Importance and Role of Biodiversity and Tropical Forests in the Cultural, Socio-Economic and Religious Life of African Black People: Case of Benin

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Abstract: Biodiversity and tropical forests play a fundamental role in the life of the black people of Africa. In Benin, while some aspects of this role are well-documented, others are barely known. Moreover, these information remains so far very scattered through the literature which does not allow to have a global view on the contribution of biodiversity and forests to the life of people. In this work, it is presented the role of forests and biological diversity in the main vital areas of life of populations in south of Benin. The methodology used was based, with regard to the field, on bibliographical research, observation and/or field stakeholder survey. Investigations are more particularly focused on hardwood lumber uses and the species that are significantly used. The results highlight the uses that are made of vegetal elements of biological diversity and timber as forest products in south of Benin. The main areas explored are animist or traditional religion and traditional medicine, as well as socio-cultural and economic life. In this latter area, the most used timber species and their uses are identified; these include furniture, light carpentry, sculpture, formwork, canoe construction, drums and mortar making.

Key words: Biodiversity, forest, areas of life, African populations, wood.

1. Introduction

The forest and wood represent, since always, important resources for humanity. Forests play a crucial role in the water cycle, the climate control and exploitation of the woods for various purposes. Therefore, they represent a major challenge to the ecological, economic and social plans for nations [1]. In addition, in developing countries, rural populations live in interaction with forests and benefit from biodiversity, for example for the treatment of the ailments. Also, wood has a lot of qualities, both on the technical level (mechanical strength, warm materials...)

and economic (inexpensive), while benefiting from a “green” naturally occurring material image, from a renewable resource, reusable and whose implementation is little energy during its life cycle. So, it is suitable for multiple uses (building, furniture, sculpture...). The benefits of forests—beyond their economic value which plays against them—hold for much the very life of humanity on the planet. They participate in the preservation of the environment, the fight against climate change because of their ability to contribute to the reduction of emissions of greenhouse gases (carbon dioxide sequestration). Their role in the fight against erosion is quite established.

In Africa, on social and cultural plan, not only biodiversity constitutes the source of products that

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contribute to the satisfaction of the basic needs of the populations, but it also has a spiritual and aesthetic value. Biodiversity and forests are the main source from which traditional medicine draws its product needs. And the WHO (World Organization of the Health) estimated that about 80% of the populations living in the African regions are resorting to traditional medicine for their healthcare needs [2].

In Benin, forestry provides finance and creates jobs to thousands of players [3] through a variety of activities. As country in the West African area, Benin has a plant cover estimated following national forest inventory in 2007, to 69% of the total area of the country [4] with more than eight hundred (800) medicinal species, over one hundred twenty (120) food species [5] and more than 40 species lumber providers [6]. According to the study on the contribution of the forest sector to the economy of Benin conducted in 2009, the participation of this sector in the training of national GDP is estimated at more than 6.64% [7]. This figure emanating from official data, would not have taken enough into account the contribution of the informal sector very little mastered but still dominant in the economic life of the country.

Biodiversity and forests do to the people of Benin, important favor in many areas namely the socio-cultural, religious, environmental and economic areas. In the economic field, it has been distinguished the different income-generating activities and trades from the collection of the fruit, the felling of the tree until the marketing of the finished product, through the subsector of the wood processing that includes lots of small trades.

On the whole, if some scientific work have already focused on the one hand, on the use of biodiversity in the medicinal fields [2, 8], religious [9, 10], in Benin and on the other hand, on the wood products used as wood energy, almost no work has focused on the wood products used as lumber. Most of the services of this category of wood are little knowledge or

documented and so weakly controlled. In this paper, it is proposed to introduce the importance and the role of biodiversity and forests in the lives of Beninese people in general through the main characteristic areas of the realities of the country namely religious, medicinal areas, but particularly in the socio-cultural and economic areas. The reasons for the use of essences in the trades of wood as well as the ecosystem in Benin backup strategies will also be presented.

