



Indigenous Knowledge of Bamboo Products and uses in the Western Highlands of Cameroon

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Authors' contributions

This work was carried out in collaboration among all authors. Authors CDC, BNN, GWF, ANP, KR and ZL designed the study. Authors CDC, BNN, GWF, ANP, KR, ZL, NAJ, TM, AM, ZGJC, TMRB, ISL collected the data in the field. Author NAJ have performed the map of study area. Authors CDC, BNN, GWF, ANP wrote the protocol and wrote the first draft of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Today, bamboo is a resource frequently used by local people for their wellbeing and rural development in poor localities.

Aims: This study aimed at identifying the ecosystem services offered by bamboo to the local

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population for their wellbeing.

Duration and Place of Study: The study was carried out in January to February 2021 in Western highlands Agro ecological zone of Cameroon; more precisely in areas with high bamboo density according to literature review.

Methodology: Three hundred and ten (310) questionnaires were administered to persons involved in bamboo activities including a direct observation in the field. This was complemented with key informant interviews.

Results: The results showed that bamboo is highly utilized for subsistence purposes in many households in the Western Highlands of Cameroon, with at least 97 bamboo uses and products identified. These uses/products were grouped into 11 sectors/domains making use of bamboo. Agriculture, silviculture, handicrafts, furniture and house construction are the sectors using more bamboo products. Only 5% of respondents used bamboo in more than 10 sectors/domains.

Conclusion: This baseline survey presents results which could orientate decisions of Policymakers and Development planners on how bamboo products could be valorized in the Western Highlands.

Keywords: Bamboo; cameroon; local people; uses and products; Western highlands.

1. INTRODUCTION

Bamboo is a woody grass species, widely distributed in tropical, subtropical and mild temperate zones. It is an integral part of the forest, but it is also widely spread outside the forests, including farmlands, riverbanks, roadsides and urban areas [1]. In Cameroon, bamboo is distributed across diverse ecosystems from humid to dry tropical and also in Afromontane forests [2]. Bamboo plays diverse roles like key resource in environmental regulation (soil, climate, water), providing income and livelihoods in developing countries, etc. [3,4]. It is an increasingly important economic asset in poverty eradication [5]. It is considered by Lobovikov et al. [1] as one of the world's most valuable and important non wood forest product with an annual exportation cost of raw bamboo in Asia estimated at 8.9 billion US Dollars. It is worldwide exported as raw material, finished and semi-finished products, as indicated by the International Bamboo and Rattan Organization (INBAR) in 1999 [6]. With such a great potential into bamboo industrialization, it can considerably contribute to the sustainable development of Cameroon through export, processing, use for agriculture, nutrition, pharmaceutical purposes, etc. [7]. According to Ingram and Tieguhong [2] about 31 000 people in Cameroon benefit from bamboo-related incomes; however, Ingram et al. [7] shows that, bamboo products represent the main trade's incomes sources (75%) for people interested in bamboo, and can provide more than 2000 USD per craftsman. Bamboo in Cameroon can contribute to the achievement of the Sustainable Development Goals (SDGs) - "the 2030 Agenda for Sustainable Development". As such, it contributes in the achievement of at least

6 SDGs (1, 7, 11, 12, 13 and 15): end poverty and hunger everywhere, ensure the lasting protection of the planet and its natural resources; create conditions for sustainable, inclusive and sustained economic growth; mitigate climate change.

Bamboo usage and products in Cameroon have not yet gained recognition. The bamboo sector is still under-developed with poor private investment in the sector. Due to the poor knowledge of bamboo usages, finishing and quality of the product made locally, consumers prefer imported manufactured bamboo products like chairs, beds, tables, wood etc. [4]. Bamboo products in Cameroon need to gain national accreditation from the National Standard Authority. However, the identification of bamboo usage and product appears to be an initial step required to valorize this resource [7]. It is in this context that this study seeks to identify the different bamboo products and uses in the Western Highlands of Cameroon. The study was motivated by the fact that, natural ecosystems are disappearing due to anthropogenic pressure and, bamboo forest/plantation proves to be an alternative resource which could be used by local people for their wellbeing; and INBAR is implementing a bamboo value chain development program in this area. These aforementioned reasons motivated this reference study, which will form a base for measuring the impact of the program in the short, medium and long terms. The research question was: what are the different uses/products provided by bamboo to rural communities of Western Highlands of Cameroon? The objective of this study was to identify various bamboo uses and products in the Western Highlands of Cameroon.

