Plant Species Selection for Charcoal Production: Dwindling Resource and Further Implications for the Environment

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Abstract: The authors investigated plant species selected for charcoal production. Then, they compared these species with those exploited for charcoal production in Togo, another West African country. The study in Ghana took place in six localities in the Volta Region. Simple ranking was used in the analysis of the species. A total of 35 species belonging to 31 genera were used. Five of these are non-traditional charcoal-making species, implying the increasing diversity of the plants used. *Anogeissus leiocarpus* ranked first with over 79% of the producers exploiting it and was reported as a preferred or a category 1 species for charcoal production in Togo. Out of the 34 woody species exploited in Togo, 10 are similar to those used in the study area. The ranking used are compared favourably with the categorization used in the Togolese studies.

Key words: Volta Region, Ghana, Togo, ranking, categorization, non-traditional charcoal-making species.

1. Introduction

Charcoal, used mostly as energy for cooking in Africa, is produced through the thermal degradation of wood. Onishi [1] stated that charcoal, cleaner and easier to use than firewood, and cheaper and more readily available than gas or electricity, has become one of the biggest engines of Africa's informal economy and has also become one of the greatest threats to its environment. The environmental impacts include land degradation, global warming and climate change.

According to Kammen et al. [2], charcoal use in developing countries affects global warming in several interrelated ways. This is because in the first place a significant portion of charcoal production wood is unsustainably harvested. Secondly, emissions during charcoal production are significant compared to those of charcoal burning. One of the gases emitted is CO₂. Ref. [3] advised that reducing CO₂ emissions limits

the ultimate amount of warming because CO₂ represents by far the largest source of climate-warming emissions and because it stays in the atmosphere for hundreds of years, large reductions in CO₂ emissions are required to meet any long-term climate-stabilization goals. Climate change has impacts and Waugh [4] therefore, recommends that modest investment will increase people's ability to assess local vulnerability to the impacts of climate change. One area of vulnerability is the resource for charcoal production: its quantity and quality. The resource is dwindling [5]. In terms of quality and the quality of charcoal produced, the wood species selected is important. A general guide which stated that all hardwoods used as fuel-wood are generally suitable for the manufacture of charcoal was given by Abbiw [6]. However, Pereira et al. [7] working on clones of *Eucalyptus* for charcoal production gave a scientific perspective. According to their findings, although several properties of wood should be considered together, basic density and chemical composition of wood in particular, high contents of

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lignin and low contents extractives were the properties that had more influence on charcoal yield and quality. The objectives of this study, therefore, were to (1) determine the species of wood selected for charcoal production and (2) to compare these species with those reported for another country.

2. Methodology

The study was examined in six localities in the Volta Region of Ghana: 4 localities in Adaklu and 2 in Akoefe. The details are shown in Table 1. Data collection was done using questionnaires and data analysis was done using simple ranking.

The ranked species were then compared with those reported in the literature for the neighbouring country of Togo.

3. Results

Out of a total of 152 charcoal producers, the majority was male and 43.4% were females (Table 2).

3.1 Species Selected for Charcoal Production

A total of 35 species were mentioned as charcoal-producing species (Table 3). Four of the genera had two species each. These were *Acacia*, *Cola*, *Ficus* and *Vitex*. The 35 species were ranked from the first to the 29th positions. Almost 80% of the charcoal producers used *Anogeissus leiocarpus*.

3.2 Species Being Newly Exploited for Charcoal Production

Table 4 shows that almost 14% of the species exploited are non-traditional charcoal-making species. The ranking which gave some idea of the level of

exploitation showed that the first of these non-traditional species *Prionostemma unguiculata* was fairly exploited, ranking fourth among the 35 species.

3.3 Similarities between Species Exploited for Charcoal Production in the Study Area (Ghana) and Togo (another West African Country)

Table 5 shows the same species that were exploited in the two West African countries, Ghana and Togo, for charcoal production. Table 5 shows that the ranking and the categorization give similar ideas about the choice of the charcoal producers.

4. Discussion

A total of 35 woody plant species were selected for charcoal production in the study area. One of the species, a species noted for its excellent charcoal production qualities, *Anogeissus leiocarpus*, was obviously under intense exploitation pressure being used by almost 80% of the charcoal producers interviewed. It is one of the 34 species used in Togo and described as one of the preferred or category 1 species [9, 10]. The future of this species in the sub-region is at stake. Some of the 35 species are forest species and others occur in the savannas or woodlands [6, 11, 12]. These 35 species occurred in 31 genera. Species belonging to a genus are expected to behave in a similar manner. Five of the species were non-traditional charcoal-making species. A non-traditional charcoal-making species used for charcoal production was reported earlier among the 23 species utilized by the charcoal producers in a cacao-growing area in the Ashanti Region of Ghana [13]. This species was *Amphimas*

Table 1 Study sites.

