



SUSTAINABLE UTILISATION OF WOOD AND NON-WOOD FOREST PRODUCTS FOR CLIMATE CHANGE MITIGATION

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Abstract

Climate menace as it affects world environment has become a global discussion especially at the United Nations. At the Climate Action Summit in September 2019, 65 countries and major sub-national economies, such as California, committed to cut greenhouse gas emissions to net zero by 2050, while 70 countries also agreed to boost their national action plans by 2020 in order to meet the deadline. Greenhouse gases in the atmosphere play a critical role in shaping the global climate and human activities have significantly modified the concentrations of many of these gases. Harvesting and utilization of wood and non-wood products are major contributors to these changes. While harvesting and utilization should continue because of the global needs, sustainable use of these products will not only reduce the scourge of climate change but assist in sustaining the resources for the unborn generation. Understanding the effects of human activities on global climate requires identification and quantification of these greenhouse gas flows and how it could be curtailed. Strategies for an enduring management of these forest resources, within the context of exploring forest resources gains through carbon budget management was discussed, as mitigation measures for climate change.

Keywords:

Introduction

The forest is dominated by wood and other non-wood products which are vital to survival of mankind. Utilization of wood has over the years supported the entire world in terms of domestic uses as well as industrial applications. As a dominant product of forests, it is used for many purposes, such as wood fuel in form of firewood, charcoal and other products derived from wood biomass. The finished structural materials used for the construction of buildings, or as a raw material, in the form of wood pulp, that is used in the production of paper. All other non-wood products derived from forest resources, comprising a broad variety of other forest products, are collectively described as non-timber forest products (NTFP); (Belcher 2005, Ticktin 2004, Belcher and Schreckenberg 2007).

The world has a total forest area of 4.06 billion hectares (ha), which is 31 percent of the total land area (FAO 2020). Globally, about 1.15 billion ha of forest is managed primarily for the production of wood and non-wood forest products. In addition, 749 million ha is designated for multiple use, which often includes production. Wood and other forest products, such as bamboo, are renewable and highly versatile natural resources for production of structural and composite materials. Reports on global wood products market indicated that wood is increasingly being used as a building material due to the numerous advantages of wood buildings over concrete buildings, thus driving the market for wood products. Increasing global demand for various wood products with the consequent high rate of over exploitation of forests has contributed adversely to climate change. Currently, the building industry is causing 25% of greenhouse gas emissions globally and therefore the concept of green building construction has evolved, which is expected to reduce CO₂ emissions and store carbon. In addition, constructing buildings with wood produces less waste and allows for quicker construction when compared to a concrete building. For instance, The University of British Columbia inaugurated an 18-storey wooden hybrid building, which was built four months faster than similar non-wooden buildings take, reducing construction time by almost 20%. Wooden building construction has increased the demand for mass timber components such as cross-laminated timber (CLT) and laminated veneer lumber (LVL). Timber is rapidly becoming the building material of the future and therefore needs to meet the increasing demand from construction industries. According to the Central Statistical Office, the number of wooden buildings in Poland in 2020 almost doubled over the last five years. Countries such as the US, Japan and China are also witnessing an increase in wood construction due to its economic and environmental benefits. Although, this trend is still very low in the developing countries, particularly in the sub-Saharan Africa, there are indications that use of wood for construction purposes would increase due to high level of urbanisation which requires high input of tropical wood. The rapidly growing urban population is expected to increase the demand for new residential and commercial buildings and furniture, thus further driving the demand for wood products.

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products market will be the middle east and Asia Pacific, where growth will be at Compound Annual Growth Rates (CAGRs) of
11.0% and 10.4% respectively. These will be followed by Africa, and South America, where the markets are expected to grow at CAGRs of 9.31% and 9.32% respectively.

The forest industries in Nigeria have over the years contributed immensely to industrial employment, manpower development and human welfare. After trees are harvested, they provide wood products which continue to store carbon in materials we use in our everyday lives. Wood-based industrial operations in Nigeria include timber logging, sawmilling, wood-based panel products manufacturing (i.e. plywood, veneer and particleboard), furniture making, paper making, match making, wood seasoning and the manufacture of various wooden items such as tool handles and wooden trays and other marketable wooden souvenirs. Items such as paper and packaging, building materials, furniture and musical instruments have a complete lifecycle which retains the carbon sequestered from the atmosphere by the trees they are derived from. The amount of wood waste generated from forest industries has become a problem to the local environment despite the fact that some are used for household cooking and in bread making industries yet a large part of the waste such as barks, slabs, lumber edges and sawdust remain unused in the factory and is either burnt or used in several locations in Nigeria as landfills or burnt to further pollute the atmosphere.