2. Methodology

2.1 Data Collecting

To collect data, methods used are bibliographical research, observation and field survey. The study area is mainly the South-Benin. The Republic of Benin covers an area of 112,622 km². It is located in the tropics, between the parallel 6°30" and 12°30" North latitude, on the one hand, and the Meridian 1° and 3°40" East longitude on the other. It is limited to the north by Niger and Burkina Faso, to the south by the Atlantic Ocean, west by Togo and on the east by Nigeria. Analysis of the typology of the uses of timber in the area, allowed to categorize the socio-professional groups targets (transformers) according to the areas of use are: furniture, light carpentry, frame construction, formwork, sculpture, construction mortar, construction of drum and canoe construction. This typology of uses is characteristic of the study area. The survey was conducted in the form of semi-directed interview with target groups. Most of the questions addressed to respondents, are issues closed; however, the conditions of the maintenance allow them to freely give their opinions and make comments based on their understanding. The answers given by each investigated are weighted (from 0 to 3) to take into account the weight or the degree of importance of the phenomenon seen or lived according to the notice of the investigation, in accordance with the weighting table under the made-up interview guide. The sample is random.

Total 273 transformers professionals of the wood have been surveyed including 139 professionals of furniture (indoor and outdoor), 48 of light carpentry, 46 of frame, 11 of formwork, 13 of the sculpture, 5 of mortar construction, 6 of the construction of drum and 5 of the construction of dugout. More 6 professionals of the construction of houses on stilts (service wood) have also been maintained.

In order to report some images of these buildings, camera Sony DSC-HX90V is used.

2.2 Data Processing

Data from surveys on the use of timber were processed in two times. Initially, it is FCA (Factorial Correspondence Analysis) under software 'R' to determine which species are used significantly in each area. Secondly, it has been done the specie classification in descending order according to the level of use based on the associated frequencies that have been calculated using Excel from Microsoft Office 2010 software.

3. Results and Discussion

3.1 Importance and Role of Forests in the Religious Life of the Beninese People

Since ancestral times, Animistic populations have adopted for shelter of their minds, the components of biological diversity. To house the spirits, several ethnic and sociological groups have chosen, whether a forest (Fig. 1), a tree (Fig. 2), a plant, an animal, or just only some of them. The consecration of the islets of the fetishes called sacred forests is a traditional technique of conservation of natural resources.

The sacred forest is defined as any area woody, revered, and is concerned, reserved for cultural expression of a given community whose access and management are regulated by the traditional powers [5]. They are a reservoir of all native pharmacopoeias [11]. Benin has about 2,940 sacred forests, which are relics of forests that are concentrated in the south, particularly in the coastal area, and are places of

pilgrimage and rituals of the "vaudou" [12]. They include the country's older trees, as shown in example at Fig. 3. The sacralization of biodiversity, therefore, wants to be a powerful way of preservation of this last because no one would touch it for fear of reprisals. It should also be noted that during the rituals, the tree leaves are often used for purification, consecration, etc..

Fig. 1 Sacred forest Igbo-OroAro in Kétou.

Fig. 2 Fetish housed at the foot of a tree in Ouidah.

Fig. 3 Sacred tree.

3.2 Importance and Role of Plants in the Therapeutic Field for the Beninese People

In Benin, 814 plant species are identified to be used in traditional medicine in the treatment of conditions [5] and one hundred (100) plants have been officially identified to be used in the form of decoction, crushing, ointment, powder according to an administration through oral or cutaneous (with bath) for the prevention and treatment of opportunistic HIV/AIDS [2]. Eighty percent (80%) of the population use traditional medicine for their needs in health care [11]. The elements of biodiversity are used partially or totally in various forms during the treatments of diseases: leaves (Fig. 4), fruit (Fig. 5), simple (Fig. 6) or sprouted seeds (Fig. 7) and sometimes even the roots or the plant full, are used in form crushed, boiled or grilled, decocted etc..

For example, the decocted of the only sheets of *Annona senegalensis* or associated with the roots of

Fig. 4 Medicinal leaves.

