

Session 5

[Wednesday 4th period 2.0 hours - Hall A]

The use of wood in different cultures (continued)

Speakers



Speaker:
Victor Adekunle

Topic:
The Social, Religious and Magico-Cultural Aspects of Wood and its Versatility for Rural and Sustainable National Development in Nigeria



Speaker:
Xiaomei Jiang

Topic:
The Inheritance and Development of Hongmu Culture in China



Speaker:
O K Remadevi

Topic:
Wooden Monuments in India, Epitomes of Beauty and Talent, Need Protection from a Biological Perspective



Speaker:
Adjovi Edmond Codjo

Topic:
Typology of Wood Sculptures in West Africa



Speaker:
Stephen Tekpetey

Topic:
Lifestyle Changes in Some Urban Centres in Ghana: What are the Existing and Potential Impacts on Wood Use in 2011 and Beyond?

The Social, Religious and Magico-Cultural Aspects of Wood and its Versatility for Rural and Sustainable National Development in Nigeria

Victor Adekunle¹

Abstract

Wood is the most versatile material that has ever been known and a material that has contributed immensely to the development of nations that are richly endowed with it. Nigeria is a tropical country with a good productive wood resource base (forest). This study therefore assessed the social, religious and magico-cultural roles of wood and its contributions to rural and sustainable national development. Data on religious and socio-cultural roles and other important utilization patterns were collected through the use of questionnaires, discussion with key experts and observation. The data on the roles of wood for sustainable development and increasing higher-value wood, now and in future, were collected from records and the relevant literature. This study elaborates on wood utilization from religious perspectives, trees and national identity, different cultural products from wood, traditional herbal medicine, wood and fetishism, musical instruments from wood and the aesthetic products of wood. Specific wood species involved in each of the utilization patterns were identified. For other utilization patterns, wood is relied on as the only source of industrial and domestic cooking, the only source of lumber, poles, stakes, handles for farm tools, hunting tools, shelter, canoes, and household utensils. On national development and sustainable future, the study reviewed the development of wood industries in Nigeria, employment and trade in wood and wood products as sources of rural and urban income. It assessed the present status of the various large and small-scale wood industries in Nigeria and their contributions to national development. Finally, the paper proposes some recommendations on how wood use and sustainable development can be strengthened with the view of promoting higher-value wood use at the local and national levels Nigeria.

Key words: Magico-cultural, Wood utensils, Joinery, Sustainable development.

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1 INTRODUCTION

The importance of forest ecosystems to human society has long been recognized for the production of the many and varied ecosystem services upon which life is based (food, fiber, fuel, water filtration, climate change, nutrient cycling, pollination, pest control and disease) and the promotion of the natural resources base upon which economic activities are founded (Swallow *et al.*, 2007). They reported moreover, that healthy ecosystems are particularly important to the rural poor of the developing world, people who often live in very close connection to their natural surroundings. Angelsen and Wunder (2003) noted that timber, non-timber forest products (NTFPs) and animal protein from the forest ecosystem are all used by the rural poor for subsistence, and also as a source of income and employment. It was estimated that 90% of the world's poor depend on forests for at least a portion of their income (World Bank, 2000). In Africa, 600 million people have been estimated to rely on forests and woodlands for their livelihoods (Anderson *et al.*, 2006), and in India, 50 million people are estimated to directly depend on forests for subsistence alone. However over the year, the number of communities and dwellers that depended on wood has increased. Kaimowitz (2003), Shackleton and Shackleton (2004), UNEP, (2006) Vedeld *et al.*, (2007) and FAO (2008) reported on the importance of wood and other forest resources to local communities and national development.

Man has always relied on wood for survival. His shelter, farm tools, weapons (bows and arrows, and clubs) and house hold utensils were made from wood. Historical records show that civilization and the continual existence of man in the world today would not have been possible without wood. The early great explorers who brought civilization to Africa, Nigeria inclusive, made their voyage with wooden canoes, an ocean-going vessel. In view of this, Oluyeye (2007) reported that the early migration and later exploration of the world would have been hindered with the inability without wood to cross large bodies of water. In the bible, Noah, his immediate family members and some privileged animals escaped the 40 days flood in an ark made exclusively of wood. These same animals later began the new world after the destruction of the old one with the flood. The roof of King Solomon's temple was made of cedar woods, the inner portion was decorated with cedar boards and the floor was covered with pine wood.

Wood is the most versatile material in the world and it is a blessing to any nation that is richly endowed with its resource base, that is, forests. It can always be relied upon for sustainable development as a renewable natural resource, it can easily be converted into any shape and size with little effort or energy and using simple tools, it can be joined and fastened together with nails, screws and bolts and nuts and it retains its colour, shape and strength for a long time. It is highly durable and beautiful in its natural form. Fuwape (2007) captured the versatility of wood in his inaugural lecture titled 'Wood: from cradle to the grave'. He noted in the lecture that man begins to rely on wood from the very day he is born and continues to use wood till the day of his death. He claimed that the first food eaten immediately after a child is born is cooked with wood and he also begins to sleep in a wood cradle, when he begins his education, he starts by writing on wooded slate, he moves ahead to write with pencils or pens on papers, both pencil and paper are also wood products, after graduation, the certificate he receives is made of paper, if he is lucky to get job, the money he receives as wages is also made of paper and when he finally dies, he is buried in a wooded coffin. This shows how indispensable wood is in the survival of man on earth.

The development of forest resources management in Nigeria could be divided into three phases. These phases are the reservation phase, between 1899 and 1930, the exploitation phase between 1930 and 1960 and the development phase from 1960 to date. The first phase was pioneered by the colonial authorities. It involved the demarcation and establishment of tracts of forest land as reserves, provision for their protection and control of wood extraction. This began in 1899 under Mr Thompson, a serving British Forest Officer transferred from India to Nigeria (Enabor, 1981, Adekunle, 2005 and Oyebo, 2006). During the second phase, there was an increase in forest exploitation because many Nigerian timber species were accepted in international market after extensive testing of their samples. The third phase witnessed a large scale afforestation projects and plantation establishment through Taungya system to argument wood supply from the natural forest. Today, all the wood is from the forest ecosystem. This study is on the social, cultural, spiritual and traditional aspect of wood. It also examines the contribution of wood to health care delivery system, development of wood industries in Nigeria and the roles of wood in rural, socio-economic and national development. Recommendations on how to promote higher-value wood use are given. The Nigeria total land cover according to FAO, 2005 is shown in table 1.

2 METHODOLOGY

2.1 The study area

This study was carried out in southwest Nigeria. It is one of the six geopolitical zones in Nigeria and it has seven states. The major vegetation type of this region is the tropical rainforest ecosystem. The mean annual rainfall is 1500mm while the mean temperature is 28⁰C. The soil type is the alfisol class, well drain and fertile. There is favourable weather condition throughout the year. There are two distinct climates (rainy and dry seasons) The rain season is for nine months and only three months of dry season. This account for why the forest contains most of the important indigenous hardwood species which are of high economic value in the timber industries.

2.2 Data Collection

Data on the social and cultural aspect of wood were collected with a well structured questionnaire administered to twenty randomly selected respondents in ten communities in Ondo state, Nigeria. The questionnaire was designed to collect information on the cultural, health, religious and traditional importance of wood, various species involved in each of the functions, cultural products from wood and the sources of employment and rural income from wood. Information was also collected from key informants on the species used for curing some common ailments. The available records and files in forestry office and literatures were consulted to obtain additional information on the development of wood industries and role of wood in national development.

3 RESULTS AND DISCUSSION

The results of this work are discussed under different subheadings according to the information obtained. All the respondents and the key informants are males, mature adults and bread winners. They all supported the wide use of wood for various purposes.

3.1 Religion, social, health and magico-cultural aspects of wood in Nigeria

3.1.1 Religion:

The Holy bible of the Christian faith stated that vegetation, which include plants by extension the forest, was created by God on the third day of creation (Genesis 1:3). Man was the last to be created, on the sixth day. So, it implies that the trees are older than man. The creator, in His wisdom, deliberately did this because of his fore knowledge that man will always depend on the forest and wood for survival. So, since creation, man has always depended on wood and wood products for livelihood. In addition, most of the roles played by wood in human life today were predicted in the bible. For instance, in Ezekiel 47:12, it was written that “the trees of all kinds (species) will grow and their leaves and woods and fruits will serve as food and for healing”. The importance of wood in religion could be dated back to the time of Jesus. He was presented with three gifts at birth and two of them were wood products (frankincense, the gum from the wood of *Boswellia thurifera* and myrrh, a fragrance extracted from the wood of *Commiphora myrrha*). He was nailed to a wooden cross (but the species used to construct the cross is yet to be identified) and a crown of thorn woven from a species identified as *Zizyphus spina-Christ* was placed on his head. During his entry into Jerusalem, branches of trees and leaves were used to welcome him. In view of this, churches are decorated with wooden cross. It is now part of worship for Christians to carry wooden cross about as object of worship. Also, during Christmas and Easter periods, churches and Christian homes are well decorated with branches of wood and palms. Prominent species of wood for these decorations are *Casuarina equisetifolia*, *Pinus caribean*, *P. Ooacarpa* and *Calistris robusta*. Wood also provides materials for worship in Nigeria. The beads (tashbia), equivalent of ‘Jap-Mala’ in India, usually counted by Muslims during their five times daily prayer are made from the seeds of *Balanites aegyptica*. The equivalent, called rosaries, of the Roman Catholic Church worshippers are made from the seeds of *Atrus precatorius* (Etukudo, 2000).

Many forests are venerated and separated for religious purposes in Nigeria. These forests are referred to as sacred groves or black forest. They are protected though taboos and local laws. So entrance and any form of activities are prohibited in such forests except the priest during festivals. Prominent among these in southwest Nigeria are Igbo Olodumare and Oshu Oshogbo that have become world heritage centres. There are also several wood species such as *Melicia excelsa* (Iroko), *Adasonia digitata* (Igi-ose), *Newbodia levis* (Akoko), *Ceiba pentandra* (Araba), *Dracenia mannii* (peregun), *Diospyrus spp* (igi-dudu or black wood), etc that are revered and worshiped as gods. These trees are worshipped with the blood of goats, chicken or pigeon at specific times of the year. Prayers for protection and request are made during the worship period. The wood of some of these trees are also believed to be the abode of both evil and good spirits. Cutting them is dreaded, so they are usually left where ever they are found. They are very common in market and town centres, traditional worship places and the sacred groves. Specifically, *Adasonia digitata* wood is believed to be the home of the ‘Abikus-Ogbanjes’, referred to as *spirit child* or *wanderer child*. ‘Abiku-Ogbanje’ refers to a child who dies and returns again and again to plague the mother (Maduka et al., 1987). They are called *familiar spirit* in religious cycle. A poet avowed in one of his poems on ‘abikus’ that they live in the wood of this tree: “Coming and going these several seasons, Do stay out on the ‘baobab’ tree, Follow where you please your kindred spirits, If indoors is not enough for you” (Clark, 2011). A common saying among the Yorubas (one of the three most populous tribes in Nigeria) holds that “an iroko tree that is not destroyed when young will require a daily oblation when it becomes a mature wood in future”. This confirms the belief that *Melicia excelsa* is a tree that is worshipped.

3.1.2 Cultural aspect of wood

For the cultural aspect of wood, *Newbodia levis* is highly recognised and used during the installation of kings and conferring of chieftaincy titles. Different kinds of drums for traditional, festival, cultural and social purposes are made from the wood of several species. The wooden part of the skin drum (Gbedu) and the talking drum (Gangan) are made from the woods of *Pterocarpus osun*, *Millicia excelsa*, and *Cocos nucifera*. The thumb piano (Duru) is made from the wood of *Alstonia congensis*, *Holarrhena floribunda* and *Pychnathus angolensis*, the musical bows and violins are made from the woods of *Anoistrophyllum secundiflorum* and *Malacanthia alnifolia*, the wooded harp, wooden bell and gong (Agogo) are carved from the wood of *Alstonia congensis* and *Pterocarpus osun* and the wooden flute (fere) from the woods of bamboo (*Oxytenanthera abyssinica*). Wood is used for the construction of beautiful coffins used in burring dead bodies in Nigeria. Production of coffins is now a very lucrative business in due to the exorbitant cost of the product. The high cost is due to the cultural importance of coffins in burial ceremonies and funeral rites.

The most popular local gin in Nigeria (Ogogoro) is produced from the distillation of palm-wine (emu), the liquid extract from the woods of *Elaeis guineensis* and *Raphia hookeri*. These liquors (palm wine and local gin) are of high social and cultural importance in SW and SE Nigeria. They are drunk in social functions like funeral, naming, and wedding ceremonies. They are items used in sacrifice especially to appease traditional gods and ancestral fathers and for offering prayers. The worshiped of Ogun, the god of iron (one of the most popular traditional gods), by its devotees is done with palm wine, local, palm leaves and dog sacrifice. There are many sheds and local bars where these liquors are sold and where people spend their leisure time, relax and drink, and in the process, they discuss business, settle grievances and make friends. Trade in these wood extracts is a source of job opportunity to many rural women in these geopolitical zones. Apart from the use of these extracts in socio-cultural activities, they are the most important and potent solvent for preparing traditional medicine practice (Etukudo, 2000). They are useful in distilling, mixing and boiling wood stems and barks during herbal preparations.

3.1.3 Wood in ethno-medicine and health care delivery system

The role of wood in providing health care delivery system among the rural communities and urban poor in Africa is becoming more popular (Adekunle, 2001). The list of several plants of medicinal importance in Nigeria and the various ailments they cure has been provided by some authors (Adekunle, 2001). The preference of ethno-medicine by rural respondents is because of its availability and affordability. It is very cheap and readily available unlike orthodox drugs and modern medical facilities. Secondly, it has stood the test of time according to them. Thirdly, it is very effective in the treatment of sickness like sickle cell, impotence in men, madness and epilepsy which cannot be cured perfectly and completely by orthodox medicine. The extract from the wood stems of species like *Enantia chloratha*, *Alstonia booneii*, *Khaya spp*, and *Pterocarpus osun*, when mixed or distilled with local gin, palm wine or water are used to cure malarial fever, stomach disorder, diuretic, diaphoretic, emetic and several other ailments. Specifically, the wood of *Securidaca longepedunculata* is reported to have the ability of curing several common ailments (Omrwa, 2009). When the wood is chewed and the aqueous solution is swallowed, it has the ability of curing erectile dysfunction; as a result, it got its local name (magani bura ntashi) from this singular function. The wood of *Hymenocardia acida* has been reported to have the ability of regulating fertility and controlling estrous cycles in women and female animals (Abu & Chinedu, 2011). The

powdery substance from the wood of this species is used by Fulani women for beautification, hence the naming of the plant as 'Fulani powder'. The extract from the bark of *Pterocarpus osun* and *Alstonia boonii* were reported to be very efficient in curing cough and chest infection when imbibed directly. The wood of *Xanthoxyllum zanthozylioides* (orin-ata) cures sickle cell anaemia, wood stem of *Garcinia cola* and *Mussalaria accuminata* is noted for curing tooth infections and gum disorder. *Mussalaria accuminata* (pako-jebu) is the most widely used chewing stick for cleaning the teeth in Nigeria for those who cannot afford the cost of tooth paste and tooth brush. A single study like this is not sufficient to list all the common wood species believed to have some ethno-medicinal potentials.

3.2 The resource base of wood

The only source of wood is the forest, as renewable natural resource. No matter how beautiful wood and its products are, without the forest, they become unavailable and their beauty is lost. So, it is paramount that this resource base is well managed for the continuous production of wood products. Forests can broadly be divided into natural and artificial or man-made. The natural forest is endowed by nature and it is the home of all tropical indigenous hardwood species in Nigeria. It is categorized into forest reserves and free areas in the country. Forest reserves are forestland conserved and managed by the government. They are protected by laws and edicts and entrance and activities such as logging, hunting, farming and collection of minor forest products are controlled by the government. The available records in the Federal Department of Forestry, Abuja show that Nigeria has a total of 1160 constituted forest reserves covering a land area of about 1075km². Their management is directly under the respective state government where the reserves are located. These reserves are allocated to timber contractors or concessionaires annually, for wood extraction, after the payment of appropriate levies and due. The free areas are all other woodlands out the reserves. They belong to communities or indigenous individuals. Government's control on the free areas is limited to the collection of fees on wood that are felled from the area. Plantation began in Nigeria to augment the wood supply from the natural forest. Species in Nigerian plantations are mostly exotic species like *Tectona grandis*, *Gmelina arborea*, *Eucalyptus spp*, *Pine spp* and *Ciderella odorata*. Some of the few indigenous species in the plantations are *Triplochiton scleroxylum*, *Nauclea dedderichii*, *Mansonia altissima* and *Terminalia supaba*. The most abundant species in Nigerian plantation is *Gmelina arborea*. Over a million hectares of this species has been established in the country under various afforestation programme of the government, especially as raw material for pulp and paper production (Onyekwelu and Stim, 2002). Since the objective of establishing the plantations of *Gmelina* (pulp and paper production) was not met, it is now harvested as sawn timber in Nigeria for all construction and productions purposes.