2. MATERIALS AND METHODS

2.1. Study Area

This study was carried out between January and February 2021 in Western Highlands of Cameroon, representing 8.2% of the national territory. Administratively, it covers the North West and West Regions of Cameroon as well as parts of the south-west and littoral regions (Fig. 1). The relief of the Western Highlands (Agro-ecological zone III) is mountainous with many plateaus and plains. The altitude varies between 1500 – 2400m [8]. The climate is the tropical type with 2 seasons; a rainy season (April - November) and a dry season (November - April). The mean precipitation oscillated between 1800 - 2400 (mm)/year and temperature varies from 11°C to 30° C with a mean of 21°C. According to Jiotsa et al. [9], the soils in this Agroecological Zone (AEZ) are essentially volcanic soils (clay, rocks). Phyto-geographically, the vegetation of this AEZ is essentially savannah grassland and montane forests. The North-West Region is typically covered by high Guinea savannah [8]. The soils of the AEZ, are significantly degraded due to anthropogenic activities, where the most natural vegetation are converted into agricultural lands. Only some natural ecosystems are found like sacred forests and gallery forests. Concerning bamboo in the AEZ, Nfonkah et al. [10] shows that, it covers an area of 241,295.87

ha which represent approximately 20% of national bamboo area.

2.2 Data Collection

Surveys focused essentially in the localities where previous studies have shown high density of bamboo distribution through remote sensed mapping [10,11]. These villages are found within six (06) Divisions of the AEZ (Bamboutos, Haut-Nkam, Menoua, Mezam, Nde and Noun). In addition, these Divisions were areas where the local population are involved in the bamboo sector [7]. In each locality, a mixed approach was used for data collection including questionnaires administered to households involved in the bamboo sector, field observations (especially on bamboo uses) and interviews with some key resource persons (traditional leaders, civil society, NGOs involve in plant conservation). Considering the fact that we could not sample all the persons involved in the bamboo sector, the households for questionnaires were chosen by convenience between those that were involved in the value chain of bamboo (producers, harvesters, collectors, sellers, consumers, etc.), and also on voluntary bases, taking into consideration those who were willing to collaborate with us [7]. Questionnaires were especially focused on the different uses/products of bamboo in this AEZ with respect to different sectors/domains.