Fig. 5 Medicinal fruits.

Fig. 6 Medicinal simple seeds.

Fig. 7 Medicinal sprouted seeds.

Securidaca longepedunculata is used per os for external use to treat snake bites, generalized edema, muscle aches, constipation, the Alex, hyperthermia, the dysmenorrhea, the jaundice and bleeding. The decoction of the roots associated with that of *securinega virosa* is used per os in the treatment of infertility, colic and especially snake bites. For trichomonas, genital infections used a decoction of the bark of the trunk of *Holarrhena floribunda* in vaginal injection. To treat diarrhea and fever, one proceeds to maceration and then consumption orally and roots crushed in water [2]. When one considers for example also, *Chromolaena odorata*, the juice of fresh leaves is used in body friction in the treatment of hyperthermia, body aches and the mycoses. The decoction of the leaves is also used in per os in the treatment of abortion threats.

Azadiarachta indica, the fruit of *Citrus aurantifolia*

leaves and others are used in the treatment of malaria; *Khaya senegalensis* bark is used to prevent small problems of health of newborns. Also, as the facts of the nutritional value of their leaves or fruits, certain food plants are used in the treatment of certain diseases. For example, it is the case of the Moringa leaves, of the fruit of the Baobab Tree, which are recommended to correct the problems of malnutrition.

3.3 Role of Forest Products in the Socio-Cultural and Economic Life of the Beninese People

Exploitation of non-timber forest products is essentially: pick-up of Shea almonds, harvest of honey and mushrooms, the slaughter of the oil palm, the sampling of food plants in the forest reserves in the protected area and in the fields. Various other non-timber forest products are also collected such as nuts, snails, meat of Bush etc.. But very little information on these products is available. Forest products timbers (wood) are used in three (03) main forms in Benin: wood energy, service wood and lumber.

Wood energy includes firewood and charcoal. 80% of the Beninese populations are dependent for their culinary activities, on wood fire and charcoal, which are mainly natural formations and fallows [4]. The rural populations, while using firewood as a source of energy, produce and feed people in cities across many related marketing channels of finance to the state by taxation mechanisms. The sector of wood energy is so far the one that has the most withheld attention of governments and even benefits from many important projects for the sector performance improvement (project wood fire, for example).

Coal is produced by a limited number of operators for whom this activity is usually secondary. In order to produce a quality coal, trees are selected according to the hardness of their wood, such as *Pterocarpus erinaceus*, *Prosopis africana*, *Vitellaria paradoxa* and *Anogeissus leiocarpus* [10]. Fig. 8 shows fuelwood in stere and Fig. 9 shows charcoal in wood

bags of 50 kg.

The wood of service includes the woods of small and medium sizes which are directly used in buildings or small achievements. It is, for example, the poles for the piles of habitat on water in Fig. 10. Service wood is also used for the realization of scaffolding on construction sites, of light frames. It is also used as poles not only by those on modest incomes, but sometimes by the national structure of electric power distribution.

Fig. 8 Bundle of firewood arranged in piles in Cotonou.

Fig. 9 Charcoal in wood bags of 50 kg in Cotonou.

Fig. 10 House on stilts above the water, Ganvie lake village.

Areas of transformation of lumber in Benin are furniture, light carpentry, frame construction, formwork, sculpture (Fig. 11), construction of drum (Fig. 12), canoes (Fig. 13) and construction of mortar (Fig. 14).

Fig. 11 Objects of sculpture.

Fig. 12 Drums.

Fig. 13 Canoes.

Fig. 14 Mortars.

The results of the surveys on the use of lumber across the South-Benin are summarized in Tables 1 and 2 which are presented by processing field, the different species used significantly, by descending order of importance of use.