Nigeria is a tropical country with three major ecological zones namely the fresh water swamp/mangrove and the rainforest in the south and the savannah in the north. The rainforest is 2% of the total forest in the country and it is the source of more than 70% of the total sawn wood in the country. About 90% of the plantations established in Nigeria from the first half of the 20th century to the 1970s have the provision of industrial wood as their primary objective. Currently, the contribution of forest plantation to global wood supply is on the increase (FAO, 2008). Although forest plantations account for less than 3% of the world's total forest area, they supply over 20% of the global wood supply (FAO, 2004). Today more than one million hectares of plantation has been established in the country (Onyekwelu, 2002).

3.2.1 Sources of threat to wood resource base in Nigeria

There is a serious threat today to the forest ecosystem, the wood resource base, due to many anthropogenic activities. It was reported that natural forest is disappearing at an alarming rate of 3.5% (about 350,000 – 400, 000 ha) per annum (Oyebo, 2006). Prominent among the drivers of deforestation are; (i) the wanton conversion of forestland to farmland of arable and permanent crops by landless farmers. This is common because of the availability of fertile land under forest cover, (ii) increased rate of encroachment to expand the enclaves. (iii) Weak forest laws, coupled with poor enforcement due to corruption and ineptitude of some forest officers, (iv) population increase which led to increases in the demand for forest land and wood products for daily survival, (v) other anthropogenic activities such as collection of NTFPs, setting the forest on fire by hunters when looking for bush meats, grazing, urban development and road construction, (vi) institutional problems including lack of capital budget by the state government for forest management, inadequate staff for forestry work, lack of patrol vehicles for forest monitoring and control of illegal activities in the forest, (vii) ignorance on the part of rural communities who see the forest as a natural gift that can be used anyhow and indiscriminately, (viii) urban and rural development (ix) logging activities.

3.3 Wood and national development

3.3.1 Wood and socio-economic development:

The socio-economic development of many rural communities could be linked with wood and wood related activities. Wood and forest, by virtue of their nature are located in the rural areas and working on them is also carried out in these local areas because of its bulkiness and cost of transportation. As a result, many rural communities in Nigeria gradually transformed into urban cities due to the presence of very active wood based activities in those communities. Example of such communities are Ore in Ondo state, Shasha in Osun state, OritaJ4 in Ogun state and Epe in Lagos state. Today, these communities are enjoying the presence of rural infrastructures like electricity, portable water, government and private health facilities, schools and communication system. Many roads constructed by loggers for the purpose of wood extraction and haulage serve as feeder roads for transporting food items from villages to urban markets by farmers. Some of these former extraction routes have now become major roads that are laid with asphalt by the government. This has gone a long way to make transportation more convenient.

The survival of rural dwellers and the urban poor depends on finding enough wood to cook their meals. Wood is the only source of fuel for domestic energy in the rural communities. Other sources of energy such as electricity, gas and kerosene and stoves are either not available or very erratic in supply where available. They are very prohibitive and beyond the reach of the masses. So, their last resort is fire wood. FAO (2006) claimed that 72,711m³ volume of wood are remove from the forest annual as fuelwood. Wood is highly valued for industrial cooking. It is the only source of energy for bakeries and small-scale confectioneries in the country. Trade in wood and involvement in wood related profession and activities are sources of employment to many rural people, thereby serving as their major or only source of family income. Felling of trees for fuelwood and charcoal production is now rampant. Sale of firewood and charcoal has become a very lucrative business especially whenever there is scarcity or increase in cost of kerosene, which is a common phenomenon in Nigeria. The incessant increase in the prices of petroleum products (kerosene inclusive) in the country therefore, has made more people who were using kerosene stoves before to abandon their

stoves for fuelwood. Table two shows the sources of energy for domestic cooking and mode of fuelwood utilization as indicated by the respondent in Ondo state, Nigeria.

3.3.2 Wood and employment generation

Employment opportunity in the wood industries and many other wood-based activities has gone a long way to reduce the mass unemployment in the country and enhance job security. It is practically not possible to estimate the total number of workers associated with wood. What I have done in this paper is to provide the list of various wood and wood related operations that have provided gainful employment to many citizens in the country. Wood based activities that provide job include; (i) those working in tree nurseries and plantations, private plantation developers, forestry staff of different cadres (Vocational, Technical and professional, and administrative) and auxiliary staff, (ii) timber contractors and forest reserve concessionaires, (iii) timber fellers (power saw operators) and their supporters such as skidders, loaders, timber truck drivers, (iv) those in wood industries, (iv) wooden electric poles, plank and firewood sellers, (v) small-scale wood based industries like wood carving, production of farm tools and house utensils (pestle, mortars, wooded plates, ladles, wooden spoons and grinders), production of souvenirs, (vi) carpentry, furniture making and joineries, (vii) sawmill workers, machine operators and saw doctors, (viii) traditional healers (Babalawo) and herbal sellers, (ix) food vendors in wood industries, sawmills and other wood workers.

3.3.3 Contributions of wood to Gross domestic product and national income

Wood is one of the major products that have contributed meaningfully to Nigeria foreign exchange earnings and Gross Domestic Products (GDP), especially before the country experienced the oil boom in the 1970s. Sawn logs and timber were major items of export from the country throughout the colonial era (Oluyeye, 2007). The contribution of forestry to GDP in 1958 was estimated at 6.1% and the value of exported wood in 1960 was above 16.2 million naira (presently about 104,000 USD but could be higher). During this period, wood was Nigerias 7th most important export product and more than 786,560m³ (10% of GDP) of wood were exported (Adeyoju, 1976). Oseni (1978) reported that more than 50% of the income from the forest was directly from timber trade. According to the report of the Central Bank of Nigeria, in 1995 alone, about 961.6 million naira accrued from timber export only to the government of Nigeria (CBN, 2006). Despite the ban on wood export by decree in Nigeria, Nwokabia (1997) reported that about eleven million metric cubic of teak wood was exploited from Nigeria in 1995 only. This period was during the military rule in the country. The Central Bank of Nigeria (2006) also put the contribution of forestry to Nigeria's GDP using 1984 factor cost at 1.27% in 1996; 1.24% in 1997; 1.22% in 1998; 1.2% in 1999 and 1.189% in 2000 and 73.46 billion naira in 2006. Akande (2006) reported that 650, 000 ha of forest reserves are allocated to concessionaires annually in Nigeria and he puts the annual forest extraction for sawn timber at 1.4 million m³/year. Adekunle et al 2010 reported that a total of 111,377 timber stems, belonging to 62 different indigenous hardwood species of tropical rainforest ecosystem, distributed among 16 families, were logged and converted to sawn timber in Ondo State between 2003 and 2005. In Oyo and Ogun States, the annual volume of wood logged as sawn timber stood at 960, 883 and 27,261.07m³ respectively (Tables 3 & 4). The annual income that accrues to every state in Nigeria from the volume of wood harvested is very enormous. The amount of income from wood by the government was compiled and reported by Agbeja (2007) for the states in southwest Nigeria between 1999 and 2005. Apart from money generated from logging activities, income is also generated by

the government through annual dues paid by timber contractors and concessionaires, levies on sawmills and annual renewal fees, sawmill registration, tariffs on sawn wood removed from free areas, taxes from plank sellers and wood industries. Table 5 is on the total amount of revenue generated by forestry subsector in Oyo state Nigeria for a 4-year period. The table shows that the highest amount was from sawn timbers.

3.3.4 Contributions of wood to achieving the millennium development goals

The United Nations Millennium Development Goals (MDGs) agreed upon by world leaders in 2000 have eight goals with 18 targets and over 40 indicators that could help to monitor and achieve these goals. The common objectives of these goals, aimed to be achieved by 2015, are to provide a framework to meet the basic needs and rights of millions of people in the developing world. The role of wood and wood based industries in achieving most of these goals is central. Wood activities and wood industries are sources of gainful employment to millions of people as noted earlier. These serve as sources of income to prevent extreme poverty and hunger to achieve the first goal (Eradication of extreme poverty and hunger). Additional income from wood has the potential to reduce poverty reduction (Thies and Pfeil, 2007). For wood's contribution to the attainment of MDG 2 (Achieving Universal Primary Education), forest resources can either be an asset, a cost, or a combination of both to education (Barrow *et al*, 2005). Income from wood-based assets are used in the payment of school fees, woods provide materials to construct school buildings, school chairs and tables for pupils and students. In addition, the paper used for manufacturing books and pencil for writing are wood products. Monela *et al*. (2007) noted that 36% of families use income from the sale of wood products for the payment of education cost.

The report of Barrow *et al* (2007) indicated that restoration of woodland around the community has reduced the time taken to collect fuelwood by up to four hours and thus has the potential to free up time for women and children to engage in other productive activities that can improve gender empowerment and equity, thus, achieving the third goal (Promotion of Gender Equality and Empower Women). In developing countries, fuel collection and cooking for the entire household are seen as the sole responsibility of women. Availability of fuelwood could enhance the potential of women in fulfilling these social roles. The role of wood in achieving goals 4-6 (Goal 4- Reducing Child Mortality, 5- Improving Maternal Health, and 6- Combating HIV/AIDS, Malaria and Other Diseases) has been discussed earlier. This has to do with the contribution of wood to health care delivery. Wood products are good sources of herbal products that are relied on by rural communities for healing. One of the major services of the forest ecosystem is environmental sustainability. The judicious use of wood and wood products, reduction in wood wastage and adequate wood pre-treatment to extent its life span could go a long way to reduce the pressure on the forest ecosystem thus ensuring that the forest is available to continue its environmental services to achieve the 7th goal (Ensuring Environmental Sustainability). Also, wood in service holds carbon in perpetuity (carbon sink) and prevents it from escaping into the atmosphere, thereby contributing to reduce the effect of one of the drivers of climate change. Forest partnerships between developing and developed countries are now being established all over the world (Olagoke & Adekunle, 2008). These initiatives will help to achieve Goal 8 (Building a Global Partnership for Development) by promoting education and research in wood and wood utilization. The partnership could also lead to capacity building in wood for developing countries for strengthening and promoting higher-value wood use at the local and national levels.

3.4 Development of wood industries in Nigeria

3.4.1 Timber logging operations:

The knowledge of logging first came to Africa in 1881, when a French Forester, Contede Vasselot de Regne was appointed superintendent of forest by the Cape Government. Logging was done manually in the past with the use of axe to cut the trees. This method is very labour intensive, and leads to time wastage and also the waste of much of the wood itself. The use of power chain saws is popular today. This reduces waste, energy and time. The cost and maintenance of the machine could be expensive and it requires the service of a well trained and skill operator. Logging includes skidding and transportation of the logs to the log yard. Logging is the first operation in wood utilization process.

3.4.2 Sawn wood production or sawmilling

This is the first wood industry in Nigeria and the most active wood industry today. It started as pit sawing in the country in 1782 by the Portuguese (Abdullahi, 2005). It involved the manual use of the tinny saw to split the fell logs on the site by two people. This method became burdensome and was no longer sustainable due to the increase in the demand for wood. As a result, it gave room for the development of mechanical conversion of wood with the use of motorized band and circular saws. Oluyege (2005) reported that the first mechanical sawmill was established by African Timber and Plywood Industry at Koko and the second by the Railway Department at Ebute Meta, Lagos, between 1900 and 1910. The number of sawmills in Nigeria has grown significantly, but most of them are small to medium size non-integrated one-man businesses. The result of this study revealed that there are 403 registered sawmills in Ondo State only which employed about 4,030 people. The setback to sawmill industries in the country is the poor conversion efficiency and the high volume of waste generation from the converted logs. It was estimated that more than half of the in-put logs usually become wood waste or residues in form of sawdust, edgings, fitches and slabs. The reasons could be due to the machine types, poor maintenance of saws, lack of training for the machine operators and carefree attitude of most Nigerian workers.

3.4.3 Plywood and particleboard industry

The first kind of this plant in Nigeria was established in 1948 at Sapele by AT&P and according to Wellwood (1966) it was the largest of its type in the world at the time of its establishment. By 1996, there were other nine plywood mills and six particle board plants in Nigeria (Oluyege, 2007). Though all of them were operating at low capacity, they were integrated industries. It is sad to report today that most of these large plywood and particle boards industries had folded due to poor management.

3.4.4 Pulp and paper

The first pulp and paper mill (Nigerian paper mill limited) located in Jebba, Nigeria, was commissioned in 1969. It was regarded as the largest paper mill in West Africa by Ogunkanmi (1987), with capacity of producing a total of 65,000 metric tons of paper and pulp per annum. Another pulp and paper mill (Nigerian Newsprint Manufacturing Company) located at Oku-Iboku, near Calabar in Cross River State, Nigeria was established. The mill had a rated capacity for 100,000 metric tons of newsprint per annum. The third paper mill in the country, located at Iwopin, Ogun state, was established by the Nigeria National Paper

Manufacturing Company. It was designed to produce about 100,000 metric tons of fine cultural papers for printing and writing, at full capacity. Many hectares of *Gmelina arborea* plantations were established in three states of the country with loans from International Bank for Rural Development and African Development Bank to serve as source of raw materials for the mill when it eventually take off. The states are Ondo, Ogun and Enugu. Unfortunately, it did not commence operation at all due to corruption, political and technical reasons. The two functioning ones (Oku-Iboku and Jebba pulp and paper mills) had also closed down. Presently, there is no functional pulp and paper mill in the country. The services of foresters and other workers in these moribund factories were dispensed with, with immediate effect and they were made to return to the labour market (Adekunle, 2008).

3.4.5 Small-scale wood based industries in Nigeria

There are so many small scale wood based industries scattered all over Nigeria and the list cannot be exhausted. The most wide spread in this category are the wood furniture, joinery and carpentry industries. They are in the country in very large number, operating from very small workshops and sheds. Only the few of them in large cities and those integrated with sawmills industries owned by the large scale afforestation projects could be regarded as large scale wood furniture industries. These industries are involved in the production of window and door frames, furniture items (upholstery chairs, tables, shelves, wardrobes, wall paneling and floor tiles, prefabricated wooded houses etc) and carpentry works (construction of house roofs). Other small-scale wood industries in the countries are those involved in wood carving, construction of canoes and paddles, production of souvenirs and house hold utensils like mortar, pestles, wooden plates, ladles and spoons and production of farm tools handles.

3.4.6 Wood Preservation industries

Wood is highly susceptible to biodegradation due to abiotic and biotic factors. The abiotic agents, according to Agrawal et al. (1990) include physical decay, thermal degradation, light (Ultra violet light responsible for photochemical actions in wood) and atmospheric pollutants (dust, dirt and gasses). The biotic agents are all micro and macro organisms that can cause bio-degradation of round wood or sawn timbers. The action of these agents is due to the fact that wood, by its nature, is an organic material, made up of 70% cellulose which is good material for biological agents. The major insect is termite while the microorganisms as noted by Clubbe (1980) include bacteria, fungi and actinomycetes. In order to prolong the life span of woods and its products from these agents of degradation, the development of wood preservative industries became very relevant. Three major wood preservatives (i.e. organic or inorganic chemicals toxic to the biotic agents) are oil based preservatives (commonly refer to as solignum in Nigeria - coal tar and creosote), water borne preservatives (metal/copper chrome-arsenates, boron, sodium pentachlorophenate etc) and organic solvent preservatives (pentachlorophenol, cuprinol etc). The common methods of application are the non-pressure (spraying, dipping or brushing) and the pressure (the use of pressure impregnation plants) treatments. However, this wood industry is still in its infancy in Nigeria. This could be due to the high cost of the chemicals involved and the machine for pressure treatment method which are imported and highly expensive. Electric poles and house roof components are always preserved with these chemicals to prolong their useful life. Plates 1-10 show some of the products from wood, wood conversion machines, planks in sawn wood of different dimensions (planks) in the plank market and logs in the sawmills and log yards.