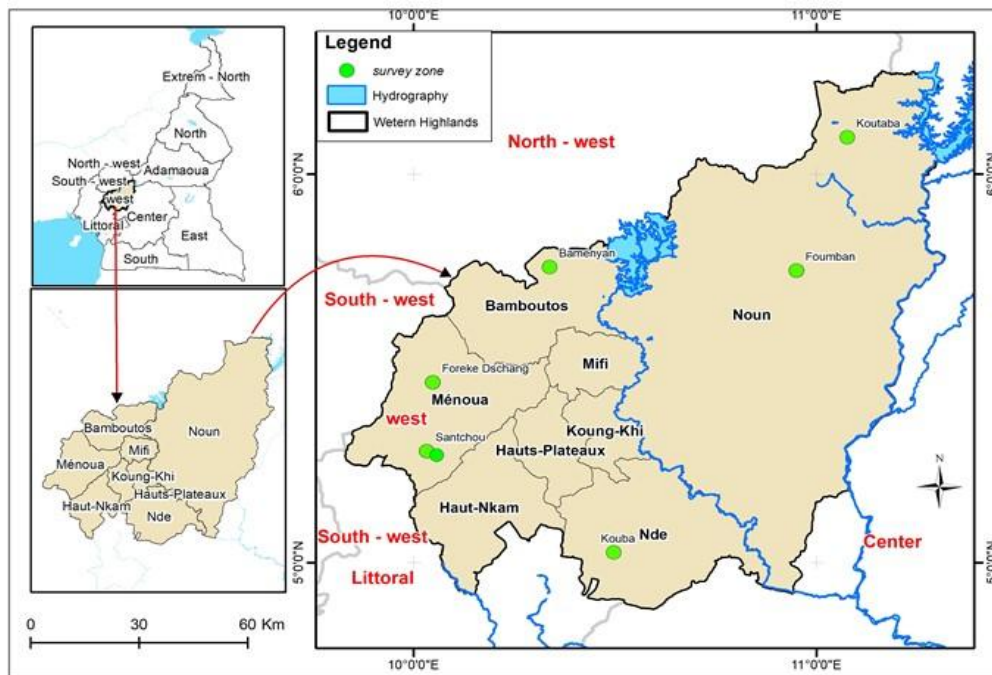


Fig. 1. Map of the different villages surveyed in the Western Highlands of Cameroon

Globally, a total of 310 persons were investigated (50 per Division, with the exception for Mezam where only 10 persons were interviewed due to the ongoing socio-political unrest).

3. RESULTS

3.1 Sectors/Domains Making Use of Bamboo in the Western Highlands of Cameroon

Bamboo is perceived by the local people as an important source of raw material, ecological regulator, and source of income for poverty alleviation. Its role is classified into ecological, economic, and social as well as cultural importance. Bamboo in this AEZ is used in at least 11 sectors/domains as indicated in Fig. 2.

3.2 Bamboo Uses and Products in Western Highlands

The uses of bamboo varied in relation to the sector. Products provided from bamboo are multiple and diverse in function, with respect to the activities of a given sector. These uses and products are dominated by three bamboo species used (*Bambusa vulgaris*, *Phyllostachys aurea*, and *Phyllostachys* spp.). All the aboveground parts of bamboo (culm, branches and leaves) are used in this AEZ. Local people use essentially the culm (in 9 out of 12 sectors, constituting 65%) for multiple products, few persons used leaves as food (for tea and bamboo juice). It is also used as fodder for cattle and goats in the dry season. Concerning water found in the internodes of *Bambusa vulgaris*, it is used as traditional medicine.

Globally, at least 97 bamboo uses/products were identified in 11 sectors/domains. Fig. 3 shows that handicraft and construction appear to be sectors with the most bamboo products (more than half of all the products) with respectively 28 and 13 bamboo uses/products. Traditional medicine and food are the bamboo sectors with the least bamboo uses/products.

Fig. 4 shows that, only 5% of the surveyed population use bamboo in almost all the sectors/domains identified. The majority of them used bamboo in less than 3 sectors/domains; this class include those who used bamboo only in one sector/domain (e.g. firewood, handicraft, medicinal and/or in construction).

For uses /products with respect to the sectors, the following were noted:

- **Agriculture:** bamboo is used essentially to support crops or as stakes for crops such as tomatoes, beans and yams because they are climbers. Bamboo is also used to support plantains and banana stems when they bear, pipes to canalise water for crops in farmlands (irrigation), and farm land delimitation. Concerning bamboo products in the agricultural sector in AEZ III, it is also used like raw material for handles of shovels, rakes and crops planter.
- **Environment regulator:** Bamboo is perceived as a key agent for climate, soil (protection against erosion), water regulation, provide shades, and also as wind break for crops like plantain and banana.
- **Silviculture:** Bamboo is used as hedge, for fencing, and for ornamental purposes. It is also used as area for plant stocks area and shading support.
- **Fishing and hunting:** In the Western highlands bamboo is also used as raw material for fishing in Mezam, Nkam and Nde rivers (these division got their names from these rivers). It is used in some cases to drain water in fish farming systems and as composter for pond. Hunting material like arrows, spears, and traps are made out of bamboo.
- **Traditional medicine:** Leaves of bamboo are used for typhoid treatment. For less than 1% of the respondents, water found in the internode of bamboo is used by stammers stutterers to improve their speaking ability.
- **Foods:** Bamboo leaves are locally used for tea/tisane and for natural juice production.
- **Handicrafts:** Bamboo is used by craftsmen as raw material to manufacture many artisanal products (flower jars/pots, ballpoint pen and pencils, walking sticks, bamboo muck, bamboo photo stand, bamboo hand bangle, bamboo neck lace, bamboo whistles, bamboo curtains, fork, bamboo lamp holder, bamboo door curtain, cigarette ash cup, curtain decoration,