It is clear from Tables 1 and 2 that, all over the study (South-Benin) area, sculptors use *Gmelina arborea*, *Pterocarpus erinaceus*, *Tectona grandis*, *Diospyros mespiliformis*, *Khaya senegalensis*, *Milicia excelsa*, *Eucalyptus spp*, *Daniellia oliveri*, *Khaya grandifoliola*, *Azzeria africana*, *Azadirachta indica*, *Vitellaria paradoxa* and *Triplochiton scleroxylon*.

All of these species do not interest professionals of furniture. For this category, *Pterocarpus erinaceus*, *Gmelina arborea*, *Anogeissus leiocarpa*, *Khaya senegalensis*, *Azzeria africana*, *Khaya grandifoliola*, *Tectona grandis*, *Eucalyptus_spp* and *Milicia excelsa* are the most used.

For professionals of light carpentry, *Tectona grandis*, *Acacia auriculiformis*, *Anogeissus leiocarpa* and *Isobertia doka* are the species mainly used while *Anogeissus leiocarpa* and *Isobertia doka* interest carpenters. *Isobertia doka* remains the single most used species for formwork. With regard to the construction of canoes, *Triplochiton scleroxylon*, *Erythrophleum africanum*, *Cola_spp*, *Milicia excelsa* and *Western Anarcadium* are the most exploited.

As far as manufacture of mortars is concerned, *Azadirachta indica* and *Prosopis africana* interest more professionals rather than *Gmelina arborea*, *Magnifera indica* and *Parkia biglobosa* that drum makers

Table 1 Types of wood used significantly in South-Benin for sculpture, furniture, light carpentry, carpentry and formwork.

Position	Sculpture		Furniture		Slight carpentry		Formwork	
	Species	Frequency of use (%)	Species	Frequency of use (%)	Species	Frequency of use (%)	Species	Frequency of use (%)
1st	<i>Gmelina arborea</i>	6.85	<i>Azalia africana</i>	19.31	<i>Tectona grandis</i>	23.88	<i>Anogeissus leiocarpa</i>	50.62
2nd	<i>Pterocarpus erinaceus</i>	6.60	<i>Khaya grandifoliola</i>	16.79	<i>Anogeissus leiocarpa</i>	19.86	<i>Isobertia doka</i>	49.38
3rd	<i>Tectona grandis</i>	6.09	<i>Tectona grandis</i>	12.01	<i>Acacia auriculiformis</i>	19.14	-	-
4th	<i>Diospyros mespiliformis</i>	5.84	<i>Pterocarpus erinaceus</i>	9.62	<i>Isobertia doka</i>	15.68	-	-
5th	<i>Khaya senegalensis</i>	5.84	<i>Gmelina arborea</i>	9.16	-	-	-	-
6th	<i>Milicia excelsa</i>	5.84	<i>Anogeissus leiocarpa</i>	6.24	-	-	-	-
7th	<i>Eucalyptus_spp</i>	5.58	<i>Khaya senegalensis</i>	6.04	-	-	-	-
8th	<i>Daniellia oliveri</i>	5.33	<i>Eucalyptus_spp</i>	5.31	-	-	-	-
9th	<i>Khaya grandifoliola</i>	4.82	<i>Milicia excelsa</i>	4.31	-	-	-	-
10th	<i>Azalia africana</i>	4.57	-	-	-	-	-	-
11th	<i>Azadirachta indica</i>	4.57	-	-	-	-	-	-
12th	<i>Vitellaria paradoxa</i>	4.57	-	-	-	-	-	-
13th	<i>Triplochiton scleroxylon</i>	4.31	-	-	-	-	-	-

Table 2 Types of wood used significantly in South-Benin for canoe construction, manufacturing of mortar and drums.