4 CONCLUSION AND RECOMMENDATIONS FOR THE PROMOTION OF HIGHER-VALUE WOOD USE IN NIGERIA

This study examined the versatility of wood, the various aspects of wood utilization, traditional and cultural importance, its contributions to national and rural development and the development of wood based industries in Nigeria. In addition, various products from wood and the species for construction were assessed and the resource base of wood was also discussed. The following suggestions are very relevant for the promotion of higher-value wood utilization in the country: Sustainable forest resources management will ensure the continuous supply of the wood. For wood to be always available as a renewable natural resource, judicious use and involvement of all stakeholders in afforestation programmes should be encouraged, otherwise wood famine is imminent due to the rate of utilization in the country. Extension services, adequate training and informal education is required for rural communities, small-scale wood industry operators, wood loggers, and sawmillers. This could improve their skills and expertise to make wood products more valuable. Incentives or credit facilities should be provided to small-scale wood industrialists to expand their business, and purchase more efficient wood working tools. Those willing to plant trees should be provided with improved planting materials and technical assistance. Integrated wood industries will go a long way to utilize the waste generated during wood conversion. Re-use of the moribund wood industries will also promote higher-value wood use. An introduction of higher efficient logging and wood conversion equipments is required to improve efficient and productivities.

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Table 1: Nigeria Total Forest Cover ('000 ha) as at 2005

Forest types	Total area (ha)	% of forest cover	% of total land area*
Forest	11, 089	12.18	12.18
Primary forest	360	2. 94	0.36
Modified natural forest	10,414	93.9%	11.43
Plantations	349,	3.1	0.43
Other wooded land	5, 595	50.45	6.14

*Nigeria total land area is 91, 077, 000 ha Source: Data from FAO (2006)

Table 2: Respondents sources of domestic energy in Ondo State, Nigeria

Sources of energy	%	Mode of fuelwood consumption	%
Fuelwood	63.6	firewood	94.2
Electricity	10.5	charcoal	4.5
Kerosene	21.2	sawdust	1.3
Gas	4.7	Total	100
Total	100		

Table 3: Summary Statistics of Timber Exploited in Oyo State between 2004 and 2007

Parameters	Forest Reserves	Free Areas	Total
No. of Species	51	67	67
No. of Stem	26754	29189	55943
Volume (m ³)	2340195	1503337	3843532

Table 4: Summary of Timber harvested from the reserves in Ogun State during the 4-year period

Variables	Years				Total for the 4-year period	Average /year
	2004	2005	2006	2008		
Number of stems	91	302	385	102	880	220
Volume (m3)	25615.1	269.6	165.6	1210.6	27261.07	6815
	4	9	3	1		
Number of spp	29	66	58	32	69	46
Number of family	18	32	28	19	42	24

Table 5: Estimate of Revenue Generated from Forestry Sub-sector in Oyo state Nigeria between 2004 and 2007

Source of Income	2004	2005	2006	2007	Total
Logging activities	3,887,693.40	3,430,351.00	3,419,785.40	4,307,056.00	15,044,886.20
Fines	238,380.00	296,965.00	300,300.00	266,600.00	1,102,25.00
NTFPs	1,167,220.00	2,060,830.00	634,950.00	262,800.00	4,125,800.00
Others	4,641,170.00	3,424,430.00	3,824,670	3,795,350.00	15,685,620.00
Total	9,934,463.40	9,212,576.40	8,179,705.40	8,631,806.00	35,958,551.20

Values are in Nigerian currency, Naira (N1 = \$157)

Fig. 1: Volume of log harvested on monthly basis in Ondo State, Nigeria (Source: Adekunle et. al. 2010)

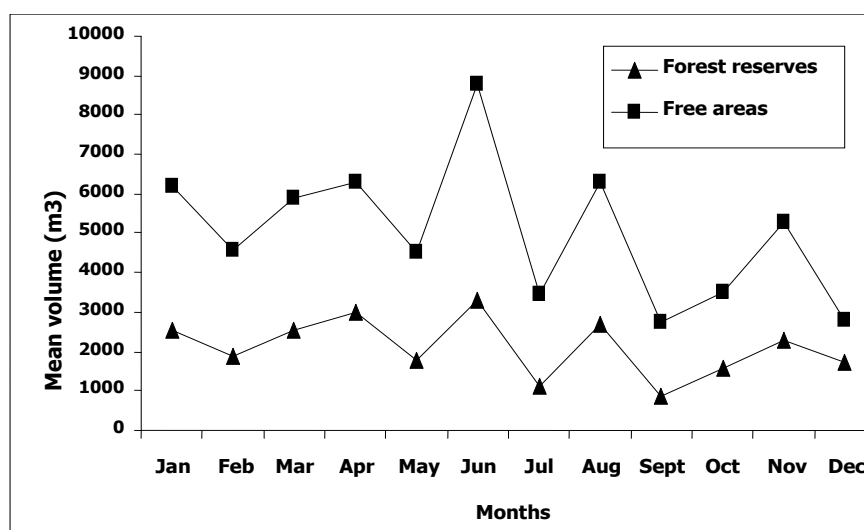




Plate 1 a: wood in roof of classroom construction



Plate 1b wood in the roof of a residential building



Plate 2: stakes of wood planks



Plate 3: Stacks of firewood



Plate 4a: round logs awaiting primary conversion in the sawmill



Plate 4b: logs in the log yard



Plate 5: Circular saw



Plate 6: horizontal Band saw



Plate 7: Wooden part of talking drum



Plate 8: The talking drums (Gangan)



Plate 9: Canoes constructed from wood



Plate 10: Coffin made from wood for burrial rites

Inheriting and Development of Hongmu Culture in China

Xiaomei Jiang²

Abstract

This paper discusses Hongmu wood usage in as a material for Ming & Qing dynasty Furniture. There is a current upsurge in interest in these wood products. The paper attempts to explain this phenomenon. Moreover, this paper deciphers the definition and taxonomy of Hongmu in the current market, its sources for the sustainable utilization of Hongmu resources and Chinese government advocacy of cultivating precious species including Hongmu. The paper also suggests that a wider variety of precious woods be used in the manufacture of Chinese classical furniture, rather than relying solely on Hongmu.

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The inheritance and Development of Hongmu Culture in China

—International Conference and Exhibition on the
Art and Joy of Wood



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Research Institute of Wood Industry, Chinese
Academy of Forestry

2011.10.19

Outline

- Connotation of Hongmu culture
- Reason that most Chinese like Hongmu
- Definition and classification of Hongmu
- Inheritance and development of Hongmu cultural



1. Connotation of Hongmu culture

1. Connotation of Hongmu culture

The Hongmu is the **carrier** of the Ming & Qing Furniture, viz. broad noun of the woods for making these furniture, which bearing the weight of Chinese national culture & element in Ming and Qing dynasty.



1. Connotation of Hongmu culture

1. Connotation of Hongmu culture

The upsurge of the Hongmu products shows the inheriting and development of Hongmu culture in China now.



2. Reasons that most Chinese like Hongmu

2.1 Historically:

Chinese classic furniture has a history of more than a thousand years. The Ming and Qing furniture stands for the peaking development of Chinese furniture.

The Ming dynasty furniture pursues rhythm with its model plain and elegant.



2. Reasons that most Chinese like Hongmu

2.1 Historically:

Dalbergia odorifera(降香黄檀) is the first choice used in Ming dynasty furniture which grows in Hainan province, China, with fine and smooth structure, higher density ($0.94\text{g}/\text{cm}^3$), beautiful figures & good odor.



2. Reasons that most Chinese like Hongmu

2.1 Historically:



Dalbergia odorifera (降香黄檀)

2. Reasons that most Chinese like Hongmu



The beds from the Forbidden City(Palace Museum)

2. Reasons that most Chinese like Hongmu



Chair & tree grate from the Palace Museum

2. Reasons that most Chinese like Hongmu

2.1 Historically:



A cabinet and a folding screen made by *Dalbergia odorifera* in Ming dynasty

2. Reasons that most Chinese like Hongmu

2.1 Historically:

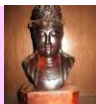


beautiful figures & good odor

2. Reasons that most Chinese like Hongmu

2.1 Historically:

The Qing dynasty, *Pterocarpus santalinus* (紫檀木 red rosewood) became the pet of imperial family. The emperors like the wood because of its deep purple color, larger density (1.26g/cm³) and excellent properties.



2. Reasons that most Chinese like Hongmu

2.1 Historically:

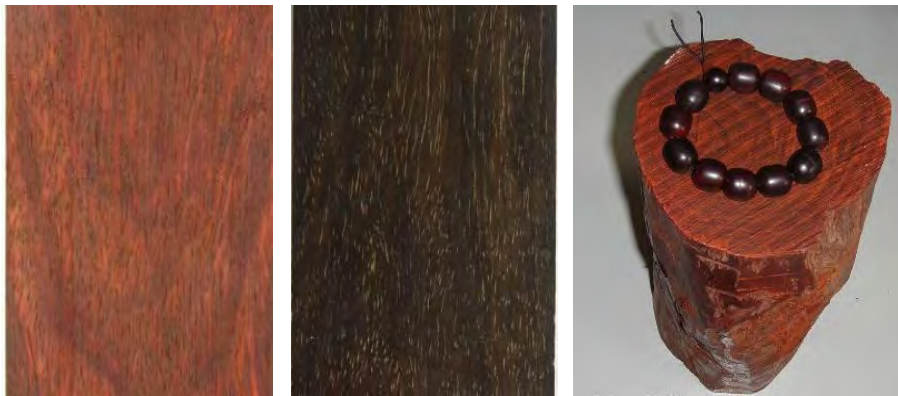
The Qing dynasty furniture pays more attention to the amount of space occupied with its model magnificent and expensive.

The decoration of Ming and Qing dynasties furniture can be called classic in Chinese furniture with its artistic achievement highly known in the world furniture.



2. Reasons that most Chinese like Hongmu

2.1 Historically:



Pterocarpus santalinus (紫檀木 red rosewood)

2. Reasons that most Chinese like Hongmu

2.1 Historically:



The furniture made by *Pterocarpus santalinus* from Palace Museum in Qing dynasty.

2. Reasons that most Chinese like Hongmu

2.1 Historically:



Throne and folding screen made by *Pterocarpus santalinus* wood and with enchasing jade.

2. Reasons that most Chinese like Hongmu

2.1 Historically:



The table and chair made by *Pterocarpus santalinus* from Palace Museum in Qing dynasty.

2. Reasons that most Chinese like Hongmu

2.1 Historically:



The cabinets made by *Pterocarpus santalinus* in current market

2. Reasons that most Chinese like Hongmu

2.2 Nationally:

Since ancient times, Chinese people have paid more attention to the quality of art carrier in contrast to westerners. The carrier's quality often related with rareness, expensiveness, attractiveness for visual, touch and odor etc.

2. Reasons that most Chinese like Hongmu

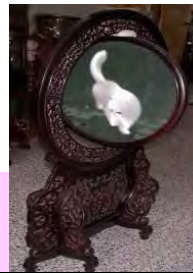
2.2 Nationally:

Chinese people love wood and jade, which are both obtained from nature. The five elements, "gold, wood, water, fire, earth", is the substance view of ancient Chinese people.

2. Reasons that most Chinese like Hongmu

2.2 Nationally:

From ancient wood building to wood furniture, to all kinds of crafts, exquisite patterns are carved. High quality wood feels like jade after repeat polishing.



2. Reasons that most Chinese like Hongmu

2.3 Ideologically:

Ming and Qing dynasty furniture is the culture engraved on the Hongmu, it reflects Chinese "**Confucian way**", such as "**stable, peaceful**", the "**nature and man in one**" and "**round sky and square earth**" concepts.

2. Reasons that most Chinese like Hongmu

2.3 Ideologically:

At the same time, every piece of furniture has the meaning of happiness by way of curving patterns, such as landscape, birds and flowers, historical story, auspicious symbols.



2. Reasons that most Chinese like Hongmu

2.3 Ideologically:



stable, peaceful



round sky and square earth

2. Reasons that most Chinese like Hongmu

2.3 Ideologically:

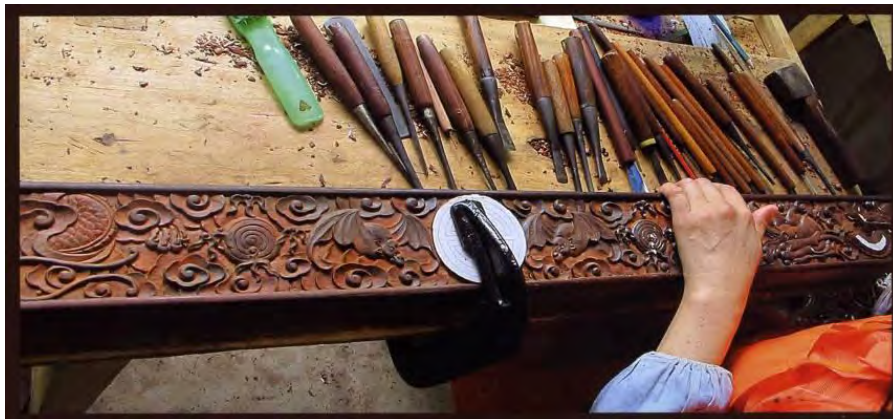


The carvings on the wood building in the Qing dynasty



2. Reasons that most Chinese like Hongmu

2.3 Ideologically:



The Chinese auspicious symbols are sculpting by hand

2. Reasons that most Chinese like Hongmu

2.3 Ideologically:



birds and flowers

2. Reasons that most Chinese like Hongmu

2.3 Ideologically:



historical story



2. Reasons that most Chinese like Hongmu

2.3 Ideologically:



Auspicious symbols

2. Reasons that most Chinese like Hongmu

2.4 Scientifically:

Strict structure and reasonable design are in accordance with human body engineering, such as chair back with "S" curve, which make people feel comfortable.

Due to the wood is very hard, which makes it unable to use nails.



2. Reasons that most Chinese like Hongmu

2.4 Scientifically:

Just because of the tenon and mortise structure, which builds the traditional Chinese furniture framework, makes it independently stand in the furniture world. We should say that "**tenon and mortise structure**" is the soul of Chinese traditional furniture.



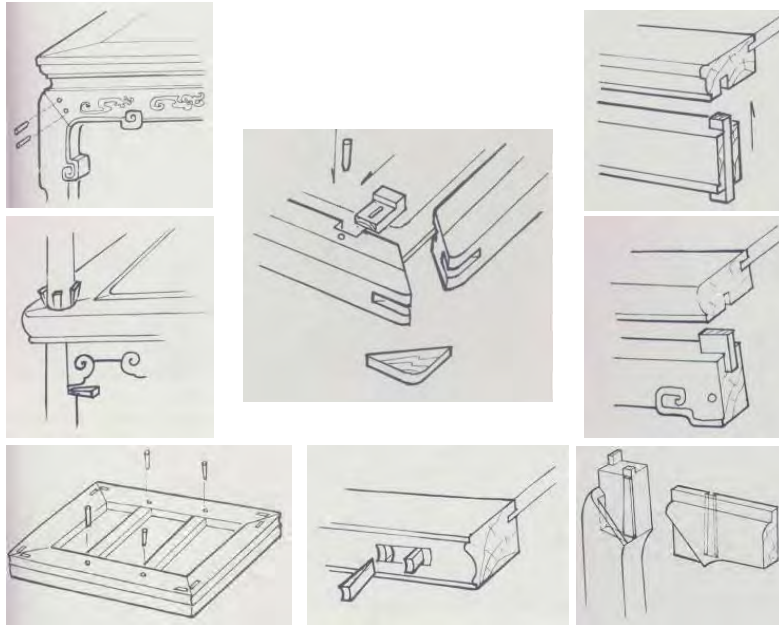
2. Reasons that most Chinese like Hongmu

2.4 Scientifically:

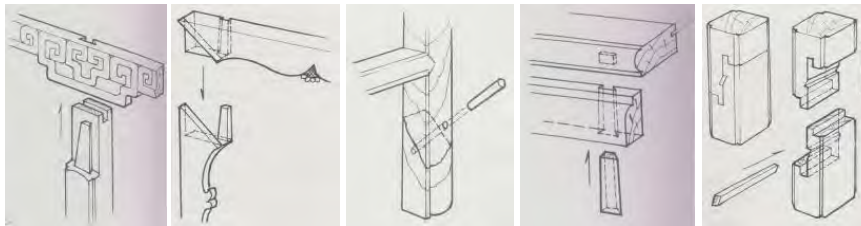
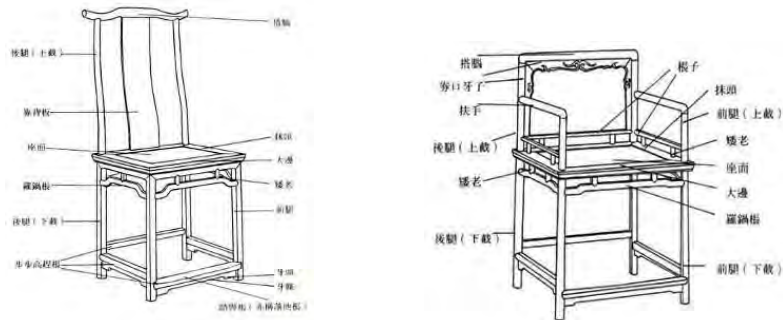


Chair back with "S" curve

Tenon and mortise structure



Tenon and mortise structure



2. Reasons that most Chinese like Hongmu

2.5 Artistically:

The furniture structure line and the fine wood texture are in accordance with the line art of Ink painting and calligraphy, which agrees with the Chinese aesthetic interest. Each Hongmu product has the uniqueness of natural beauty. Various life-like carvings give vitality to the furniture, which make it highly artistic and ornamental.

