood and for creating household items
6.	African Star Apple	<i>Gambeya albida</i>	Sapotaceae	Furniture, household items like bowls and spoons, fuelwood, and construction materials
7.	Shea tree	<i>Vitellaria paradoxa</i>	Sapotaceae	Furniture and construction
8.	Monkeykola(yellow)	<i>Cola lepidota</i>	Malvaceae	Fuel wood and for creating household items
9.	Velvet tamarind	<i>Dialiumgu ineense</i>	Fabaceae	Furniture and construction
10.	Monkey kola(red)	<i>Cola lateritia</i>	Malvaceae	Fuel wood and for creating household items
11.	Cashew	<i>Anacardium occidentale</i>	Anacardiaceae	Fuel wood and for creating household items
12.	Mango	<i>Magifera indica</i>	Anacardiaceae	Fuel wood and for creating household items
13.	Guava	<i>Psidium guajava</i>	Combretaceae	Fuel wood and for creating household items

Source: Olorunnisola 2002

WOOD PRODUCTS

Since the beginning of time, wood products have been essential to meeting the requirements of all people for transportation, energy, shelter, and durable and non-durable commodities (Van Noordwijk *et al.* 2014). For nations who controlled the seas for trade and/or territorial development, wood for ship construction became crucial in the early eighteenth century. A significant part of the Nigerian economy has traditionally been played by primary and secondary wood products (Omotayo *et al.* 2020). Wood-based forest industries were among the top local businesses for employment creation in the 1960s through the mid-1970s, earning significant foreign exchange (Lucas and Olorunnisola 2002). The major products included are as follows.

Table 2

Wood products and their uses

S/N	WOOD PRODUCTS	USES
1.	Posts	i. Used for fencing, scaffolding, and rafting, and as wall plates and columns for farm homes, sheds, and other livestock and storage buildings. ii. They are also used as beams for drying platforms and typically for fencing.
2.	Poles	Mostly utilized during building construction for scaffolding, telephone, electrical transmission lines, pit supports, studs, columns, beams, wall plates, rafters, and purlins.
3.	Logs	i. Logs used to produce lumber. ii. They are also used to make furniture, erect buildings, etc.
4.	Wood and charcoal	They are used for heating, cooking, and creating electricity.
5.	Plywood, particleboard, and fiberboard	They are used in a variety of ways in the construction of buildings, the manufacture of furniture, packaging, etc.
6.	Paper and paper-based items	Paper and paper-based items, such as cardboard or paperboard for packing and newsprint, stationery paper for writing, sketching, printing, and photocopying, etc.
7.	Other wood products	A variety of wooden products, including tool handles, sporting goods, looms, toys etc

Source: Lucas and Olorunnisola 2002

CHALLENGES OF UTILIZING FRUIT TREES WOOD IN NIGERIA

Lack of information: Centers for Wood Research have been actively working to describe the physical, mechanical, and aesthetic properties of many lesser-known regional species, including forest fruit trees since the 1990s (Adiji *et al.* 2021). While this method has increased knowledge about these species, it has not been sufficient in promoting their use. Currently, the lack of information regarding these species is the main issue, and the theoretical understanding of wood characteristics is no longer a central problem (Kukull *et al.* 2012). However, it is necessary to update the data according to current protocols. In Nigeria, there is little to no awareness regarding the use of lesser-known or lesser-used wood species like forest fruit trees.

Lack of database: Efficient management of data is crucial, which is why a database management system is important as it allows users to perform various tasks with ease. The lack of effective database management is not unique to forest fruit trees and wood species in Nigeria but is a prevalent problem in forestry management that hinders proper planning and management.

Lack of acceptability: Adapting to changes can be challenging for humans, especially when it comes to using new or lesser-known wood species. Commercially popular wood species have been heavily harvested, and some are at risk of extinction. Wood users may be hesitant to adopt lesser-known species due to cultural beliefs and their familiarity with commercial wood. Hines and Eckman (2008), Indigenous species are often preferred by local people for various purposes like charcoal, furniture, house construction material, and medicine. However, there is little attention given to the properties of the wood required for these end uses. As a result, the use of wood from these species without adequate knowledge of their properties may lead to safety hazards and inefficient utilization (Mahonge and Hamza 2001). Smith and Ajidi *et al.* (2021), Research on the introduction of new species shows that raw material preferences in the global timber trade are slow to shift, necessitating more focused and strategic marketing efforts to buck the trend as shown in Fig. 1.