Harvesting timber can cause environmental problem. One of the greatest environmental concerns of twentieth century worldwide is deforestation, particularly the destruction of the tropical rain forests of Africa, Asia, and Central and South America by forest industry through unsustainable logging practices. Consequently, the environmentalists call for boycotts of tropical timber products that are not certified as derived from well-managed forests. Expert Group meeting held in Kyoto, Japan to discuss "Clean Development Mechanism and Sustainable Industrial Development" (UNIDO, 2000) suggested that African Industries should build institutional and infrastructural capacity to take full advantage of opportunities available in world trade by adopting environmental friendly technologies. Hence, it is important to assess the forest industry sector of Nigeria particularly the influence of the wood wastes factors on the long-term sustainability of the operating environment, in order to suggest recommendations for improvement. There is need to align the forest industry in the developing countries with the realities of the modern global forest products trade and the institutional requirements for the smooth running of the industry in line with the concept of sustainability. Developing countries should realise that wood harvesting per se is no longer a problem, rather the manner of harvest in relation to global best practices.

Forest Industry, Global Warming and Climate change mitigation

Climate change can be defined as fluctuations in the pattern of climate over a long period, it manifests by temperature increase as a result of increase in atmospheric concentration of CO₂, CH₄, and other gases. Greenhouse gasses cause warming of the atmosphere because they absorb outgoing long wave radiation and therefore less radiation is lost. Forest industry can be classified into two categories: primary activities and secondary activities. Primary activities, which typically use logs as raw material, include sawmills, veneer mills, and pulp mills. They are located near the source of raw materials and hence located in rural communities or country sides. Secondary activities on the other hand involves conversion of products such as lumber, plywood, and particleboard into finished goods, such as mass timber products like LVL, OSB, furniture, doors, boats, and packaging. They are located close to major transportation routes and population centres that serve as markets. Activities of these industries contribute to global warming. There has however been an increasing concern in the last two decades over the operational status of wood transformation industries and their consistency with the contemporary drive towards sustainable forest management. Total dependence on the natural forest in the and excessive commercial logging have caused wood scarcity and untold impact on the forest ecosystem in many timber producing countries. Increasing concerns of global warming and climate change have significantly shifted consumer preferences towards eco-friendly furniture, which has enabled manufacturers to develop furniture using eco-friendly materials. This helps wooden furniture manufacturers to gain a competitive edge in the market. Along with the environmental concerns, consumer demand for modular and elegant furniture is also driving the demand for wooden furniture across rural and urban areas: therefore, benefiting the wood processing market's growth.

Sustainable Utilisation of wood and non-wood products

The concept of sustainability stipulates that resources should be used in such a manner will allow generation yet unborn to have access to the same quality of use if not better. In the language of the current dispensation, it is called responsible utilisation and consumption. In order to ensure responsible consumption and utilisation, forest products should be exploited in line with the provisions of the pillars of sustainability, figure 1. It ensures ensure that products are used in a manner that is economically viable, socially acceptable and environmentally compatible.