2. Reasons that most Chinese like Hongmu

2.5 Artistically:



The table & chairs with carved pictures

2. Reasons that most Chinese like Hongmu

2.5 Artistically:



The bed & sofa with artistic sculptures

2. Reasons that most Chinese like Hongmu

2.5 Artistically:



The beautiful hongmu sculpture & the folding screen

2. Reasons that most Chinese like Hongmu

2.5 Artistically:



artistic & carved patterns

2. Reasons that most Chinese like Hongmu

2.6 Practically:

Hongmu furniture is indispensable for human living.

Overall, Chinese people have deep feelings of Hongmu culture, cause she is the symbol of Chinese national culture.



3. Definition and classification of Hongmu

Since the reform and opening up, people's living standards are highly improved with the high-speed development of national economy. Hongmu products start to own by common people, which makes the Hongmu market very prosperous, while it is still



3. Definition and classification of Hongmu

unknown how many species are contained in hongmu timbers. In order to make the development of Hongmu market more healthy, the Chinese National Standard "Hongmu" was implemented in 2000.



3. Definition and classification of Hongmu

Hongmu includes 33 species, belonging to 8 groups or 5 genera

- *Pterocarpus* spp. 紫檀木
- *Pterocarpus* spp. 花梨木
- *Dalbergia* spp 香枝木
- *Dalbergia* spp 黑酸枝木
- *Dalbergia* spp 红酸枝木
- *Diospyros* spp. 乌木
- *Diospyros* spp. 条纹乌木
- *Millettia* spp./*Cassia* spp. 鸡翅木

3. Definition and classification of Hongmu

The main source of Hongmu:
relying on imports, such as

Pterocarpus santalinus (紫檀木 Zitan) from India;
Pterocarpus spp.(花梨木 Hualimu) from Southeast Asia,
Africa and Latin-American;
Dalbergia odorifera (香枝木 Xiangzhimu) from Hannan
province of China;
Dalbergia louvelii & *D. melanoxylon* (黑酸枝木 Black
Suanzhimu) from Madagascar & East Africa



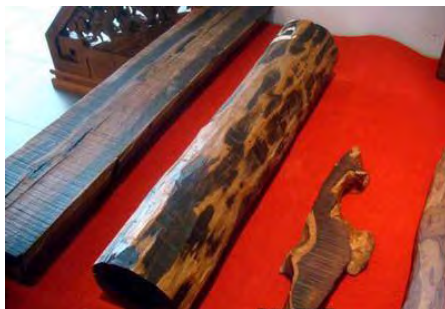
3. Definition and classification of Hongmu

The main source of Hongmu: relying on imports, such as

D. latifolia, *D. oliveri* & *D. cochinchinensis* (红酸枝木 red Suanzhimu) from Southeast Asia, *D. retusa* from South & Central America;

Millettia spp./*Cassia* spp.(鸡翅木 Jichimu) from Southeast Asia, & Africa;

Diospyros spp.(条纹乌木 Tiaowenwumu) from Southeast Asia, like Sulawesi island of Indonesia, some are from Papua New Guinea.



Pterocarpus santalinus from
India 紫檀木



***Dalbergia* spp.**
红酸枝木



Dalbergia louvelii
卢氏黑黄檀



D. melanoxylon
东非黑黄檀



Dalbergia odorifera
香枝木



Millettia spp. from
Africa 非洲鸡翅木

4. inheritance and development of Hongmu culture

Firstly, we should make the Hongmu resource sustainable development, then design Hongmu furniture and products rich in more newly and beautifully modern style; to allow our Hongmu culture to be better inherited and developed.



4. inheritance and development of Hongmu culture

4.1 Chinese government advocated the strategy of making best use of both domestic and overseas precious resources. The project **“precious trees’ breeding”** has been implemented to adapt to the sustainable utilization of Hongmu resources.





Trees from *Pterocarpus indicus* plantation (印度紫檀)



Seedlings & trees of *Dalbergia odorifera* (降香黄檀)

4. inheritance and development of Hongmu culture

4.2 Some experts also suggested that wood species for making Chinese classical furniture should be enlarged by **applying other precious woods instead of Hongmu** to meet the demand of various consumers.



4. inheritance and development of Hongmu culture

4.2 Some exported woods from Africa and Latin-America are also adopted by the current market, such as *Swartzia* spp., *Guibourtia* spp., *Intsia* spp., *Gluta* spp. & *Melanorrhoea* spp. and *Bulnesia* spp.. Besides, the woods of *Entandrophragma* spp., *Toon* spp. were also used to make Chinese classic furniture.



4. inheritance and development of Hongmu culture



The Chinese classical furniture using not- Hongmu is getting good results.



Wooden Monuments in India, Epitomes of Beauty and Talent, Need Protection from a Biological Perspective

O K Remadevi³ and S C Joshi

Abstract

Conservation of natural resources and national heritages is a major challenge of our times, from both environmental and cultural perspectives. The most dominant material culture of any country is produced by trees in the form of wood. Wooden Monuments not only lock in within them carbon stocks, but also the cultural heritage of any country. Quality and beauty of wood blended with the skills of dedicated architects of India have created many wooden monuments, which have stood the tests of time, associated with the vagaries of climatic changes and biological agencies. Though they have a major influence on the strength and life of the structures, biological threats are not very much apparent. The art of wood protection was known to the ancestors and it was mostly from the angle of prevention and in some cases with environmental friendly materials. Still, many monuments suffer the attack of microbes and insects and it is a really a difficult puzzle for Archaeological Survey of India and Other National Museums to keep the vintage structures in their past glory and preserve them for posterity. A study into the wooden monuments of the country from a climatological and archaeological perspective, covering aspects of biological status- durability, deterioration by insect borers, termites and decay fungi along with wood identity, anatomy, strength and properties will go a long way in protecting the monuments and at the same time revealing the untold story of their life cycle over many decades. Quantification of degradation, identification of wood species, chemical preservatives used etc. need in situ assays and laboratory experiments. A thing of beauty is a joy forever and upkeep of the beauty for perpetuating the joy over ages is a task facing the wood lovers of the country and the world.

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FUTURE OF THE PAST MATERIAL CULTURE

The explosion of technology development in the latter half of the twentieth century has provided archaeologists, historians, and managers with powerful tools for analyzing and preserving the material culture of the past. It has also created new challenges. We have to assure that the remnants of our past will have a future. Although we possess greater capability than ever before to preserve and protect the past, and have a deeper interest in preserving it, the entire global scenario in the changing climatic context is under greater stress. The major threats to historic resources include air and water pollution, looting, vandalism, population growth, unplanned development, neglect and war (Holloway, 1995). Even tourism, generally promoted by the managers of historic sites as well as local communities, constitutes a major threat in many cases. But the threats by biological factors are not very much apparent, though they have a major influence on the strength and life of the structures. Effective archaeological management demands detailed information on not only the spatial distribution of artifacts but also the degradation state of the materials present. Though many of them are pure stone structures, in the religious and kingly abodes, many wooden structures imparted the architectural splendour and aesthetic symphony. Changes in the degradation state, quantification of degradation, identification of wood species used, chemical preservatives used etc. need in situ assays and laboratory experiments.

HISTORY AND NATIONAL IMPORTANCE OF MONUMENTS

Archaeological and historical pursuits in India started with the efforts of Sir William Jones, who formed the Asiatic Society on 15th January 1784 in Calcutta. Many Acts were enacted for better preservation and maintenance of monuments and also to prevent illegal trafficking of antiquities and art treasures. Some important acts include the following; Ancient Monuments and Archaeological Sites and Remains Act, 1958 ; Antiquities and Art Treasures Act, 1972 ; The Treasure Trove Act, 1878 and the Ancient Monuments Preservation Act, 1904. The Ancient Monuments and Archaeological Sites and Remains Act of 1958 was framed for legal issues associated with the conservation of historical and archaeological monuments in India. This is an act to provide "for the preservation of ancient and historical monuments and archaeological sites and remains of national importance, for the regulation of archaeological excavations and for the protection of sculptures, carvings and other like objects." According to this Act, an "ancient monument" means any structure or monument, or any tumulus or place of interment, or any cave, rock-sculpture, inscription or monolith which is of historical, archaeological or artistic interest and which has been in existence for not less than 100 years. Archaeological Survey of India (ASI), protect monuments ("protected monuments") which are ancient and are declared to be of national importance. There are 3,650 ancient monuments and archaeological sites and remains of national importance, which are protected by ASI. Overall, there are around 8,000 monuments protected by the government, which include temples, mosques, tombs, churches, cemeteries, forts, palaces, step-wells, rock-cut caves, and secular architecture as well as ancient mounds and sites which represent the remains of ancient habitation. There is no comprehensive database on archaeological resources, sites and antiquities in India and many monuments are fast disappearing without any record for the posterity. Therefore there is an urgent need for proper accounting of our resources by which an appropriate archaeological heritage resource management and policy can be formulated. The honorable Prime Minister of India made an announcement on Independence Day, 15th August, 2003 for setting up of a National Mission

and the National Mission on Monuments and Antiquities was launched on 19th March 2007 with its activities throughout the country for a stipulated time frame of five years.

WOODEN MONUMENTS IN INDIA

A monument is a type of structure either explicitly created to commemorate a person or important event or which has become important to a social group as a part of culture and heritage. The cultural heritage of India's five-thousand-year old civilization is reflected by a number of monuments- Forts, palaces, temples, mosques and churches scattered throughout the country. Indian Architecture evolved over a period of time, and incorporated definitive influences from its various rulers, Hindus, Muslims or British. Monuments and Architecture are inseparable and monuments depict the plentiful supply of materials in the past and the talent and creativity of our ancestors and the rulers of the past dynasties. Wood has been used since Paleolithic times for building purposes and it is reflected in many monuments. Indian architecture concentrates immensely on the religious and spiritual aspects and dates back to 2500 BC. In 300 B.C., Chandragupta Maurya had built many buildings, palaces and monuments with wood; one wooden fort was 14.48 km long and 2.41km wide, along the Ganges in Bihar. The fort has fully perished and only a couple of beams of teak have survived. Millions of temples, forts and palaces are spread out across the length and breadth of India. There were days when wood was in plenty and scarcity was unknown. Wood is an essential part of architectural designs in palaces, temples and community places throughout history. Wooden sculptures and art works in monumental structures depict the creativity of artists in historic past. Teak, rosewood, and sandalwood were used for carving sculptures, doors, ceilings etc. in many monuments in India. The wooden sculptures which now exist are very fine monumental specimens of ancient woodcarving techniques. No doubt, the Indians are sculptors of proven merit and skills. Wood art has significantly contributed to the artistic history of India.

1. Palaces in India

The palaces in India are the epitomes of sheer opulence and comfort. These were built in some of the most beautiful cities of the country, offering a visual treat to visitors. They showcase a brilliant range of architectural style and artistry, reflecting an elegance of style which speaks of the bygone golden era of intrigue, valor, glory, deceit, romance and splendor. Some of the palaces have been renovated as luxury hotels offering a whiff of royalty. There are many monumental structures in India where wood has been bountifully used for creating structural elegance or for decorative purposes. In Punjab, old havelis and palaces bear carved doors and windows. But today wood carving tradition and very famous wood inlay technique is continued only in Hoshiarpur. The workers from Hoshiarpur specialize in inlaying intricate design that are primarily based on floral motifs.

Some of the well known examples are presented here.

- a. Padmanabhapuram Palace, a magnificent wooden palace of the 16th century, is located in Thiruvananthapuram, at the end of Indian mainland. This old palace of the Rajas of the erstwhile Travancore (1550 to 1750 AD) is a fine specimen of Kerala's indigenous style of architecture and is an enticing piece to any lover of art and architecture. Sri Padmanabhaswamy temple, located nearby is also with ceiling made of well-seasoned wood, abounding in carvings. On the eastern side of Padmanabha Swamy Temple,

installed in 1833 during the reign of Swathi Thirunal, is the Meshan Mani (clock). It has on its dial, a man's face with two goats on either side. Crafted from mahogany, every time the clock completes an hour, the man opens his mouth and the goats hit his cheeks.

- b. The Dharia Daulat Bagh or Tipu Sultan's summer palace in Srirangapatna was built in 1784 mainly of teak wood. The beauty of this palace lies in its simple and elegant architecture. Every pillar and wall is profusely painted with variegated colors, made of vegetable dyes. The biodeterioration reported there consisted of the presence of wood wasps as well as fungal decay, mainly by white-rot or wet-rot fungi. Mould and lichen attacked the canvas and mural paintings.

2. Temples and architecture

Andhra Pradesh has a tradition of manufacturing woodcarvings for religious centers. The Tirupathi dolls of red wood were made primarily for sale to pilgrims. In south Karnataka interesting form of life size wood carvings of Bhuta figures made from single wood pieces are found in religious locations. From the northwest coast, the temple of Somnath is famous for its beautiful wooden skills. The doors of this temple are famed for their magnificence and are highly valued as sacred relics. The wooden idol of Lord Jagannath, Balaram and Subhadra in Puri (Orissa) are unique and made of neem wood. The building of idols of three deities takes place once in 12 years in the month of Aashaadh with extra days in the calendar.

I. Temples in Maharashtra

Trishundya Ganapati temple is a temple located in Somwar Peth, Pune in Maharashtra is dedicated to Lord Ganesh. It was built during reign of Peshwa. The temples derived its name from the idol of Ganesh, which has three trunks and hence the name 'Tri-Shundya' which means three trunks. The idol is of wood and the temple made of stone has beautiful carvings on its exterior. It is the only one of its kind in the entire country

II. Temples in Himachal Pradesh

Dhungri or Hadimba Temple in Kullu is constructed in pagoda style displays the finest example of wood carving on it. Bijli Mahadev is a temple situated at an altitude of 2,435 metres, the temple is ideally located offering a commanding view. 20 mt high wooden pole stands are installed in front of the temple believed to be for seeking blessings from the sky.

III. Temples in South India

The State of Kerala had also one of the richest traditions in woodcarving. The temples are with carved pillars and beams and almost every house from this state have a carved family temple with intricate patterns of designs on the ceilings and pillars preserving the woodcarving style of sculpturing in Kerala. Normally in many temples, there is a wooden Dwaja Sthambham (flag pole) which is given a great deal of importance. They are treated in gingelly oil for about a year. The idols in these temples are normally made either of stone or wood, the preferred wood is that of the jack fruit tree. Abhishekam is not performed for such statues but the statue is coated with saffron mixed in oil. This ensures a very long life for the wooden statues. Kozhikkode Tali Mahadeva Temple has a two storied sanctum which has works of art in terms of stone sculptures and wood work with scenes from the puranas. In front of the sanctum is a chamber with intricate woodwork. In the temple of Kottarakkara

Manikandeswaram Temple, the idol of Vigneswara, is a magnificent one carved in wood by the famous artist, Perumthachan. As a part of the daily ritual, smearing of oil is being carried out. As a result, the idol has been turned to black. It is 3 feet high, with a small trunk and four hands, carrying coir, hook, rice cake, and plantain fruit.

