



Sustainable Management of Nigerian Forest through Efficient Recovery of Harvesting Residues

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Abstract- Harvesting residue poses a lot of problem especially to the waste management authorities in Nigeria and as a disturbance to forest floors since it is not being used appropriately. Large quantity of wood waste is generated daily in harvesting and some other forest management operations which run into millions of Naira if recycled or properly used. This paper focused on wood harvesting practices, sources of harvesting residue, the percentage recovery and their potentials for future usage in other to be able to manage the forest sustainably. Available literatures on this subject were critically reviewed. Findings revealed that large quantity of wood harvesting residue generated could be used for energy production, ceiling boards, Charcoal production, fuelwood, briquette and Pharmacognosist. This provides a solution to increasing deforestation caused by overexploitation of the forest due to increasing demand for forest products thereby reducing pressure on the forest. It is evident, however, that not all forest industries, particularly in developing countries, currently use harvesting and wood residues efficiently for energy.

Keyword: Harvesting, Forest Management, Residue, Recovery Rate, Energy Generation

INTRODUCTION

Forestry is concerned with the theory and practice of growing trees, the management of forest and the utilization of the products. Modern forestry as the scientific management of the forest resources for the continuous production of the various goods and services obtainable from the forest. Forest exists to serve some definite or specific objectives, thereby requiring adequate conservation in other to achieve these objectives. Forest is a large area of land thickly dominated with trees and Forests play very important role in building the economy of a particular country[1]. Forest is very important to us as it provides various products which are very essential for mankind, it provides raw materials, and without it no one can survive. It provides fodder, fuel, food like fruits and vegetables etc. to human being. Forests are useful to mankind in many ways such as providing oxygen, plants to eat and many other ways. However unlike other natural resources, forest resources are biologically renewable, they can grow after harvesting on the same site[2].

There are 1,700 million hectares of tropical forests accounting for half of the world forest area. Tropical forests are of different types and include rainforests, coastal mangroves, savanna woodlands and alpine forests in the

Andean highlands of South America. Africa contains 703 million hectares of forests of which 69% is open savanna woodland. Many literature has reported that a common rule of thumb in forestry is 50:50 for the proportions of the tree that are residues and harvested wood respectively, while some literature reviewed gave estimates of 30–40% residues. Forest constitutes an integral part of the environment. It provides essential environmental services as well as important resources (timber and non-timber products) which are classified as renewable natural resources [3]. The major problem which Nigeria forestry is facing is ensuring sustainable forest management. Nigeria's forests have depleted over the centuries and its depleting at an alarming rate.

This is not farfetched from the inability of the country to sustainably manage its forest lands and resources to meet the demands of both present and future generations in terms of economic, ecological, social and cultural needs. Forest needs including pruning, thinning and other appropriate management practices will lead to a beautiful and stable forest with healthy, safe trees and a great grazing environment. A financial return from the timber when the trees are matured can provide an added incentive[4].

Harvesting and Residue generation

Forest throughout Nigeria and the rest of tropical countries are diminishing at an alarming rate of 3.5% (about 350,000-400,000 ha) per annum in land coverage over the past 50 years in Nigeria[5]. The natural forests are increasingly being depleted in Nigeria through indiscriminate extraction of economic trees and encroachment for other purposes such as large scale agriculture, urbanization and industrial development. In general, there are two types of forestry residues – primary forestry residues produced while harvesting timber, such as tree tops, branches and stumps, and secondary forestry residues produced during processing of forest materials or products, such as sawdust, bark and scrap wood[6].

The forest industry in Nigeria has traversed a variety of circumstances. Prior to 1976, round wood overexploitation for export was rife, and this, coupled with high waste generation in the forest led to significant reduction in industrial round wood availability in the forest reserves. Less than 80% of the harvested tree during logging operation are taken away from the forest, the rest are left in the forest as residue. In Nigeria, forest industry, residue comprises nearly half the total wood volume. This coupled with the vast generation of waste during wood processing operations substantially reduce wood resource availability for industrial processing[7]. The residues (Fig 1) left in the forest impede forest regeneration, increase the risk of forest fire and hinder the area for recreation use. Increasingly, harvesting plans on public and private lands require some form of residue management, which usually means either piling or burning [8].

The tropical timber industry generates wood waste at various points in the production chain. An ITTO study estimated that the timber industry in the Amazon generated 49.7 million m³ of waste per year, including 28 million m³ (57%) of logging residues and 20 million m³ (40%) in sawmills. In Malaysia, forestry generates about 9.83 million m³ of wood residues, comprising 5.1 million m³ of logging residues, 2.2 million m³ of primary manufacturing residues, 0.91 million m³ of plywood residues and 0.9 million m³ of secondary residues such as sawdust [9].