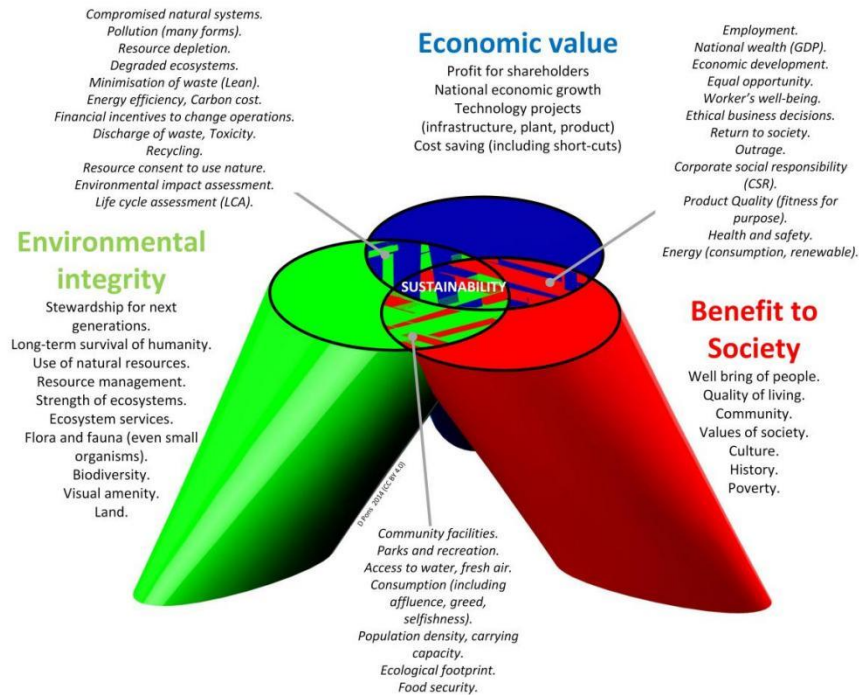


Figure 1: Model showing the pillars of sustainability

Natural resource utilisation is a social process in which different interest groups, with diverse and often conflicting intentions, confront each other at local, regional, national, and global levels. The social relations of resource utilisation are historically and politically constructed, and the concepts change over time and between different social and cultural actors. It is important to determine the most influential actors who mobilise development in the direction of their own interests in terms of the utilization of nature resource utilisation. As a natural resource, wood has been used in various industries for centuries. In this regard, wood resource utilisation has complex stakeholders and interests according to the social structural and cultural construction. The supply of and demand for wood in each country have thus affected sustainable wood resource utilisation, since the pattern of supply and demand of wood resources varies according to the industrial composition of wood products by country. Wood supply is affected by factors, such as harvestable trees in the forests, accidental felling, wood stock from previous periods, ownership structure, own consumption, wood price, price of production factors, and legislation. In contrast, wood demand depends on the number and structure of the processing industry, the energy industry, wood stock from previous periods, economic development, demand of related industries, supporting programs and activities for wood promotion, wood and wood products prices, traditions, and consumer preferences. Primary wood products require different raw materials. The quality of sawn wood and plywood depends on specific round wood conditions, such as the species and size, which leads to a difference in the quality and price of the sawn wood produced. On the other hand, fiberboards, such as medium-density fiberboard and particle boards, are produced using round wood as well as recycled wood, wood chips, and wood by-products as raw materials. All these social and economic considerations should stay within the framework of ecological compatibility, such that a web of relationships among economic consideration, social well-being, cultural and spiritual beliefs as well as ecosystem services and functions are established in a manner that is consistent with internal best practices.

Mitigating Climate Change through Sustainable Wood and Non-wood Utilisation

1. Regulating Forest Products use through Global products market

In order to ensure sustainable utilisation of wood and non-wood products, the Forest Stewardship Council (FSC) and other related Organisation such as Forest Law Enforcement, Governance and Trade Action Plan FLEGT have instituted Forest Certification procedure. which will ensure that forest products generated from sources other than a sustainably managed forest will be

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or

countries who are willing to follow standard global practices in timber and timber products trade through a thoroughly verified

procedure. This approach to sustainable forest utilisation on the long run regulate harvesting and prevent practices that are normally aggravating climate adversities.

2. Sustainable Utilization of Lesser Known and Lesser-Used Tree Species

Increased demand for traditional timber species has led to the depletion of large areas of Nigeria’s forest cover. Sustainable forest management requires that measures are put in place to minimize forest depletion through the utilization of lesser-known species, reforestation, setting margins for annual allowable cut, banning export of round logs, conservation of biological diversity and promotion of efficient wood-based industry. In a study conducted by Ewudzie *et al* (2018), Greater part of the population prefers species like *Milicia excelsa* (iroko), *Nesogordonia papaverifera* (Danta), *Pipadeniastrum Africana* (Dahoma) and *Ficus benghalensis* (Denyan), for roofing while *Khaya senegalensis* (mahogany), *Tieghemella heckelii* (Makore), among others are used for furniture. The perception is that when the traditional species are used for either roofing or furniture they last longer.

3. Sustainable Utilization of Non-wood Forest Products

A lot of works have been carried out on the technical suitability of some non-timber products such as bamboo as substitutes for woods to optimize its utilization potential. Ogunsanwo *et al* (2015) found an average density of 700 kg/m³ which was a prerequisite for high mechanical strength. The moduli of elasticity were high and exceeded 14 kN/mm² for bamboo boards and 13 kN/mm² for finger joints. Comparing *Bambusa vulgaris* with selected topical hardwoods, Adebayo (2020) observed higher specific strength of glulam *Bambusa vulgaris* boards. The specific gravity for MOR was 10.36Nmm² which was higher compared to *Sterculia rhinopetala* (1.67Nmm²) and *Mansonia altissima* (2.08 Nmm²). Utilisation of Bamboo, a product with far lower gestation period, as substitute for wood will offer greater opportunity to sustainable forest products utilisation.

4. Sustainable Utilisation of Residues of Forest Products for Energy Generation

Wood remains the largest biomass energy source (Urban and Mitchell 2011). The principal uses of mill residues for energy are as domestic fuel, as reed stock for charcoal production, and as industrial fuel to produce process heat, electric power, or both. In a research carried out by Egbewole *et al* (2009) on potential use of wood residues for briquette production; *Anogeissus leiocarpa* had the highest heat of combustion value of 5211.28 323 Kcal/kg, followed by *Antiaris toxicaria* with 5035.61 543 Kcal/kg, while the mixture of *Anogeissus leiocarpa* (Ayin) and *Albizia adianthifolia* had the least heat of combustion value of 4874.80 326 Kcal/kg. In Developing countries, particularly in sub-saharan Africa, the wood processing industry lacks facilities to process sawmill wood residues into energy products. This makes it very inefficient in terms of wood economy (Ogunsanwo (2010). In the past, these items

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 kept at homes as carbon stock for several years.