IV. Wooden Chariots in Indian temples

In Southern states of India like Karnataka, Tamil Nadu and Andhra Pradesh, the tradition of woodcarving finds its best expression in the form of chariots which are carved skillfully in wood. It is mainly used by temples for taking out the deities in procession on festive days. Chariots figure prominently in the Rigveda, proving their presence in India in the 2nd millennium BC. With its historic and mythological residues, Hampi in Karnataka is in the list of UNESCO's World Heritage sites. The Hampi is capital of the Hindu empire, Vijayanagara, which ruled the south India during 14th to 16th century AD. The ruins of Hampi, as it is known today, are a vast open museum of history, architecture and religion. In a largest religious festival in Hampi, the image of the god and goddess are kept on the temple car (the giant wooden chariot) taken in the procession along the main chariot street.

a. Rath yathra – A journey towards salvation

Chariot festival is observed in Puri, one of the four greatest places of pilgrimage in India. Here three chariots, one each of Lord Jagannath, Lord Balaram and Subhadra Devi are brought on the streets of Puri and drawn by thousands of devotees. Balaram's chariot is 44 feet high, Devi Subhadra's chariot is 43 feet high and Lord Jagannath's has a height of 45 feet. Each year the three chariots are built with wood collected on Vasant Panchami day and there is not a single piece of iron used in it.

b. Heritage village and wooden Chariot

Kalpathy is a heritage village in Palakkad, Kerala state. Kalpathy Viswanathswamy temple is one of the oldest Shiva temples in Malabar, built in A.D.1425. The major festival is the annual Kalpathy Ratholsavam in which a highly decorated wooden chariot is moved by a croud of devotees through the streets.

3. Wood work and wooden statues in Churches

India is a secular country and many religions and beliefs exist in the county. Just like temples, churches built by Christians also adorn the nook and corner of the country. Many churches and cathedrals were built during 16th and 17th century AD at Old Goa. The paintings in the churches are on wooden borders and fixed between panels having floral designs. Excepting a few which are in stone, the statues are mostly in wood delicately carved and painted to adorn the altars. They depict mostly the saints, Mother Mary and Jesus on the cross.

Wood degradation in monuments

A study into the wooden monuments of the country from a climatological and archaeological perspective, covering aspects of biological status- durability, deterioration by insect borers, termites and decay fungi along with wood identity, anatomy, strength and properties in relation to chronological and climatological changes would go a long way in protecting the monuments and at the same time revealing the untold story of their life cycle

over many decades. Protection of large wooden monuments located in the open poses real problems to the conservation agencies in India. As wood degrades, the reflection coefficients become more negative, resulting in the hypothesis that the more degraded wood becomes, the easier it should be to detect. Exposed timbers, when heavily degraded, can be acoustically transparent and so undetectable by acoustic methods. Application of new methods of detection of wood degradation is a real challenge and in India the modern methods are not in vogue and nondestructive tests is not very popular as in other countries elsewhere.

Wood degradation by weathering

There are many agencies of degradation. Wood exposed in exterior conditions undergoes sever weathering deteriorations. The degradation is caused by a combination of factors present in environment (sunlight, moisture, heat, atmospheric pollution, chemicals and biological agents). This results in physical and chemical changes manifested by discoloration, loss of brightness, roughening, cracking, and physical deterioration of wood surfaces. Weathering is a surface phenomenon as penetrability of UV and visible rays are limited to 75 and 200 microns. Water as dew or rain degradation goes to depths of 0.05 – 2.5 mm. High temperature reduce RH and causes reduction in equilibrium moisture content and hence results in shrinkage of surface layers. Weathering lead to degraded cellulose in 20 – 30 years, loss of colour, luster and erosion of 6 – 13 mm per century.

Fungal Degradation

Wood, being of organic origin, is metabolized by many fungi for food. Even the most durable wood species may fall a victim to fungal attack due to photodegradation and depletion of wood extractives. The discoloration of wood in the presence of moisture is caused by growth of fungi. The most commonly observed fungi are mildew and stain fungi which have very modest ecological requirements and are quite resistant and adaptable. Fungal degradation is a rapid process which can destroy the entire wood. Surface checking and cracking along with photodegradation and weathering exposes new surfaces for rapid fungal attack and degradation.

Borers and Termites

Borers and termites are other agents which can destroy inadequately protected wood. Most of the wood species used for monuments namely, deodar, teak, sal, etc. are durable in nature. However, their durability fades with time due to depletion or modification of the extractives present in such wood species. Chemical treatments for long term protection are thus needed even for such wood species.

Protection from Biodeteriogens

India, being a land of rich cultural heritage, is a treasure house of historic buildings and monuments. India has been included in the World Heritage listing by UNESCO. In addition, until 2005 approximately 67,000 listings covering 200 places and 25 states in India were completed outside the World Heritage listing. The Archeological Survey of India (ASI) functions as an attached office of the Department of Culture, Ministry of Culture, is responsible for preserving designated ancient monuments of national importance. ASI has declared more than 3600 monuments to be of National importance. Its major activities are

maintenance, conservation and preservation of centrally protected monuments and sites, the chemical preservation of monuments and the raising of awareness of heritage.

In situ protection of wood used in structures poses a real challenge. Naturally resistant timbers are teak (*Tectona grandis*), Chandan (*Chenopodium album*), anjan (*Pennisetum cenchroides*), arjun (*Terminalia arjuna*), irul (*Xylia dolobriiformis*), Champak (*Michelia champaka*), rosewood (*Dalbergia sissoo*), mesua (*Mesua ferrea*), white cedars (*Cedrus deodara*), jarul (*Dalbergia oogeinensis*). Many historic monuments have been built using these woods. Continued exposure to climatic and biotic factors initiates their deterioration and unless protective measures are taken, they will become degraded. A large number of chemicals are available for restoration of damaged objects and their future preservation. Polyethylene glycols and various monomers have been used for impregnation of wood to make them dimensionally stable. These bulking treatments can keep the wood fairly dry and protect it from fungal attack. There are several chemicals/ formulations, which can prevent fungus and insect attack in exposed structures. The choice and use is however, limited as some of these may stain the wood and thus alter its natural colour. The most effective wood preservatives like creosote oil may not be acceptable as it would stain the wood blackish brown. Painting with fungus resistant paints also masks the natural wood surface and may not be acceptable for many situations.

Chemical treatment of wood

Incorporation of toxic chemicals in the wood structure is necessary for complete protection of wood. Chromic acid treatments on wood surface enhances resistance to photodegradation, fungus attack and reduce swelling. Ammoniacal copper-chromate, ammoniacal copper-chrome-arsenate, Acid-copper-chromate, are all well known preservatives for treatment of wood. Treating the wood surface with resorcinol solution prior to treating with acid-copper-chromate improved permanence as well as imparted a natural brown colour. Wood species which leach extractives can be stabilized by coating with dilute solutions of copper and chromium salts. Penetrating finishes and water repellent preservatives have been found suitable for long time protection. Pigmented semi-transparent stains containing UV absorbers have also been developed for this purpose. Drying oils such as boiled linseed oil and mineral spirit based thinners form the base of such penetrating finishes. Pentachlorophenol dissolved in mineral solvents and containing paraffin wax is an excellent wood preservative for long term protection of wood against mildew, fungus insects and water. Water repellent preservatives are better for an overall protection. Film forming finishes include, lacquers and varnishes act as moisture retarders and UV barriers. Specially formulated paints containing preserving chemicals can protect wood against decay. Such finishes are normally effective for a period of two to three years. Since it is not possible to impregnate chemicals without pressure, soil fumigants like chloropicrin, methyl-isothiocyanate and N-methyl-dithio-carbonate can be encapsulated in gelatin for slow release of the chemical and can be expected to be effective for a period exceeding 20 years.

Chemical treatment increases the life of wood by several years by protecting against white ants and insect borers. The commonly used preservatives are (i) coal tar creosote (diluted with crude oil or fuel oil in a ratio of 1:1.) (ii) ASCU (CCA): The wood can be treated with preservatives by brushing, dipping or hot and cold open tank process and under pressure. For dipping, the wood should be kept for 48 hours in the cold preservative. In the hot and cold method, the wood is kept alternately in the heat (about 105oC) and cold (room temperature)

preservative for a few hours. Pressure treatment is done in the treatment plant; the timber should be dry and dipped in the pure chemical for 48 hours.

Presently wood has become a valuable commodity which is extremely expensive. But there were times when wood was available in plenty and scarcity of wood was rare. In the history of India, wooden sculptures play an important role. A material like wood provided an excellent medium for artists in India to express their creativity. Wooden sculptures and toys are very popular for their intricate carving works and meticulous finishing. Sandalwood, Rose wood and Softwood are commonly used by artists in making sculpture. Throughout the history of Indian art, woodcarving seems the most luxurious kind of art. Wood sculpture was produced from many centuries back. The well-known example of wooden sculpture can be said as carved on temples. The Hindu temples in ancient period were marvelously decorated with doors, ceilings and various fittings carved in teak and other kind of woods. This carving was marked with typical patterns of extreme richness and minute elaboration. Some of the architectural remains from Kashmir and Punjab are from as far back as the 3rd or 4th century.

The real challenge before us is to plan the necessary measures of conservation with a view to ensure the survival of this built cultural heritage and unique symbols of our civilization for centuries to come. There is a need to give more thrust to the scientific research in conservation options based on preliminary investigation which includes the knowledge of physical nature of the object (attack of insects, state of decay) and of the factors which induce its decay. The field of conservation therapy needs to be based on correct diagnosis. Rational and scientific approaches must start with a study of structural integrity, determining the causes of deterioration, planning the corresponding remedial measures, selecting compatible repair and restoration materials and meticulous execution with the help of qualified contractors.

Challenges and need for research to develop Strategies for monument protection

1. Assess the status of health of wooden monuments in relation to their strength and durability.
2. Isolate and identify the biological deteriorants in cases where the damage is identified.
3. Identify the wood species and assess its anatomical, physical and mechanical properties in relation to climatic and physical environment.
4. Assess the protection practices employed and in vogue with respect to chemical contents and surface protectants used.
5. Develop a wood protection strategy to preserve the monuments and prolong their life.

Wooden Monuments in India, epitomes of beauty and talent, need protection from a biological perspective

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MONUMENTS IN INDIA

- A monument is a type of structure either explicitly created to commemorate a person or important event or which has become important to a social group as a part of culture and heritage and in existence **for not less than 100 years**
- The cultural heritage of India's five-thousand-year old civilization is reflected by a number of monuments- Forts, palaces, temples, mosques and churches scattered throughout the country
- Indian Architecture evolved over a period of time, and incorporated definitive influences from its various rulers, either Hindus, Muslims or British.

Monuments and Architecture

- Architecture concentrates immensely on the religious and spiritual aspects and dates back to 2500 BC. Millions of temples, forts and palaces are spread out across the length and breadth of India.



A retrospect



- There were days when wood was in plenty and scarcity was unknown.
- Wood is an essential part of architectural designs in palaces, temples and community places throughout history.
- Wooden sculptures and art works in monumental structures depict the creativity of artists in historic past.
- **Teak, rosewood, sandalwood** were used for carving sculptures, doors, ceilings etc. in many monuments in India.

Wood for architectural excellence



The most dominant material culture of any country is contributed by the trees in the form of the material, wood. **Wooden Monuments not only lock within them the carbon stocks, but also the cultural heritage of our country**

Palaces in India

- The palaces in India are the epitome of sheer opulence and comfort. These were built in some of the most beautiful cities of the country, offering a visual treat to visitors.
- They showcase a brilliant range of architectural style and artistry, reflecting an elegance of style. All this speaks of bygone golden era, of intrigue, valor, glory, deceit, romance and splendor.
- Some of the palaces have been renovated as luxury hotels offering a whiff of royalty.



Wooden Palaces



On the eastern side of Padmanabha Swamy Temple, installed in 1833 during the reign of Swathi Thirunal, is the Meshan Mani (clock). It has on its dial, a man's face with two goats on either side. **Crafted from mahogany**, every time the clock completes an hour, the man opens his mouth and the goats hit his cheeks.

A magnificent wooden palace of the 16th century, Padmanabhapuram Palace lies at the land's end of mainland India. An enticing piece to any lover of art and architecture -this old palace of the Rajas of the erstwhile Travancore (1550 to 1750 AD) is a fine specimen of Kerala's indigenous style of architecture



Padmanabhapuram
Palace

Tipu Sultan's Palace in Srirangapatna

- The Dharia Daulat Bagh or Tipu Sultan's summer palace was built in 1784 mainly of teak wood.
- The beauty of this palace lies in its simple and elegant architecture
- Every pillar and wall are profusely **painted with variegated colors, made of vegetable dyes.**
- The biodeterioration consisted of the presence of wood wasps, as well as fungal decay, mainly by white-rot or wet-rot fungi. Mould and lichen attacked the canvas and mural paintings.

Temples and architecture



Sri Padmanabhaswamy temple. The ceiling is pure artistry in itself and is made of well-seasoned wood, abounding in carvings



The Golden Temple in Amritsar, India

Temple wood art

- Sun temple-The temple is in the form of chariot, the legend has it that the ' Sun-God', used to ride on this divine chariot across the heaven.

From the northwest coast, the temple of Somnath is famous for its **beautiful wooden skills**. The doors of this temple are famed for their magnificence and are highly valued as sacred relics

Wooden Carved Wheel - Sun Temple



Jagannath Temple, Puri

- The wooden **idol** of **Lord Jagannath**, **Balaram** and **Subhadra** in **PURI** are unique and made of **neem wood**.



- The building of **idols of three deities** take place **once in 12 years** in the month of Aashaadh with extra days in the calendar.

Wooden Chariots

- Chariots figure prominently in the [Rigveda](#), evidencing their presence in India in the 2nd millennium BC

- With its historic and mythological residues Hampi in Karnataka is in the list of UNESCO's World Heritage sites.

- capital of the Hindu empire, [Vijayanagara](#), who ruled the south India during 14th to 16th century AD.

- In a largest religious festival in Hampi, the image of the god & goddess is kept on the temple car (the giant wooden chariot) in the procession along the main chariot street.



RATH YATRA – A journey towards salvation



• Chariot festival is observed in Puri, one of the four greatest places of pilgrimage in India.

Here three chariots, one each of Lord Jagannath, Lord Balam and Subhadra Devi are brought on the streets of Puri and drawn by thousands of devotees.

Balam's chariot is 44 feet high, Devi Subhadra's chariot is 43 feet high and Lord Jagannath's has a height of 45 feet

- Each year the three chariots are built with wood collected on Vasant Panchami day and there is not a single piece of iron used in it.

Heritage village and wooden Chariot



Nice wood work in a chariot used for Kalpathy festival

- Kalpathy is a heritage village in Palakkad, Kerala.
- One of the oldest Shiva temple in Malabar, Kalpathy Viswanathswamy temple was built in A.D.1425.
- The major festival is the annual Kalpathy Ratholsavam
- A highly decorated wooden chariot is moved by a croud of devotees



IDOL made of wood

- **Trishundaya Ganapati Temple**

Trishundaya Ganapati temple is a temple located in Somwar Peth, Pune dedicated to Lord Ganesh. It was built during reign of Peshwa.

- **The temples derived its name from the idol of Ganesh, which has three trunks and hence the name 'Tri-Shundaya' which means three trunks.**
- **The idol is of wood and the temple made of stone has beautiful carvings on its exterior. It is the only one of its kind in the entire country.**

Temples in Himachal Pradesh

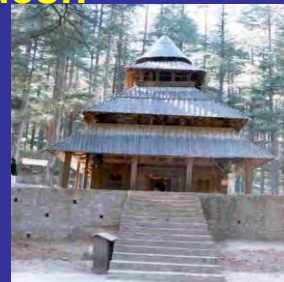
Dhungri or Hadimba Temple in Kullu

Bijli Mahadev Temple



This temple constructed in pagoda style displays the finest example of wood carving on it

Situated at an altitude of 2,435 metres, the temple is ideally located offering a commanding view. 20 mt high wooden pole stands are installed for seeking blessings from the sky



Wood in monuments- temples in Kerala

- Normally there is a wooden Dwaja Sthambham (flag pole) which is given a great deal of importance. They are treated in gingelly oil for about an year.