Fig 1: Logging Residue

Recovery Rate

There is considerable potential for increasing wood-use efficiency, particularly in the forests and in sawmills: in 2002, there was 20% of logging residues, 36% of sawmilling wastes[10]. Increasing the recovery of waste and its use in the bioenergy sector is constrained by several factors, including limited economic returns, the remoteness of many forests and mills from bioenergy markets, a lack of incentives for wood waste utilization, a lack of know-how on efficient waste utilization, and inadequate enforcement of environmental regulations. Nevertheless, there are some positive signs[10]

FOREST MANAGEMENT

Forest Management

Forest management is the branch of forestry concerned with the overall administrative, economic, legal, and social aspects and with the essentially scientific and technical aspects, especially Silviculture, protection, and forest regulation[11]. This includes management for aesthetics, fish, recreation, urban values, water, wilderness, wildlife, wood products, forest genetic resources and other forest resource values.

Sustainable forest management is the management of the forest to provide good and services to meet present day needs while at the same time securing their continual availability and contribution to long term development. Sustainable forest management ensures that the forest produces resources on continual basis that will satisfy both current and future needs and the aim is to achieve approximate balance between net forest resources and harvest. Sustainable forest management is one of the most important contributions that forestry can make to the sustainable development objectives of any nation, Thus to achieve sustainable development, it is necessary to manage

and preserve natural resources in other to meet the needs of present and future generations[12].

Nigeria currently has less than 10% of her total land area under constituted Forest Reserves. Undisturbed forest covers only 12,114 km² (Fig 2,3 and 4), which is about 1.3% of the Country's total land area. Forest area declined during the 1990s at an estimated annual rate of 2.6% (or 398,000 hectares per year) [13], due to agricultural expansion, encroachment, over harvesting, bush burning and illegal harvesting. The Federal Department of Forestry in 2001 estimated the annual depletion rate to be about 3.5%.



Figure 2: Vegetation Index for Nigeria (1978)



Figure 3: Vegetation index for Nigeria (1986), Source: [14]



Figure 4: Vegetation Index for Nigeria (1995)
Source: [14]

Factors responsible for high volume of residue generation
The high rate of waste generation is caused by a multitude of factors. The factors responsible differ from one sector to the other, but a general trend indicated that average percentage volume recovery is getting lower while waste generation is on the increase. This is mainly due to the reduced size of average timber available for processing and the increasing need to utilize lesser used wood species whose properties are not well understood[15].

- Silvicultural Practices such as Pruning, thinning
- Harvesting Method
- Equipment availability
- Lack of Appropriate Harvesting Technology

POTENTIALS OF FOREST RESIDUE

In Nigeria, forest industry residue comprises nearly half the total wood volume. The industry does not make efficient use of this residue. Options to improve efficiency include briquette production, Charcoal production, and better fuelwood management.

Optimum use conserves natural resources (Trees) by reducing the need for new trees. Some natural resources are renewable and some are not. Although trees or wood come from renewable timber sources. Trees harvested can be replaced by growing more trees but by maximizing the tree (Fig 5) after felling both the forest residue and the sawmill residue will go a long way in helping conserving Natural forest [3]. These residues can be used in producing or manufacturing some useful products.

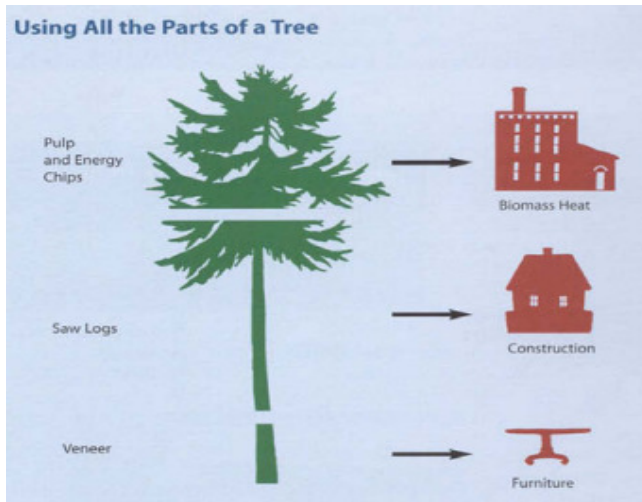


Figure 5: Parts of the Tree, Source: [15].

Horticultural Surfacing

In advanced countries, Wood chipper machine is taking to the forest and is being used to reduce forest residues such as branches, tops, offcuts, stumps etc. into chips can be used by horticulturist to form bed layer on the surface of the flowers or plants (fruits, flowers, vegetables or ornamental plants). It also suppresses the growth of weed around the flower, provide decorative ground surface finishing and also replenishes the soil nutrients after decay.