artificial fruits, and traditional dancing tools). For musical instrument done from bamboo, the flute, musical whistles, and bamboo xylophone were identified in the Western Highlands. For kitchen use, bamboo is used to produce kitchen utensils and bamboo products like, drinking cups or mock, cupboard, kitchen rammer, bamboo egg tray, bamboo jars in the western highlands.

- **Furniture:** Bamboo is also used as raw material to manufacture some bamboo products like: tables, chairs, beds, bar decoration, stools, sofa, screens hanging, racks, compartments).
- **Construction:** In the construction sector, bamboo is mostly used as poles for scaffolding, ceiling of houses, ladder, gate/door, fencing, maize storage hurts, barns, animals pens for pigs, fowls,

goats, animal feeders, wall coatings, supports for house, handle of shovel, house attic.

- **Cattle:** Leaves of bamboo are used for fodder. Bamboo is also used for animal fence, tools for feeders and drinkers for domestic animals.
- **Cultural:** Some bamboo forests in some villages are considered sacred areas where rituals are performed to appease the gods. Bamboo is also used in funeral ceremonies, forest fencing and land owners' delimitation.
- **Other uses/products:** Bamboo is also used like electric poles, support antenna for TV, fire wood, ladder for tapping of palm wine, paddles for canoe, hand cane, bridges, in the rivers during fishing or crossing.

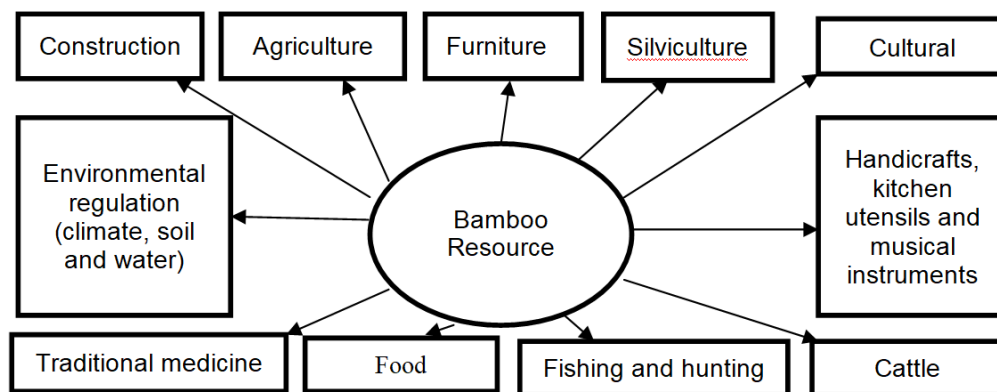


Fig. 2. Different activity sectors where bamboo resource is used by local population

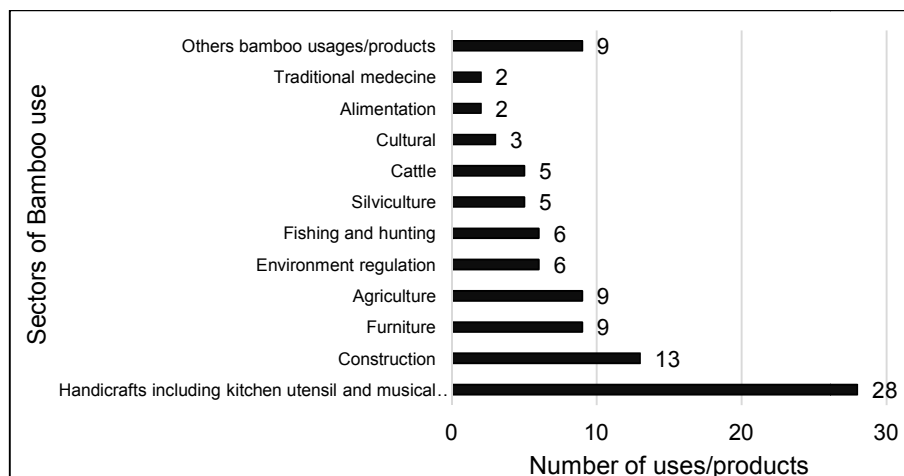


Fig. 3. Number of bamboo uses/products found with respect to sectors/domains in the Western Highlands