The idols in these temples are normally made either of stone or wood, the preferred wood is that of the jack fruit tree.

Abhishekam is not performed for such statues but the statue is coated with saffron mixed in oil (chandattam). This ensures a very long life for the wooden statues.

Wood in monuments- temples in Kerala

- The two storeyed sanctum has works of art in terms of stone sculptures and **wood** work with scenes from the puranas. In front of the sanctum is a chamber with intricate woodwork.

Kozhikkode Tali Mahadeva Temple



Kottarakkara Manikandeswaram Temple

The idol of Vigneswara, is a magnificent one carved in wood by Perumthachan. As a part of the daily ritual smearing of oil is being carried out. As a result, the idol has been turned to black. It is 3 feet high, with a small trunk and four hands, carrying coir, hook, rice cake, and plantain fruit.

Wood work and wooden statues in Churches

- Many churches and cathedrals were built during 16th and 17th century AD at Old Goa.

- The paintings in the churches are on wooden borders and fixed between panels having floral designs

- Excepting a few which are in stone, the statues are mostly in wood delicately carved and painted to adorn the altars.

They depict mostly the saints, Mother Mary and Jesus on the cross.

Agencies of wood degradation

- Weathering – chemical, mechanical and light energy factors.
 - Solar radiations – UV (Visible and IR), moisture (dew rain, humidity), temperature and oxygen.
 - Pollutants – SO₂, Nitrogen dioxide, Ozone.
- UV – Colour change to yellow, brown and later gray.

Weathering is a surface phenomenon as penetrability of UV and visible rays is limited to 75 and 200 microns.

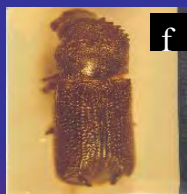
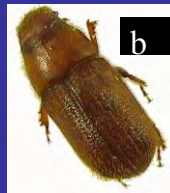
Water as dew or rain – exposes surfaces and degradation goes to depths of 0.05 – 2.5 mm.

High temperature reduce RH and causes reduction in equilibrium moisture content and hence shrinkage of surface layers. Air moisture/ fluctuating RH also cause shrinkage. Winds of sand and dirt cause mechanical abrasion – sand blasting effect.

Weathering lead to degraded cellulose in 20 – 30 years, loses colour, luster and erodes 6 – 13 mm per century.

Biodeterioration of wood in monuments

Decay
Termite attack
Insect borers
Wood inhabiting bees/wasps



Insects damaging timber

a) Platypodid, b) Scolytid, c) Buprestid, d) Lyctid,
e, f, g) Bostrychids, h) Cerambycid, i) Xylocopid & j)
Termites

FUNGAL ATTACK

- Even the most durable wood species found resistant to decay fungi may fall a victim to fungal attack due to photodegradation and depletion of wood extractives, that contribute to resistance.
- Fungal degradation is a rapid process and if favourable conditions continue, can destroy the entire wood.
- Surface checking and cracking along with photodegradation and weathering exposes new surfaces for the fungal attack, leading to more rapid degradation.
- Wood coming in ground contact is prone to soft-rot attack and this effect is more pronounced in hard woods.



Borers and Termites

- Borers and termites are other agents which can destroy inadequately protected wood.
- Most of the wood species used for monuments namely, deodar, teak, sal, etc. are durable in nature.
- However, their durability fades with time due to depletion or modification of the extractives present in such wood species.
- Chemical treatments for long term protection are thus needed even for such wood species.



Protection of Monuments

- India, being a land of rich cultural heritage, is a treasure house of historic buildings and monuments. As many as 26 cultural and natural sites in India have been included in the World Heritage listing by UNESCO. In addition, until 2005 approximately 67,000 listings covering 200 places and 25 states in India were completed outside the World Heritage listing.
- Archeological Survey of India The Archeological Survey of India (ASI) functions as an attached office of the Department of Culture, Ministry of Culture, is responsible for preserving designated ancient monuments of national importance
- ASI has declared more than 3600 monuments to be of National importance.
- Its major activities are maintenance, conservation and preservation of centrally protected monuments and sites, the chemical preservation of monuments and raising of awareness of their heritage

Preservation and maintenance of monuments

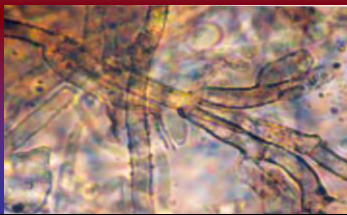
- Archaeological and historical pursuits in India started with the efforts of Sir William Jones, who formed the Asiatic Society on 15th January 1784 in Calcutta.
- The following Acts were enacted for better preservation and maintenance of monuments and also to prevent illegal trafficking of antiquities and art treasures.

Ancient Monuments and Archaeological Sites and Remains Act, 1958

**Antiquities and Art Treasures Act, 1972 ;
The Treasure Trove Act 1878 and the Ancient Monuments Preservation Act, 1904 are also in vogue in addition to the above mentioned legislations.**

Protection from biodeterioration

- It is important to determine which biocidal compounds, or which combination of products, will be the best suitable to combat/prevent the biodeterioration
- Apply termite bait technologies for combating the termite infections in the walls and wooden structures
- **Identification and isolation of fungi and termites** and assess the efficacy of the treatments



Our monuments need protection

- The real challenge before us is to plan the necessary measures of conservation with a view to assure the survival of these built cultural heritage and unique symbols of our civilizations for centuries to come
- There is a need to give more thrust to the scientific research in conservation options based on preliminary investigation which includes the knowledge of physical nature of the object (attack of insects, state of decay) and of the factors which induce its decay.
- The field of conservation therapy to be based on a correct diagnosis



Scientific approach



- Rational and scientific approach starts with a study of structural integrity, determining the causes of deterioration, planning the corresponding remedial measures, selecting compatible repair and restoration materials and meticulous execution with the help of qualified contractors.

METHODS OF PROTECTION

- **FUMIGATION FOR ERADICATION OF INFESTATION.**
- **BORATES FOR REMEDIAL TREATMENTS OF WOOD IN SERVICE.**
- **SPRAYING, DIPPING OR PRESSURE IMPREGNATION OF ORGANO PHOSPHATE OR PYRETHROID INSECTICIDES.**
- **TREATMENTS WITH PRESERVATIVES- CCA,CCB**

Challenges and need for research

- **Identify the wood species and its anatomical and physical properties in relation to Climatic and physical environment**
- **Compare the biological and mechanical properties in respect to age, species, situations and any treatments adopted**
- **Develop a wood protection strategy to preserve the monuments and prolong their life.**



Typology of Wood Sculptures in West Africa

Edmond Adjovi⁴

Abstract

In Africa, the royal courts, traditional religions and initiation rites make widespread use of wooden statues and masks. They use these sculptures to symbolize the “immaterial”: genies and figures of mortal or immortal ancestors. West Africa boasts a wide variety of wooden statues that can be found not only in local markets but all over the world. This presentation will highlight some of the different styles and particular points of this rich cultural heritage.

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International Conference and Exhibition on the Art and Joy of Wood

19-22 October 2011, Bangalore, India

Typology of wooden sculptures in West Africa

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INTRODUCTION

Context And Method Of Collecting
Information

Western Africa is constituted by two categories of countries:

The first one concerns those who spread out in sea border and arrange big rain forests example: Nigeria, Côte d'Ivoire, Ghana

The second groups includes the countries which has no outlet on Ocean, and are regions of savannas or deserts example: Niger, Burkina, Mauritania, Mali

The Inhabitants who live in these countries use differently the nature to express their enjoyment and life, because the natural and cultural landscape is varied.



This variation of landscape obliges the inhabitants to use differently the nature to express their life and enjoyment and protect themselves from bad weather.

So, the inhabitants who settled around the close forests and savannas use the wood under natural and sawed-off shape for shelters and under sculptured shape to express their enjoyment in past and present life, contrary to the nomads who rarely express themselves in the wood.

When we want to speak about some wood as materials creating the freshness, giving the enjoyment and participating in the identification of societies, we turn to the sculpture.

This sculpture, while resulting from western Africa which we are going to expose in the present communication according to the plan below:



1) Origin

2) Some wood used in the sculpture, the local method of treatment and finish of sculptures

3) Types of sculptures and their symbolic interpretation

4) Conclusion

Informations are collected from

-The book: IDOWU A. E., Art Standard for schools and colleges, Wisdom Seed, Lagos 2002.

-specialist of Arts in the village of Arts in Benin ,Nigeria and Ghana.



THE WEST-AFRICAN SCULPTURES

Origin

The agrarian and initiatory rites, the religions of the country, the royal courts are the main foundations of the West African sculpture. The main genres remain masks and statues

These arts expressed themselves especially in the wood, the ivory, the "bronze", the terra-cotta, the gold and the silver. We know some of the most famous styles; their naming also correspond to ethnonymes: senoufo and dan in Ivory Coast, bambara and Dogon in Mali, baga of Guinea, mosi in the Burkina Faso, Guèlèdè in Benin and Nigeria for example.

It is in Nigeria where we find the biggest historic depth. The researchers proved that there was a relationship between the diverse styles which succeeded one another in this country for 2000 years at least.

THE WEST-AFRICAN SCULPTURES

Some wood and colours used in
the sculpture



N°	Espèces et essences forestières		Caractéristiques	Provenance
	Nom scientifique	Noms vernaculaires		
1	<i>Acacia albidia</i> Del. – Légumineuse mimosacée	<i>Cad, Gao, Balanzan</i>	Soft wood, yellow color	Quite the parts(parties) of dry Africa
2	<i>Adansonia digitata</i> L. - Bombacée	<i>Baobab</i>	Soft, spongy wood, full of water)	In all tropical Africa: Sahel- Sudanese region of western Africa
3	<i>Azelia bipidens</i> Harms - Césalpiniacées	<i>Doussié</i>	Hard and heavy wood, perfect wood becoming brown red in the light	Nigeria, Côte d'Ivoire, Ghana
4	<i>Azelia africana</i> - Césalpiniacées	<i>Lingué</i>	Hard and heavy wood, perfect wood becoming brown red in the light	Nigeria, Côte d'Ivoire, Ghana
5	<i>Brachystegia cynometroides</i> Harms. - Césalpiniacées	<i>Naga</i>	perfect brown wood, middle hard wood,	Liberia
6	<i>Canarium sckweinfurthii</i> Engl - Burseracées	<i>Aiélé</i>	soft and light wood	Sierra Leone
7	<i>Chlorophara excelsa</i> Benth et Hook, <i>Chlorophara regia</i> A. Chev- Moracée	<i>Iroko</i>	Light and middle heavy wood	Wood of Forest semi- decidues

N°	Espèces et essences forestières		Caractéristiques	Provenance
	Nom scientifique	Noms vernaculaires		
8	<i>CoCoelocaryon preussii</i> wARB - Myristicacée	<i>Ekoune</i>	Bois mi-dur , mi-lourd	Libéria
9	<i>Cordyla pinnata</i> Milne- Redhead - Césalpiniacée	<i>Metondo, Dimb</i>	Bois mi-dur , mi-lourd	Mali, Burkina Faso, Côte d'Ivoire, Gambie, Guinée, Ghana, Bénin, Togo, Nigéria
10	<i>Diospyros crassiflora</i> Hiern. - Ebenacée	<i>Ebène</i>	Bois dur de couleur noir	Bénin, Nigéria
11	<i>Entandrophragma cylindricum</i> Sprague	<i>Sapelli/Sapele</i>	Bois mi-dur , mi-lourd	Côte-Ivoire
12	<i>Entandrophragma utile</i> Sprague - Méliacée	<i>Sipo/Utile/Assie</i>	Bois léger et tendre	Côte d'Ivoire
13	<i>Eribroma oblonga</i> Mast -Sterculiacée	<i>Eyong</i>	Bois mi-dur, mi-lourd	Libéria
14	<i>Isobertinia doka</i> Craib - Césalpiniacée	<i>Sau</i>	Bois mi-dur, mi-dur	Dans toute l'Afrique occidentale
15	<i>Kaya ivorensis</i> A. Chev., <i>Kaya anthotheca</i> . DC. - Méliacées	<i>Acajou d'Afrique</i>	Bois tendre et léger	Côte d'Ivoire
16	<i>Kaya senegalensis</i> A. Juss - Méliacée	<i>Caïcedrat</i>	Bois lourd et dense	Sénégal

The colors which choose the artists as the tint(coloring) of sculptures are bound(connected) to their symbolic feature.
The manufacturing of colors is obtained other time by means of the local materials.
Today, the artists use of the commercial paint(painting) (for example shoe polishes for shoes).

Colors usually met in the sculpture are:

- The white is the symbol of the revival, the purity, the innocence, the light. This color is obtained with some Kaolin, the shell of snail, egg, excrement of lizard.
- The black represents the death, the witchcraft, the evil. The manufacturing is made by means of leaves or barks of lianas.
- The red represents the fire, the blood, the sun, the fertility and the power. It is obtained by means of Kola.
- The yellow represents the peace, the serenity, the fortune, the hope, the fertility, the eternity, but also the decline and the announcement of the death.
- The blue represents the coolness, the ground rest.

THE WEST-AFRICAN SCULPTURES

Types and symbolic interpretation

The African artist does not make a work for the representation, imitation, but gives meaning and of symbolism. We cannot separate the plastic value of the works of his social or religious, cultural, political, economic, historic, therapeutic context.

So, two particular points are brought to light through sculptures: the aestheticism and the function of the object.



MASK

The mask, symbol of the existence of an intermediary between the reality and the supernatural. The mask is a means of control of the magic religious of every society. The multiplicity of his shape and aspect explains this fact. So every model corresponds to a particular circumstance of the life of the group. There are used for the dance, the marriage and the funerals.



Mask from Benin and Nigeria « Guèlèdè »

The mask " Guèlèdè " (the secret of the women) native of Benin and Nigeria represents an ancestor insuring the connection of the human world and the invisible, is wooden light polychromatic which concerned the summit of the head, its facies being directed to the sky.



MASK FROM MALI

MASK BAMBARA: The Babamra are the MANDE speaking tribe of Mali. Their pre_occupation is farming. They believe in the, god FARO,,regarded as the river god of rain and fertility,It became a god of annual worship. The mask Bambara represent the creation of god and the guide of the universe.

MASK DOGON : the dogon of Mali reside in south of Timbuktu. Dogons believe the mask has a life force NYAMA which comes from human and animals to them after death. They are used during Burial to chase away the soul of the dead person to avoid harming others.



Bambara



Dogon

MASK FROM IVORY COAST,

MASK DAN: The origin of the Dan is from the forest of golf of guinea .The Dan use many form and aspect of mask. It represent half animal and half human, which is used for celebration of Mariage and funeral.

This form of mask is used particullally for mariage.



MASK FROM BURKINA FASO

The masks from Bukina-Faso, are used for some functions: they are the object of cult and art. These masks are generally used in dry season.

For example, The mask OISEAU » 'BIRD' is used to call upon rain and the mask « SOLEIL » is used to call upon sun to shine when rain falls much



OISEAU



SOLEIL

STATUARY

The statuary serves to like the manes of ancestries. It is as intermediary between the living and died (the power which it represents). It is an idol, which embodies a spirit, a genius. It establishes a link between the visible world and the invisible world.



STATUES OF TWINS

The sculpture is made to represent the dead twins to replace the dead ones.

In Benin and Togo, .The sculpture is being adored by the mother. The mother of the twins placed the sculpture by her side when eating and also put some the food on the lips of the wooden sculpture believing that the twins is eating with her. she also gose along with the sculpture to every where .



STATUES OF ASHANTI

The Ashanti Art can be categorized into forms of art. These are the metal and wood work. The wood sculpture here is related to the miniature, it is basically in abstract form used by small girl and the charming brass weights formerly used in hanging over the sale of gold dust.



STATUES OF BAULE

Baule is from Ivory Coast, it has some cultural lineage with the FANTA and ANYI of Ghana. It is believed that Baule have creative power to prevent miscarriage and to insure fertility and also to promote well being of owners.



STATUES OF SENUFU

The senufu tribe occupies part of Ivory Coast and some part of Mali. They are governed by a secret society called LO SOCIETY.

Their main function is to ensure that the creation Myths, custom, and moral norms are obeyed in the community. It promotes members to the higher rank, it depends on the test carried out after a period of seven years.