Energy generation

Method of converting harvesting residue to energy

This involve a three-stage gasification process involving the following sub-processes:

- low temperature gasification,
- high temperature gasification and
- Endothermic entrained bed gasification.

During the first stage of the process, the biomass (with a moisture content of 15 – 20 %) is continually carbonized (low temperature pyrolysis) with air or oxygen at temperatures between 400 and 500°C. During the second stage of the process, the gas containing tar is postoxidized using air and/or oxygen in a combustion chamber operating above the melting point of the fuel's ash to turn it into a hot gasification medium. During the third stage of the process, the char is ground down into pulverized fuel and is blown into the hot gasification medium. The pulverized fuel and the gasification medium react endothermically in the gasification reactor and are converted into a raw synthesis gas. Once this has been treated in the appropriate manner, it can be used as a combustible gas for generating electricity, steam and heat [16]. Fig 6 showed the rate of energy generation from different sources in the United State of America

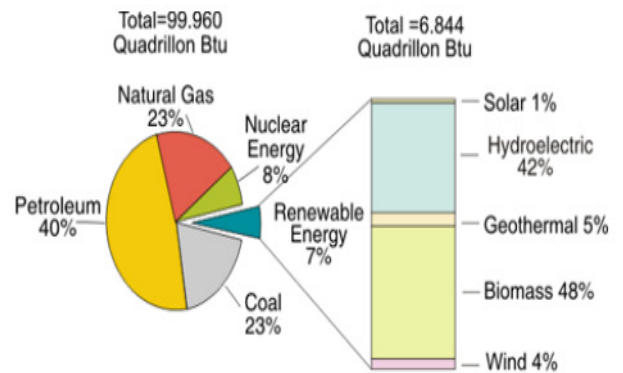


Figure 6: Energy usage in the USA, Source: [17]

Value added products

Particle board are made from small pieces of wood particles which are coated with resin, organic and inorganic materials and bonded together under heat and pressure. It is usually manufactured from small, low-quality logs that are milled into wood particles. It may also be made from sawdust, shavings and other wood waste generated by wood manufacturers [18]. These logs or wood scraps are milled to a specific particle size, and the particles are blended with an adhesive. This blend is then bonded in a hot press to form a panel. Particleboard is commonly used for making inexpensive furniture, cabinets, and shelving. It is also used for underlay floors, roofs, stairs, and countertops. They are also used in making composite board like lamin board, block board, cement bonded board etc. [19]. Particleboard usually consist of fine wood particles like sawdust and flakes and the core is made of coarser material, it has a smoother surface and is being used instead of asbestos while some can also be used to make bricks used in building houses and some can be used to build a pre-fabricated house.

Charcoal Production

Most charcoal can be produce from the harvesting residue, but other sources may be coconut shells and crop residues. Charcoal is produced in kilns by a process called pyrolysis, i.e. breaking down the chemical structure of wood under high temperature in the absence of air [20]. During the process, first the water is driven from the wood (drying), and then the pyrolysis starts when the temperature in the kiln is high enough. When the pyrolysis is complete, the kiln gradually cools down, after which the charcoal can be removed from the kiln. Because some of the wood is burned to drive off the water, dry wood produces better charcoal at a higher efficiency [6]. Charcoal is being used widely in Africa instead of solid wood and to some extent is preferable to using wood for cooking, e.g. charcoal can be used to cook indoor while it is not possible using firewood to cook inside etc.

CONCLUSION

Although forests regenerate naturally, the natural process of restocking exploited forests is rather slow and cannot match the rapid rate at which forests are being exploited. If the exploitation of the forest is sustainably controlled, it has the potential of providing the various goods and services obtainable from it. The contributions of forestry to the economic, ecological, social and cultural development of any country cannot be overemphasized. While deforestation continues at an alarming rate, the demand and pressure on the forest and its goods and services is anticipated to continually rise. Recycling waste and residue generated through harvesting will go a long way in combating climate change and drastically reduce deforestation. Also this will increase the energy generation of the country as it is being practiced in some advanced countries. Also provision of value added products such as ceiling, wall paneling, tiles and some other products which can serve as substitutes in place of solid wood. Thus the need for judicious and effective management of the forest and its resources to ensure a sustainable environment, so as to harness its full potential to meet the insatiable demand of present and future generations. Stemming residue generation using best harvesting practice, effective and whole utilization of harvested trees will help in protecting our forest and allow the forest tree to attain both biological and financial maturity before harvesting.

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