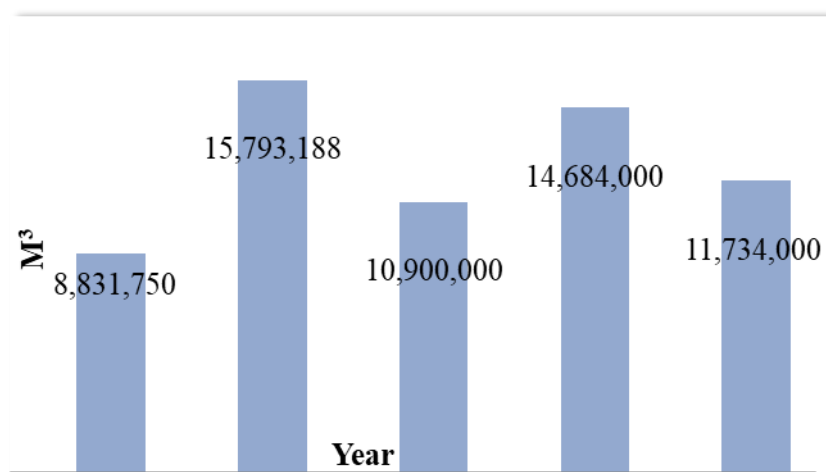


Fig. 1.

Capital utilization of wood (m³) in sawmills in Nigeria in the years 1988, 1992, 1996, 2002 and 2010 (Owoyemi et al. 2016).

INREGULAR OR INSUFFICIENT SUPPLIES TO WOOD INDUSTRIES

Manufacturers of forest products and export customers are often reluctant to embrace alternatives to conventional species due to the fair of erratic or insufficient supplies. The following situations illustrate how the current environment does not favor the supply or use of forest fruits, trees, and timber species: In several tropical American (8.4m³ per ha) and African (13.5m³ per ha) countries, agric-conversion and related development of wooded land, inundation of forested land owing to the construction of dams, conversion of natural forests into forest plantations, and low logging output are all common Ajidi et al. (2021) as shown in Fig. 2.

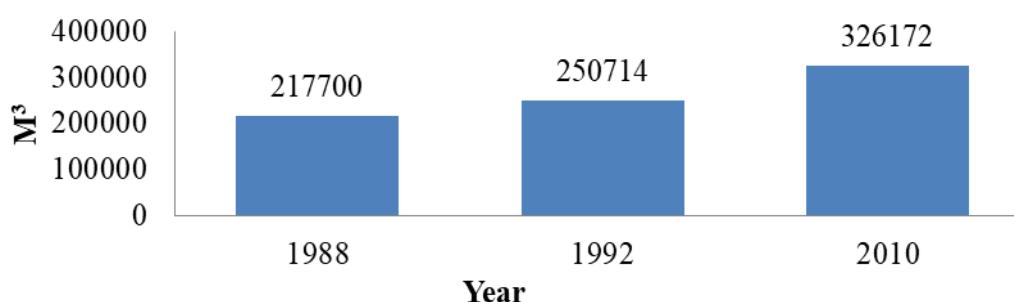


Fig. 2.

Capacity utilization of wood (m³) in the furniture industry in Nigeria (Owoyemi et al. 2016).

Sustainability of forest fruit trees utilization for wood production

According to studies, using forest fruit trees sustainably for the production of wood is possible with the right management techniques. For instance, it has been discovered that selective logging, which entails removing only old trees while permitting younger trees to develop and replace them, is a sustainable method of obtaining lumber from forest fruit trees (Egbe et al. 2017). By using this technique, it is made sure that the trees are left in the forest and can continue to produce other valuable resources like fruits and nuts. Reforestation initiatives can also aid in forest replenishment and ensure the long-term viability of the harvest of timber from forest fruit trees (Ciolacu et al. 2022; Van Noordwijk et al. 2014). To maintain the forest ecosystem and offer a sustainable source of lumber, these projects involve planting new trees to replace those that have been taken (Ofori 2018). The management and maintenance of these resources should also engage the communities whose livelihoods depend on forest fruit trees. This can be accomplished by setting up community-based forest management systems, which allow local communities control over the administration and utilization of forest resources (Oba et al. 2014).