Position	Canoe making		Mortar making		Drums making	
	Species	Frequency of use (%)	Species	Frequency of use (%)	Species	Frequency of use (%)
1st	<i>Triplochiton scleroxylon</i>	11.00	<i>Azadirachta indica</i>	5.85	<i>Gmelina arborea</i>	36.59
2nd	<i>Erythrophloeum africanum</i>	10.00	<i>Prosopis africana</i>	48.15	<i>Mangifera indica</i>	34.15
3rd	<i>Cola_spp</i>	9.00	-	-	<i>Parkia biglobosa</i>	29.27
4th	<i>Milicia excelsa</i>	8.00	-	-	-	-
5th	<i>Anarcadium occidentale</i>	5.00	-	-	-	-

prefer. The reasons that motivate the professionals in their choice (of species) are diverse and vary from one socio-professional group to another. The histograms in Figs. 15 and 16 show the levels of importance of the reasons for the use of species of wood furniture and light carpentry.

In the field of furniture, the histogram in Fig. 15 presents the situation of these reasons. They mainly concern the selection factors namely the availability of wood, its resistance, its beauty (aesthetics), the quality of the finish, the ability to be impregnated, the absence of deformation, machinability and defects. Analysis of Fig. 15 shows that professionals prefer the species *Azalia africana* not only because it is

mechanically very resistant and has a beautiful appearance with a good finish and absorbs well, but also because it is durable and deforms little (low game of wood) even though it is not quite available and remains somewhat difficult to machine with a few flaws. *Khaya grandifoliola* is often used because it is very available and still has a pretty good mechanical resistance. It works well and does not have a lot of defects even if it is sensitive (deformation) in the moisture gradient. It has a good aesthetic like the species *Azalia africana* but not high durability. Its finish is pretty good and it permeates well. As for *Tectona grandis*, the reasons for his choices are close to those of *Khaya grandifoliola* to the slight difference

Fig. 15 Comparative frequencies of the reasons for the use of the species in furniture.

Fig. 16 Comparative frequencies of the reasons for the use of the species in light carpentry.

that it is a little less available that works a little better and has a little less than faults as this one. Regarding *Pterocarpus erinaceus*, it is a good wood as *Afzelia africana*, but a little weaker and a little less beautiful than this one, but better machines. According to professionals, *Gmelina arborea* and *Anogeissus leiocarpa* are used for the same reason, only the latter

is very available almost like *Khaya grandifoliola*, but it distorts a lot with changes in humidity and machines with the same ease as *Tectona grandis* but less easily than *Gmelina arborea*. As *Pterocarpus erinaceus* which is scarce, the professionals think that *Khaya senegalensis*, *Eucalyptus spp* and *Milicia excelsa* are also rare, but if they use them, it's because they have

almost equivalent features. Overall, *Azizelia africana* and *Pterocarpus erinaceus* are the hardest species. The first is the more aesthetic and both are still sought while *Khaya grandifoliola*, *Anogeissus leiocarpa* and *Tectona grandis* are more available.

The species *Azizelia africana* has always been sought by furnishing professionals to the point that his native was, according to Agbahungba, G., et al. [5], and remains of the view of the professionals, in danger of extinction. According to the statements of the professionals and confidences that traders of wood who were met during the investigations have done, most of the *Azizelia africana* woods used are imports from the forests of Nigeria and Togo. The annual report of 2015 of the Directorate General of forests and natural resources [13] noted this situation. In general, professionals of furniture are supplied with other woods of their choice by merchants who pick them up in the forests of the center and north of Benin.

For light carpentry (small carpenters) professionals, what motivates their choices remain overall, as shown in the histogram in Fig. 16, the availability of the wood, even if they are interested also with the resistance and the sustainability of the species. Analysis of the histogram, shows that the professionals consider *Tectona grandis* and *Anogeissus leiocarpus* as more resistant than *Acacia auriculiformis* and *Isobberlinia doka* and the latter is much less durable than the other three.

In the field of sculpture, professionals believe that all wood can be used for the realization of their works. That is why they use a little all the wood to craft works of forms as various as varied, from small art objects (key rings, crèches and hammers) up to big ones that can reach a height of 2 m and a wingspan of 1 m. But more specifically, the main factors of choice that they combine are availability, durability, size and economic value of the species. It's that way *Diospyros mespiliformis* whose economic value is very high because rare, is mainly encountered only with sculptors of the cities. These professionals find their

material first in the forests of northern Benin and Togo and Nigeria at times.