HISTORICAL TREE

This work of art is in Ouidah. Ouidah is an historic city situated on the sea border having 47 kilometers from Cotonou (Republic of Benin). This work of art is in Ouidah.

This sculpture demonstrates that a dead timber can "be resuscitated" and to be used to redraw the history of a society. It shows environmental aspects of the use of the wood in the sculpture: instead of eradicating the dead tree and transforming it into firewood, the municipality of Ouidah had the brilliant idea to transform it into scenes of history of Benin and Ouidah.



Photo

Scenes presented by the tree report functions of the African art namely: Social and cultural function: scenes 1 and 2 symbolize the religious practices (Vodoun and the Christianity) as well as the place of the man and the woman in the society.

Historic function: scenes 3 and 4 symbolize the draft of the slaves (started of slavery and the liberation of an unchained (given rise to slave). On the scene 3 there is also a symbol of the national unity " pierced care of king Guézo "

Therapeutic function : the scene 4 shows the tray (plateau) of divination " Fâ " used to determine the nature of the problems and their potential solutions.

- Political function: on the scene 5 is sculptured the " Zangbeto " divinity of preservation of order;



Scene 1



Scene 2



Scene 3



Scene 4



Scene 5

FURNITURE

The sculpture also plays a political role:

- The enthronement of the head of the village, the kings is made with sculptured seats. Sat relaying on an animal which characterizes the power of every king or head of the village.



Seat of King



Seat of head

Doors attics Dogon carry symbolic representations such as:

- Masks of the protective spirits;
- The representations of the pregnant women who evoke fertilizations of the earth (ground);

The effigies of ancestors deprived reminding the dead parent owner of field



Traditional Door

TOM-TOMS

The wooden sculpture is used as musical instrument to call upon the spirits and make masks dance. Tom-toms are associated to religious ceremonies, in particular to celebrate the burial, accompany rites of initiation.



GAME

The wooden smart game sculptured most repent in western Africa is the "Awale". It shows how many times the sculpture can play the role of entertainment in a society. This game contains six cavities on each side dug in the wood. These cavities are intended to contain seeds.

At first, we distribute forty eight seeds in twelve holes at the rate of four seeds by hole. As in the chess, only two players can be in confrontation. A tour takes place in the following way: the first player takes all the seeds of one of the holes of his camp then he gets into all the compartments which follow on his row then on that of his opponent following the sense of rotation. If his last seed grave in a hole of the opposite camp and that there are now two or three seeds in this hole, the player gets back these two or three seeds and puts aside them. Then he looks at the previous compartment: if she is in the opposite camp and contains two or three seeds, he gets back.



WOODEN SCULPTURE FOR FOOD

This wooden sculpture is used to pound yam in Africa. It is mostly used in Togo, Benin, Nigeria and Ghana to prepare a traditional food called « pounded yam » in Ghana and Nigeria, it is called « Agun » in Benin and Togo.

The mortar cover is used to pound yam in the mortar in order to make the yam soft for eating.



CONCLUSION

Wooden offers a wide different types of sculptures which are found both in markets in west African countries as well in the greatest international exhibits.

According to the style, sculptures play a social, political, economic, historic and therapeutic role. So for example, masks and statuaries provide the protection and the cure infertility. They are sometimes used as trophy to encourage the farmers to produce advantagegely. Tom-toms have to function to make dance statuaries and call upon the spirits and lead the religious rites.

In West-Africa, we meet a new shape of the sculpture which takes into account the environmental aspect of the use of the wood, that makes us tell story of a society by a dead tree.

Lifestyles Changes in Some Urban Centres in Ghana: What Are the Existing and Potential Impacts on Wood Use in 2011 and Beyond?

Stephen Tekpetey⁵ and Emmanuel Appiah-Kubi⁶

Abstract

In recent times in major city centres in Ghana, the design of houses and ceilings patterns have changed drastically with reduced wood use. Metal doors and plastic T&G are rapidly replacing the use of wood panelling in most private and public building projects. This trend has been linked to a number of factors which include increased wealth status, desire for aesthetic satisfaction and the scarcity of wood in the urban centres. However, the greater and sustainable use of wood is believed to make a significant and valuable contribution to Ghana's desire for a greener future. In this study, the pattern of roofing and ceiling in some private and public buildings constructed in the last five years in three centres: Kumasi, Accra and Tema were assessed using semi-structured questionnaires and field observations. The reasons for the choice of the ceiling and panelling materials were highlighted. Among other things, it is recommended that artistic wood materials should be developed to enhance the use of wood in most building projects in Ghana and other countries where the trend exist.

Keywords: urban centres, wood, ceiling materials, greener future

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1. INTRODUCTION

Wood, a renewable natural resource, has accompanied man's developmental process for centuries in many countries including Ghana. Wood, in its natural state, can be used for many forms of construction (Jayanetti, 1998). As a construction material, wood is strong, light, durable, and flexible and can be easily worked with. In contrast to the substitutes for wood in structural purposes such as brick, metal, concrete and plastics, wood can be produced and transported with little energy consumed and the products are renewable (Koch, 1991). It is also a structurally sound material. Wood is still the major energy source for the majority of the world's people, and burning of wood for fuel is still the major use of wood. In terms of volume of wood used, it was reported that the world population used about 3.4 billion m³ (or tonnes) of wood in 1996 with a continual increase annually since then. Global industrial consumption of wood averages 0.29 m³ per person per year (Sutton, 1993).

There are huge differences in wood consumption between countries. In the USA, for example, per capita consumption exceeds 2.0 m³ per person per year. Consumption in Australia is about half this level, whereas in China and India per capita use is less than 0.1 m³ (Sutton, 1993). Though information on the actual consumption is not readily available, the annual consumption of wood in Ghana can be related to the Annual Allowable Cut (AAC) of about 2 million cubic metres with some authors quoting about 3.5 million cubic metre of wood consumed annually. As the population increases in Ghana and the world at large, wood demand is expected to increase. Sutton (1993) indicated that rising expectations and improving living standards of the developing countries, especially in Asia, seems certain to increase wood use. The world demand for wood products is expected to increase significantly if developed countries are sincere about their commitment under the 1992 Climate Change Convention to hold atmospheric emissions of fossil carbon (Koch 1992, Sutton 1993).

Ghana's population has increased significantly since the 1920s when formal censuses were introduced. Along with the increased population has come the increasing concentration of the population in settlements of 5000 or more people. Urban centres in Ghana are officially defined as settlements with populations of 5000 or more (Owusu, 2005). In 1921, it was reported that 7.8 % of Ghana's population lived in urban centres. That rose gradually to about 43.8 % in 2000. As of 2000, Kumasi and Accra alone accounted for about 34% of the total urban population though there were about 350 urban centres in the country. More importantly, there has been continuous increase in the number of urban centres in Ghana over the last decades.

Using Ghana's official urban definition, three main classifications of urban centres can be made: small towns, medium-sized/intermediate towns, and large towns/cities. At the top of Ghana's urban hierarchy are the large towns/cities of Accra, Kumasi, Tema and Sekondi-Takoradi, with populations of 250,000 or more (Owusu, 2005). This is followed by the intermediate (medium-sized) towns with populations of 50,000 to 250,000, typified by the regional capitals. Exemplified by district capitals/administrative centres are the small towns with populations between 5000 and 50,000.

Rapid urbanization and globalization is accompanied by changes which exposes many individuals to risks and different patterns of resources use. For instance, fast paced economic transition has also resulted in reduced physical activity levels, decreased hours of rest and increasing levels of stress. More often than not, urbanization, with its attendant lifestyle changes, places much pressure on natural resources and infrastructure.

In recent times in major city centres in Ghana, the design of houses and ceilings patterns have changed. Metal doors and plastic T&G and other non-wood materials are rapidly replacing the use of wood in windows, doors and paneling in most private and public building projects. This trend has been linked to a number of factors which include increased wealth status, awareness of emerging products for buildings, the desire for aesthetic satisfaction and the scarcity of wood in the urban centres. However, the greater and sustainable use of wood is believed to make significant and valuable contribution to Ghana's and the world desire for a greener future. This study is aimed at assessing the existing and potential threat to the use of wood in roofing and ceiling of houses in selected urban centres in Ghana.

2. METHODOLOGY

The pattern of roofing and ceiling in some private and public buildings in urban centres in Ghana were observed. In all 100 housing units at Kumasi; 99 at Accra 100 and 53 at Takoradi were randomly sampled for the study. In all 252 housing units were randomly selected in the study areas (Fig. 1). Semi-structured questionnaires were administered and field observations were made. The information required included the type of ceiling materials used for their houses and what informed the choice of such material. The owners and occupants of private, public and students hostels were contacted during the survey. The data collected was analyzed using SPSS version 16. Photographs of some ceiling materials in the urban centres were taken.



Figure 1: Map of Ghana showing the Urban centres (Source: Owusu 2005)

3. RESULTS AND DISCUSSION

3.1 Types of Ceiling Material in study areas

The survey of the selected urban centres in Ghana revealed the different ceiling materials. The materials used included plywood, polished and unpolished wooden Tongue and Grooves (T&G), Plastic T &G, POP and concrete. The use of these materials varies in private and public buildings and from one urban centre to another. In Kumasi, results revealed that majority of the houses surveyed use plywood and wooden T& G. About 48% of respondents use plywood and only 6% uses plastic T and G. Some of the buildings as shown in Fig 2 exhibit a combination of more ceiling than two materials (especially plywood and plastic T&G). However, less than 10% of the respondents use the combination of ceiling materials. Similar trends were observed in the other two urban centres of Ghana, however Takoradi recorded a combination of concrete and plywood as ceiling materials in private houses sampled in the survey than the two other urban centres.

All wood substitutes in ceilings, door and door frames of housing structures are far less environmentally friendly than wood. Wood substitutes like plastic and synthetic rubber often involve pollution with the atmospheric release of carbon from the extraction and production processes than that generated from wood and wood products. A major shift from the use of wood, and an increased use of wood-substitutes like plastics, would increase overall energy requirements in a developing country like Ghana.

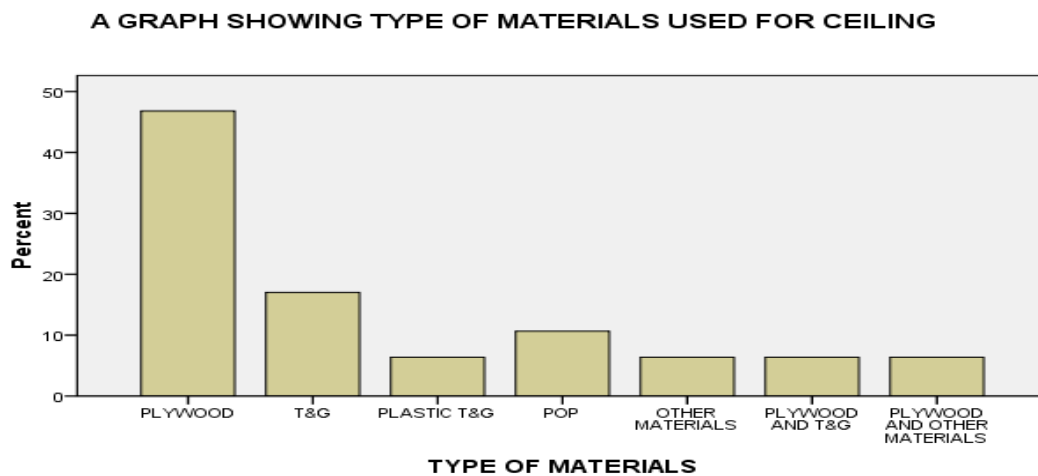


Figure 2: Types of ceiling materials used in building in Kumasi, Ghana.

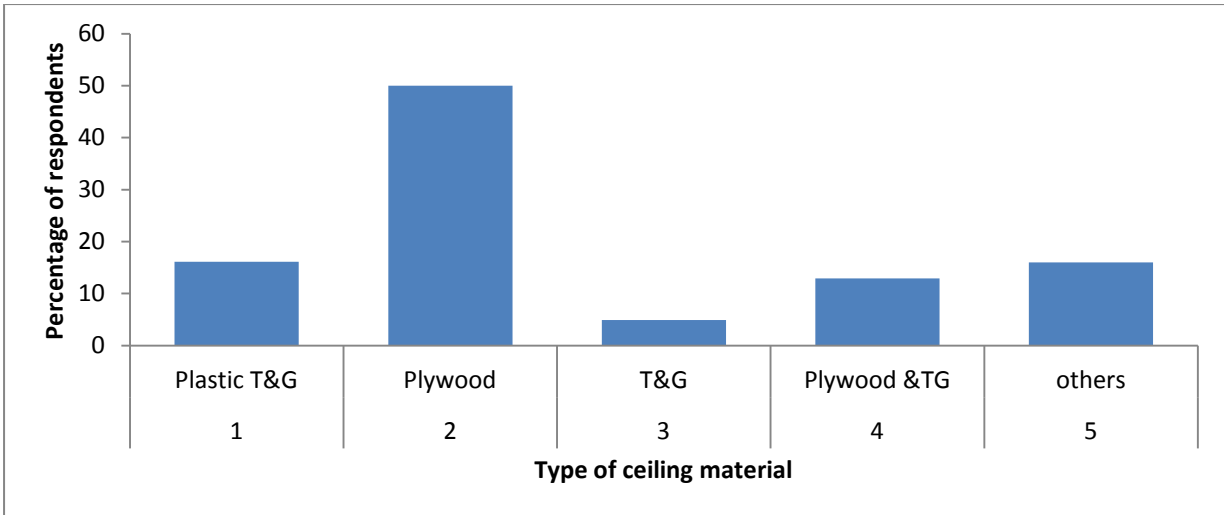


Figure 3: Types of ceiling materials used in Accra, Ghana

Figure 4 shows the reasons respondents gave assigned to the choice of ceiling materials on the Ghanaian market in the selected urban centres. The majority of respondents in Kumasi, Accra and Takoradi use plywood or plywood with other ceiling materials because it is cheap and attractive. Other reason that was given by respondents was that plywood was the only ceiling material that was on the market when they were building the structures. A combination of plastic T& G and plywood is because of the need to replace damaged parts of ceiling with a more attractive and emerging plastic T&G.

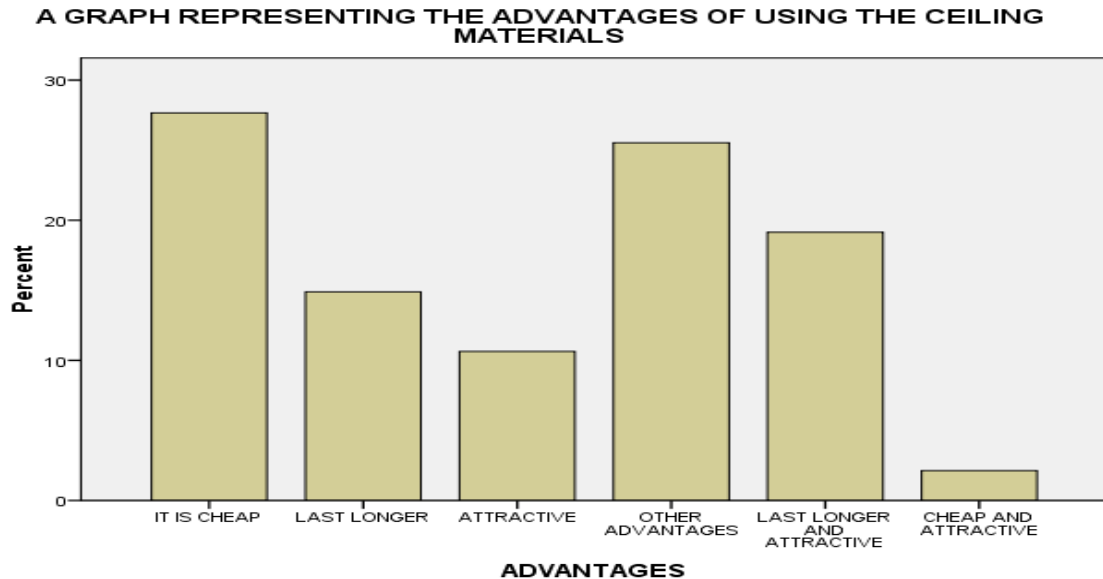


Figure 4: Reasons for choice of ceiling materials

3.2 Some Photographs of Ceiling materials in Selected Urban centres in Ghana



Figure 5a: Wood panel in building Ghana.