Environmental Sustainability: Fruit trees found in forests are an integral part of forest ecosystems because they support soil health, biodiversity, water conservation, and carbon sequestration. Additionally, they serve as a habitat for a variety of wildlife species, especially pollinators, which are essential to the health of ecosystems. Forest fruit tree harvesting for wood production can benefit the environment by

encouraging sustainable forest management techniques Kukull *et al.* (2012). These methods, which include selective logging, replanting, and forest restoration, support robust forest ecosystems. A further way to lessen greenhouse gas emissions, which contribute to climate change, is to use forest fruit trees to make wood. In their biomass, trees store the carbon dioxide that they acquire from the environment. When trees are cut down, the carbon that was stored in the wood is sequestered, lowering the atmospheric concentration of carbon dioxide. By increasing carbon sequestration in forests, sustainable forest management techniques can aid in the fight against climate change (FAO 2016).

Social Sustainability: Forest fruit trees assist local communities in many ways, including by providing food, medicine, and cultural and spiritual qualities. Forest fruit tree harvesting for wood production has the potential to benefit rural communities by creating jobs and generating cash. Through the use of sustainable forest management techniques, it is possible to ensure that local communities have access to forest resources without endangering the ecosystem or jeopardizing the welfare of future generations (FAO 2018).

Economic sustainability: The forestry industry may profit economically from the usage of forest fruit trees for wood production, including the creation of jobs and the generating of money. Fruit trees found in forests can also be utilized to make high-end wood goods including furniture, flooring, and ornamental things. The long-term financial viability of the forestry industry can be ensured through the application of sustainable forest management techniques (Rana and Adhikari 2019) as shown in Fig. 3.

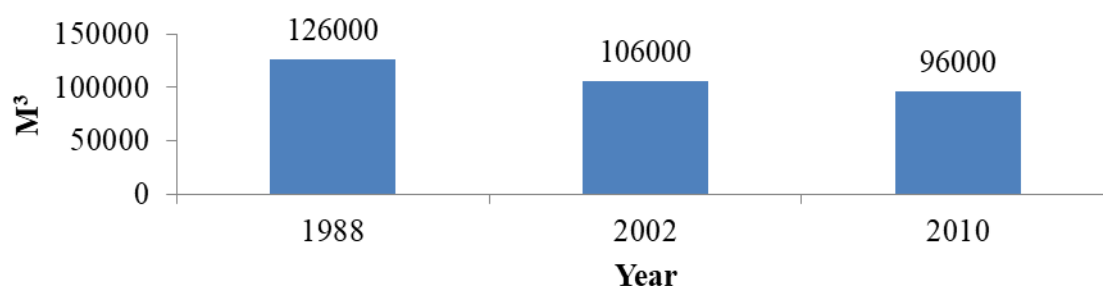


Fig. 3.
Capacity utilization of wood (m³) in the plywood industry in Nigeria (Owoyemi *et al.* 2016).

CONCLUSION

It is understood, that the utilization of forest fruits for wood production in Nigeria is a complex issue that requires a multifaceted approach to sustainable forest management. While trees that produce both fruits and wood can provide a valuable source of income for local communities and contribute to the country's economic development, there are also potential negative impacts on the environment and social sustainability that must be carefully considered. The paper has highlighted the benefits and challenges of using these trees for wood production and has provided recommendations for sustainable forest management practices that integrate both timber and non-timber forest products. To guarantee the ongoing availability and utilization of forest resources in Nigeria, it is crucial to adopt a balanced approach that considers economic, environmental, and social sustainability. However, more research is necessary to evaluate the long-term environmental and social outcomes of using forest fruits for wood production. Additionally, effective policy interventions should be developed to promote sustainable forest management.

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