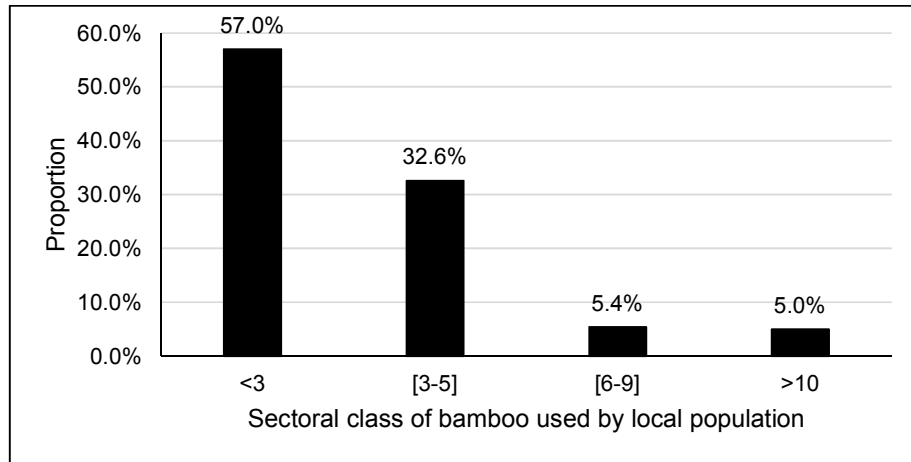


Fig. 4. Proportion of bamboo uses with respect to the number of sectors/domains in the study area

3.3 Level of Importance of Bamboo with Respect to Different Sectors/Domains in the Western Highlands

Responding to the question “what is the main sector for which bamboo is used more?” 51.6 % of the local population sampled used bamboo in the agricultural sector, followed by handicrafts (18.3%) and construction sectors (14.2%). Only 7.3% used bamboo at the same level as in agriculture and construction. The least sector for

which bamboo was used is fishing with a proportion of 1.4% (Fig. 5).

Table 1, shows the level of importance of bamboo with respect to sectors. According to these results, bamboo is perceived by the local people as important and very important(65%) with the exception of nutrition/food & medicinal sector where 91.5% of the local population sampled perceived bamboo to have limited importance in the sector.