In the field of the frame, the professionals think that the selection factors focus on first resistance and the availability of wood, then its scope (length). The high durability and low sensitivity to gradients of moisture (geometric stability) are also considered. It is for these reasons that *Anogeissus leiocarpa* and *Isobberlinia doka* are used. These species come from forests of northern Benin.

For the professionals of the formwork, *Isobberlinia doka* is currently the most used species because its wood is considerably available and cheap, and in trade it is also on of great length.

Manufacturers of drums and mortars seem to use some specific species and feel that this is a legacy of their senior parents. However, manufacturers of drums focus on sustainability, low sensitivity to gradients of moisture and in terms of portable drums, low weight and more while mortars manufacturers are more interested in the consistency of wood.

As for manufacturers of canoes from the village of Ganvie, they distinguish two types of canoes: the so-called canoes "monoxiles" of small and medium sizes (capacity of 15 people at most) and canoes in boards (capacity of 30 to 40 people). For the first type, the species of wood used are not controlled because these canoes would be cut directly from trunk of large trees (difficult to find locally) in Nigeria by professionals. So, these are the wooden canoes which are carried out in Benin from wood which generally come with natural woodlands and plantations of the departments of the "Ouémé" and Plateau and sometimes in trade. Local professionals carry their selection on a particular species because its wood is resistant, durable and not too heavy.

3.4 Strategies for Maintaining Ecosystems in Benin

The importance of forest resources in the lives of people has the exploitation of these immediate consequences. The situation with regard to the exploitation

Fig. 17 Evolution of the strata of vegetation covers from 1972 to 2007.

of timber resources does not look good. According to the report of end of mission of implementation of the national forest inventory of 2007 [4], it was revealed a threatening decline of forest cover resulting from the primarily anthropogenic factors. The situation is all the more worrying that the lumber and wood fuels needs are increasing as a result of the increase of population and the development of economic activities [14]. For example, consumption in timber estimated to 112,000 m³/year in 1997, has doubled ten years later [12]. In addition, while Benin is not a producer of softwood lumber on a large scale [15], it happens in the country a selective and uncontrolled logging that led to a scarcity of certain species [5]. But policies and strategies reconstruction and preservation of vegetation seem to bear fruit. Indeed, while the period from the 1970s until the 1990s was marked by a deforestation that was evolving at an alarming rate as shown in Fig. 17, the trend has been reversed and a gradual improvement of the situation with a recreation of the cover began by observing such as indicated by Fig. 17.

This improvement of the situation which continues to be supported so far is consecutive to important strategies put in place that are governed by the law n° 93-009 July 2nd, 1993, establishing the system of forests in Republic of Benin with his multiple decrees

of application. The main strategies implemented are those of regulation with a view to the preservation of forest resources and vegetation renewal. As far as control strategies are concerned, the main concern on the one hand is the installation of cantonments enforcement of regulations for the exploitation of the timber forest resources by populations. On the other hand, the involvement of local authorities following a participatory approach is also prioritized part.

Renewal strategies focus on projects and programs of reforestation also integrating the participatory approach with local authorities. Each year, several projects are developed and implemented by the authorities in charge of forest management, such as the project “Ten Million Souls, Ten Million Trees” [6].

4. Conclusion

Biodiversity and forests play important roles as various and varied in the Beninese people’s lives. This work has shed light on the different spheres of daily life of the population where plant resources are present but especially the purposes for which they are used. A rich variety of plant species are used in traditional medicine, which is officially recognized, to treat diseases of all kinds, whether physical or spiritual. The religious life of the Animistic

populations benefits from the strengths of forests. On socio-cultural and economic terms, the timber forest resources are also very useful for the people and government. In their broad variety, woody species are generally used three forms: service wood, fuel wood and timber. Areas of use of the lumber are many and cover furniture, light carpentry, frame construction, formwork, sculpture, construction of mortar, construction of drum and canoe construction.

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