Figure 5b: A concrete ceiling at Accra,

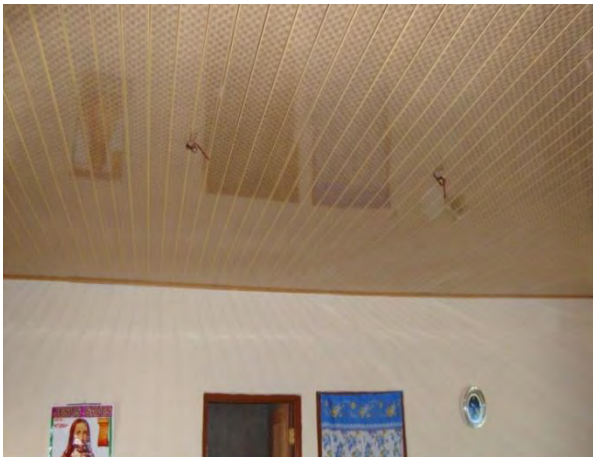


Figure 6a: Plastic T&G ceiling in Kumasi, Ghana

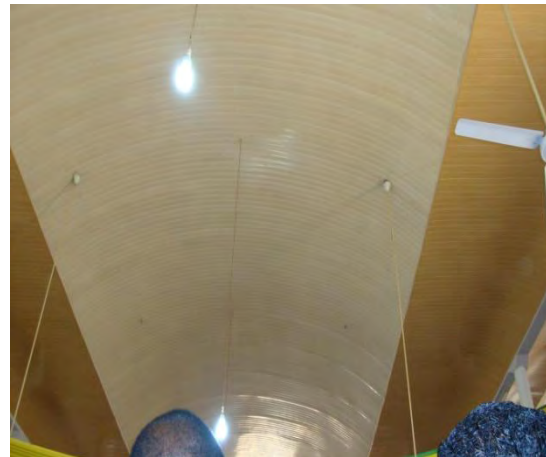


Figure 6b: Plastic T&G Ceiling

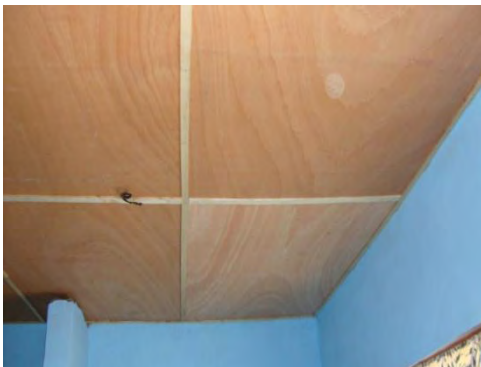


Figure 7: Wood as a ceiling material at FORIG, Kumasi, Ghana

Analysis of the data also revealed that over 85% of respondents in the selected study sites have not changed the ceiling materials since the buildings were constructed. Many of the respondents are aware of the aesthetic values of plastic T&G and POP as ceiling materials and would replace the existing ceiling materials in their private apartments with any of the new materials because they are attractive and would not deteriorate rapidly like plywood and wood products.

As the world population increases, the question about urbanization and the need to provide decent accommodation will demand the use of ceiling materials. The choice of material for

roofing and ceiling is influenced a number of factor: taste of consumer, their purchasing power, availability and awareness of desired materials and the policy direction on the use of renewable natural resources like wood. In the wake of concern of the adverse impact of climate change especially in developing countries like Ghana there is the need to build a greener future with the use of wood and other materials bamboo as ceiling materials.

4. CONCLUSION AND RECOMMENDATIONS

Wood as a ceiling material is gradually being replaced by plastic T&G in some urban centres in Ghana. The trend, attributed to a number of factors like dwindling wood supply, is likely to increase in the coming years as Ghana's population and the global population increase with dwindling commercial forest tree base. Though attractive, its use has some technical disadvantages like heat retention, and increasing carbon emission into the atmosphere. There is therefore the need to sensitize populace about the benefits (cooling and carbon storage) of using wood as a ceiling material instead of the other emerging alternatives. There is however the need to improve the design of wood panel, durability and availability of wood for these purposes in Ghana and other parts of the world where the trend in the use of plastic materials exist.

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**Lifestyles Changes in Some Urban Centres in
Ghana: What are Existing and Potential Impacts
on Wood Use in 2011 and Beyond?**

**AJW International Conference 2011
19-22 October, 2011**

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Outline of Presentation

- Introduction
- Objective
- Methodology
- Results and Discussion
- Conclusions and Recommendations
- Acknowledgement

Introduction

Wood is good



Introduction

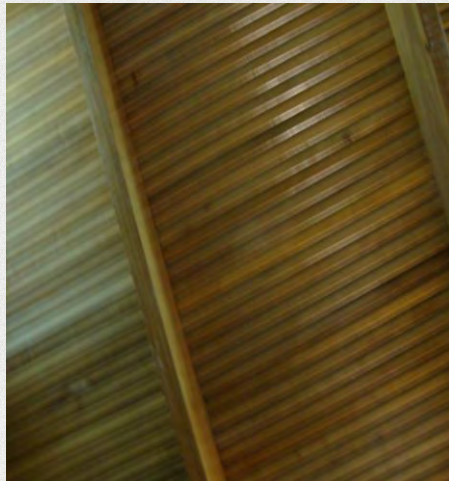
- Wood and wood products have been associated with human survival over the decades.
- Wood is used as firewood, roofing and ceiling material, for furniture, carvings/art works etc
- In Ghana, the export of wood products contribute significantly to the economy.

Introduction

Ceiling designs using wood in Ghana



Introduction



Introduction

- In recent times, other designs and ceiling materials are gradually replacing the use of wood and wood panels in ceiling in Ghana.

Objective of study

- This study is aimed at assessing the existing and potential threats to the use of wood in roofing and ceiling of houses in selected urban centres in Ghana.

Study Areas



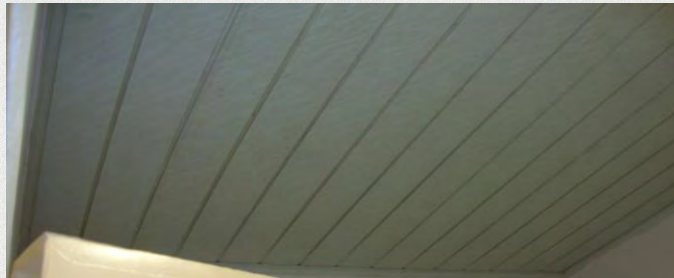
Ghana has a total land area of 23.9 million hectares.

Southern Ghana has a high concentration of urban centres. (Urban centres are settlements with pop. of 5,000 and more.)

Methodology

- About 252 housing units were randomly selected in the study areas.
- Semi- structured questionnaires were administered and field observations made.

Emerging trends



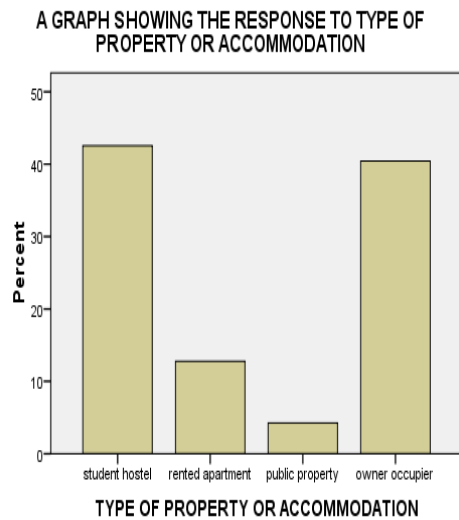
Emerging Designs



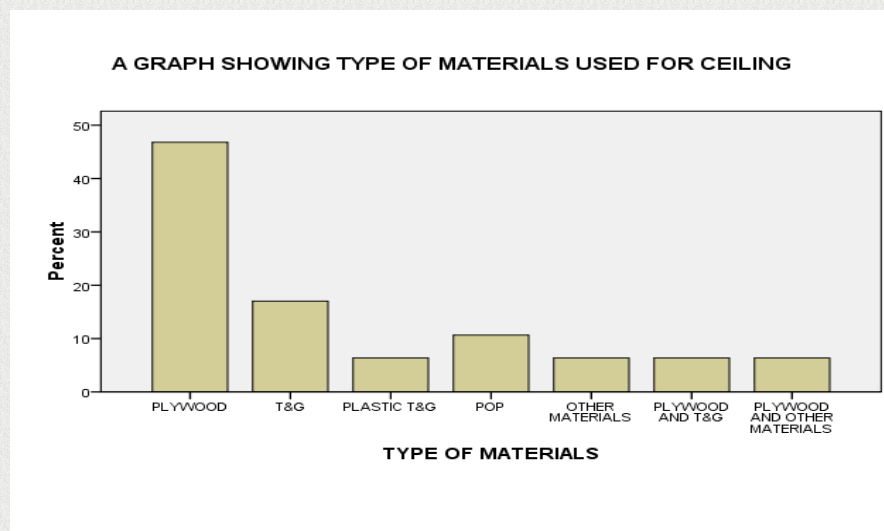
Results and Discussion

In Kumasi, the type of accommodation:

- Owner occupiers(42%)
- Hostels (41%)
- Rented apartment(14)
- Public property (3%)

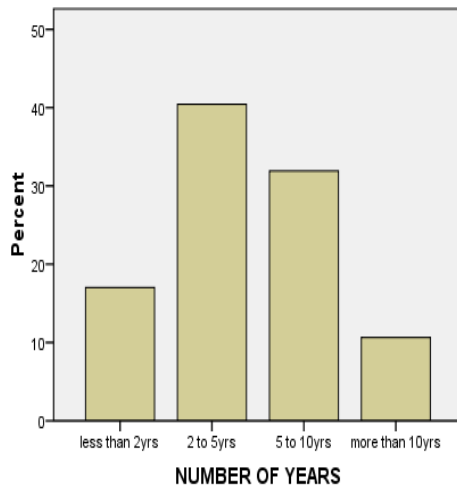


Results and Discussion

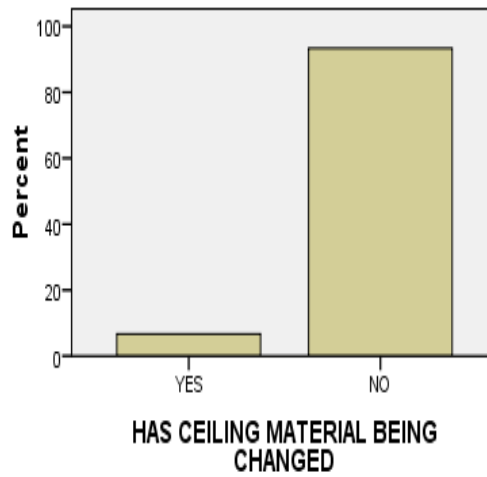


Results and Discussion

A GRAPH SHOWING THE NUMBER OF YEARS A PERSON HAS OCCUPIED THE PROPERTY

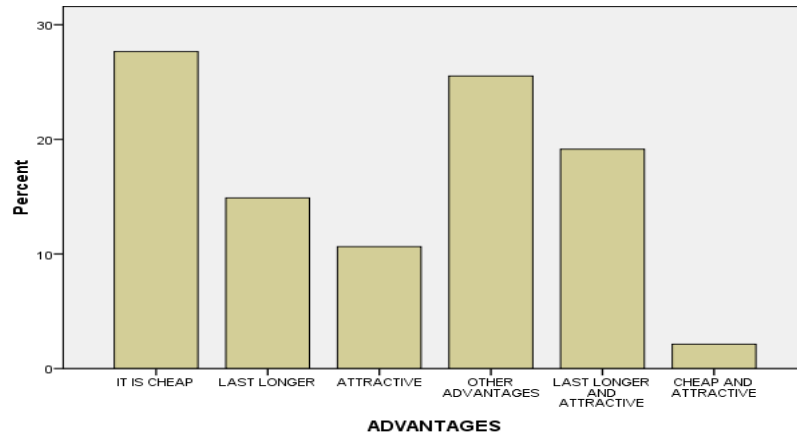


A GRAPH SHOWING RESPONSE IN ANSWERING Q9

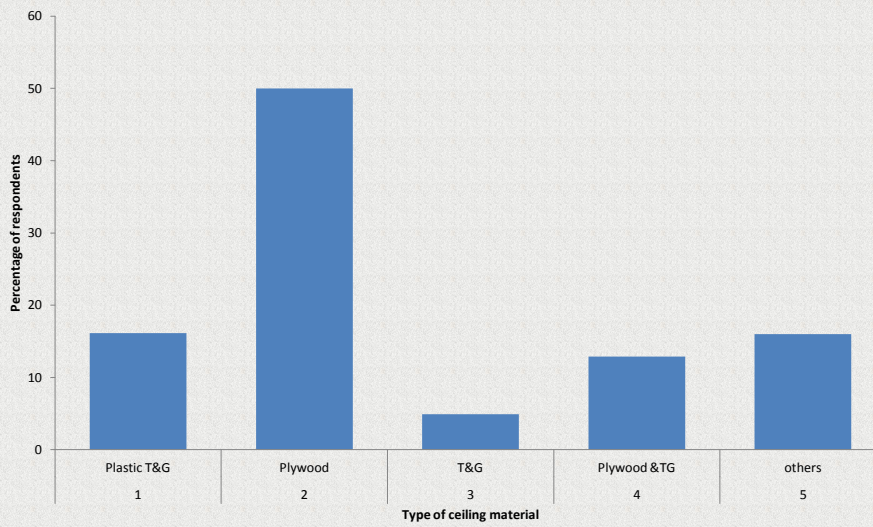


Results and Discussion

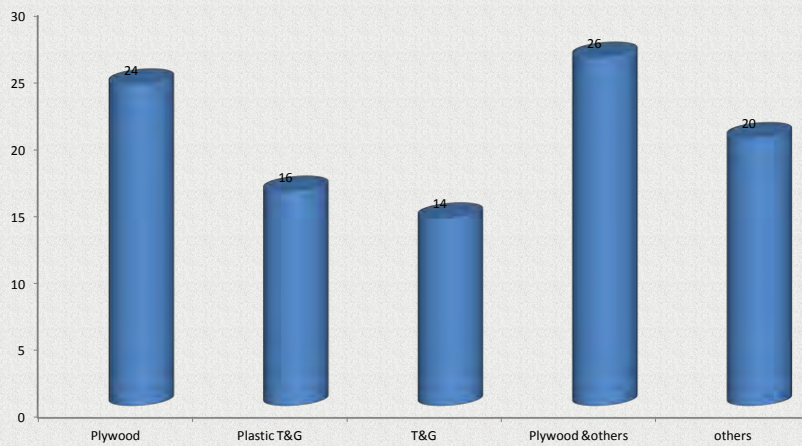
A GRAPH REPRESENTING THE ADVANTAGES OF USING THE CEILING MATERIALS



Results and Discussion



Results and Discussion



Results and Discussion

Table 1: Average cost of ceiling materials in Ghana

Type of Ceiling material	Average Price(US\$)	Average Price (GhC)
Plywood	10 - 23	15-35/m2
Plastic T&G	19 - 26	30-40/m2
POP	32- 64	50-100/m2
T&G (polished)	16	24 /m 2
(unpolished)	12	18/m2

Results and Discussion

- Most Ghanaians are becoming wealthier.
- In Ghana , private remittance inward transfers through the banks in 2008,for instance, amounted to US\$8.7 billion, which represents 26.8 percent increase over 2007.

October, 2008	November,2008	December,2008
US\$654.8 million	US\$608.0 million	US\$990.2 million

Threats to the use of wood

- Use of Plastic T&G(panels) in Construction
- Dwindling timber species
- Low satisfaction in the durability, attractiveness, design of plywood and wood panels among respondents in Ghana.

Conclusion & Recommendations

- Wood as a ceiling material is gradually being replaced by Plastic T&G in some urban centres in Ghana.
- There is the need to sensitize populace about the benefits (cooling and carbon storage) of using wood as a ceiling material instead of the other emerging alternatives.
- There is the need to improve the design of wood panels, durability etc.

Acknowledgments

- Special thanks for the organisers of the AJW 2011 conference for granting me financial and technical support to attend this important conference.
- Management of CSIR-FORIG for their technical assistance

Thank you all