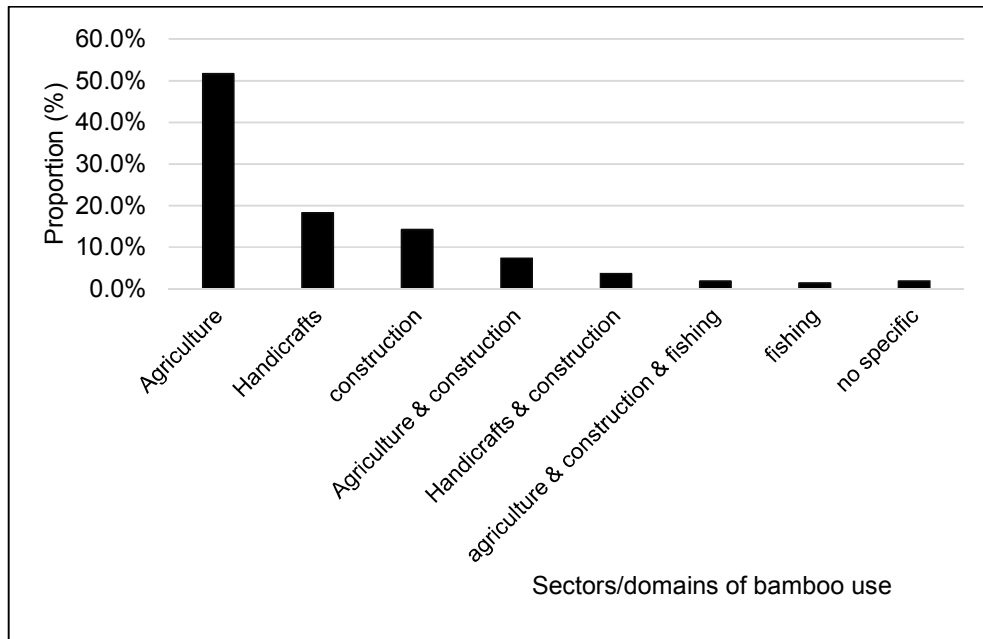


Fig. 5. Proportion of main sectors/domains for which bamboo is used by the local population in the Western Highlands of Cameroon

Table 1. Perceptions of the local population surveyed on the level of importance of each sector in the Western Highlands

Sectors/domains	Less important (%)	Important (%)	Very important (%)
Agriculture	26.6	34.1	39.3
Environment regulation (soil, climate, water, etc.)	21.4	61.4	16.2
Fishing & hunting	39.5	50.5	10.0
Cattle	34.0	37.3	28.7
Handicrafts	26.2	44.8	29.5
Construction	10.7	18.6	66.0
Nutrition/food & medicinal	91.5	3.4	2.6

In fact, in the Western Highlands agroecological zone, the natural ecosystem where trees species or timber raw material were easily found, have disappeared due to agricultural expansion, and bamboo plantation/natural forests available appears more or less like a raw material for local people. Then, due to the limited availability of timber raw materials needed in the artisanal and furniture sectors for example, craftsmen are obliged to resort to available bamboo raw materials which are more available and less expensive. In addition, products coming from bamboo are generally perceived by bamboo consumers to have good quality compared to others, although some people feel, it is a 'poor man's good'. Concerning the agricultural sector, in the dry season, farmers cultivating crops like tomato, and vegetables benefit from traditional method of irrigation using bamboo as pipes on farmlands. This explains why bamboo has a high value for crop irrigation as well as support to crops like plantains /bananas against violent winds. The ban placed by the Ministry in charge of forestry in Cameroon, on the exploitation of young trees for poles (scaffolds) has diverted users of young trees and harvesters or local people to resort to bamboo for scaffolding and support/stakes for crops since bamboo is very resistant like other tree supports.

Bamboo being one of the fastest growing plants, quickly substitutes the role of these poles after the prohibition of harvesting of young trees by the competent ministry in charge of forestry in Cameroon. Bamboo assumes immediately the same role performed by the prohibited young poles. Bamboo is also available for local people like raw material in the different sector. Therefore, bamboo could permit a continuous generation of incomes for local people and then contribute significantly to their well-being [12].

Ecologically, the role of bamboo in conserving soil in the Western Highlands, where soils and

natural ecosystems are more degraded seems weak and fragile. Bamboo demonstrates significant potentials as a strategic resource for reducing degradation, protection against erosion, improve soil fertility, restoration and repairing damage ecosystems [4,13-15]. It is also the case for climate change mitigation where bamboo can play a major role due to its fast growth rate and high capacity in atmospheric carbon absorption [16], and stored in bamboo products properly transformed. In this context, bamboo is an ecological solution and fortunately, the local people of the Western Highlands have already perceived this regulating role of bamboo and have integrated it in their daily practices.

5. CONCLUSION

The aim of this study was to identify bamboo uses and bamboo products in the Western Highlands based on local people's involvement in the bamboo sector, and from observations. The results show that at least 97 bamboo uses/products were identified in 11 sectors/domains. The handicraft and construction appeared to be sectors with the most bamboo products with respectively 28 and 13 bamboo uses/products. Bamboo appears like a resource commonly used by local people of Western Highlands for their wellbeing. This is critical for bamboo management and organization of the sector. In perspective, additional studies on value chain and best indigenous practices with respect to bamboo management will be required for better planning of the bamboo sector in the Western Highlands. This remains a knowledge gap to be addressed by future studies and policymakers.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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