Plate 1: Wooden souvenirs produced from some tropical hardwoods

5. Harvested wood products (HWPs) in climate change mitigation

Greenhouse gas (GHG) reduction by conserving carbon stocks in forests and increasing carbon uptake through improved forest management and reforestation are important tools for mitigating climate change. According to Jang and Youn, (2021), Harvested wood products (HWPs) have been recognised for their contribution to the reduction in GHGs by storing carbon dioxide from the atmosphere in trees before decaying and combustion. When trees are harvested from forests, a significant amount of carbon is released, but will be continually stored in wooden products (e.g., in wood products as a building material, furniture, and paper). HWP, therefore, contributes to sequestering carbon dioxide over a period of time, rather than being immediately released into the atmosphere after harvesting.

HWPs as a carbon pool in the second Kyoto implementation period were ratified by the parties of the United Nations Framework Convention on Climate Change (UNFCCC) during the 17th Conference of the Parties (COP) in 2011. As a result, the parties were able to account for carbon stored in HWPs as a means to reduce GHG emissions and include them in their national carbon inventory. Harvested wood products are good sources of stored carbon which are gradually being incorporated into national and international carbon budgeting. At the present, there are challenges arising from socio-economic differences among states, efforts are however being intensified to provide needed information towards acceptable and enduring harvested wood carbon pools.

6. Green Building as climate change mitigators

Wood as store of carbon is being exploited in the building industry. It is a sustainable, high-value building material which has potential to contribute immensely to decreasing the fossil carbon footprints in the construction sector and possible direct and indirect benefits from wood use can contribute to the achievement of multiple Sustainable Development Goals. A typical Hotel constructed in Australia for instance has the capacity to store 1,500 tonnes of CO₂. This trend is growing all over the world and indeed attracting

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carbon calculations in its regulations for buildings. These requirements turn the spotlight on timber, due to its lower embodied carbon and its ability to act as a carbon sink.

From January 2022, Sweden requires developers to submit embodied carbon calculations for the whole lifecycle of a new building in order to receive planning permission. France also brought in new regulations at the beginning of 2022: its RE2020 regulations require embodied carbon analysis over the lifecycle of residential buildings, a requirement that will extend to other building types from 2023. RE2020 also introduces embodied carbon limit values which will tighten in stages over the years. In order to expand the scope of green building concept, France also has goals for using bio-sourced materials, such as timber, in its public buildings. Currently its legislation calls for bio-sourced materials to be used in at least 25% of major refurbishment or new build public projects from 2030. The new direction is clearly indicating that timber harvest in a sustainable manner will contribute positively to climate change mitigation while expanding the frontiers of global wood and wood products utilization.



Plate 2: A typical Timber structure in Australia



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Conclusion

Global demand for wood and wood products will continue to increase due to population increase and the need to produce green products of wood origin. The trend has the ability to aggravate the climate change adversities due to loss of carbon sink and other related ecological problems. Sustainable utilization of wood and wood products through adherence to standard global practices has great potentials to stem the tides of climate adversities arising from unsustainable practices. To date, several practices have been proposed to expand the efficiency of wood products utilization through sustainable practices. One practice that has recently caught the attention of forestry experts is the cascading concept. The concept of cascading use has been resented for the sustainable use of wood resources and consists of a method to increase the usage time of wood resources and efficiently increase the carbon stock in Harvested Wood Products. It uses wood resources sequentially: (1) by producing raw wood as sawn wood, (2) using sawn wood as a building structural material, (3) recycling sawn wood into wood-based panel materials, and (4) using wood as fuel at the end of its life. Using wood products for as long as possible is a way to trap carbon in the HWPs in use and delay carbon dioxide emissions into the atmosphere, thereby contributing to greenhouse gas reduction.

Recommendations

1. There is need for an aggressive afforestation programme through private plantation development initiative.
2. There is need for all Countries to embrace timber legality standardization in order to stem unsustainable wood utilization practices.
3. Scope of wood should be expanded by utilization of lesser-used species and non-wood products like bamboo.
4. Residues generated from wood processing should be used to generate green products that are compatible with the principle of responsible consumption and utilization.
5. Harvested Wood Products (HWPs) are enormous store of carbon all over the world, technologies and strategies for their incorporation into the Country's carbon balance should be encouraged.

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