Country	Administrative Region	Sites
Ghana	Volta Region	Adaklu Have Adaklu Helekpe Adaklu Kodzobi Adaklu Vodze Akoefe Avenui Akoefe Ahati

Table 2 Gender of the charcoal producers.

Gender	Number	Percentage
Males	86	56.6%
Females	66	43.4%
Total	152	100%

Table 3 Plant species selected for charcoal production in Volta Region of Ghana.

S/IN Species	Percentage	Rank
1. <i>Anogeissus leiocarpus</i>	79.97	1st
2. <i>Acacia nilotica</i>	48.7	2nd
3. <i>Detarium senegalense</i>	42.4	3rd
4. <i>Prionostemma unguiculata</i>	36.9	4th
5. <i>Terminalia glaucescens</i>	34.9	5th
6. <i>Bridelia micrantha</i>	32.9	6th
7. <i>Vitellaria paradoxa</i>	22.4	7th
8 <i>Azadirachta indica</i>	14.5	8th
9. <i>Icacina oliviformis</i>	9.2	9th
10. <i>Dialium guineense</i>	9.2	9th
11. <i>Ficus sur</i> (= <i>Ficus capensis</i>)	7.9	11th
12. <i>Piliostigma thonningii</i>	6.6	12th
13. <i>Daniella oliveri</i>	5.9	13th
14. <i>Cathormion altissimum</i>	5.9	13th
15. <i>Senna siamea</i>	5.3	15th
16. <i>Ficus laprueri</i>	2.6	16th
17. <i>Tectona grandis</i>	2.6	16th
18. <i>Acacia auriculiformis</i>	2	18th
19. <i>Gardenia nitida</i>	2	18th
20. <i>Lannea</i> sp,	2	18th
21. <i>Blighia</i> sp.	1.3	21st
22. <i>Cola nitida</i>	1.3	21st
23. <i>Zanthoxylum xanthoxyloides</i> (= <i>Fagara xanthoxyloides</i>)	1.3	21st
24. <i>Gliricidia sepium</i>	1.3	21st
25. <i>Mangifera indica</i>	1.3	21st
26. <i>Triplochiton scleroxylon</i>	1.3	21st
27. <i>Hymenocardia acida</i>	1.3	21st
28. <i>Maytenus senegalensis</i>	1.3	21st
29. <i>Antiaris africana</i>	0.7	29th
30. <i>Cola gigantean</i>	0.7	29th
31. <i>Leucaena leucocephala</i>	0.7	29th
32. <i>Milicia excels</i>	0.7	29th
33. <i>Vitex doniana</i>	0.7	29th
34. <i>Vitex glabrata</i>	0.7	29th
35. <i>Parkia biglobosa</i>	0.7	29th

Table 4 Non-traditional charcoal-making species and their ranks.

S/N Species	Rank
1. <i>Prionostemma unguiculata</i>	4th
2. <i>Icacina oliviformis</i>	9th
3. <i>Cathormion altissimum</i>	13th
4. <i>Gardenia nitida</i>	18th
5. <i>Milicia excels</i>	29th

Table 5 Same species exploited in study area and Togo, their categories and ranks.

S/N Species	* TOGO Preferred or Category 1 Species	* TOGO Alternative or Category 2 Species	GHANA Rank in present study
			Y
1. <i>Anogeissus leiocarpus</i>	√		1st
2. <i>Terminalia glaucescens</i>	√		5th
3. <i>Vitellaria paradoxa</i>	√		7th
4. <i>Dialium guineense</i>	√		9th
5. <i>Daniellia oliveri</i>		√	13th
6. <i>Tectona grandis</i>		√	17th
7. <i>Hymenocardia acida</i>		√	21st
8. <i>Cola gigantea</i>		√	29th
9. <i>Parkia biglobosa</i>		√	29th
10. <i>Vitex doniana</i>		√	29th

Sources: Refs. [8-10].

pterocarpoides. This brings to six of the non-traditional charcoal-producing species. The expansion of the range of species used by the producers appears to be a strategy to make up for the diminishing resource base of the traditional charcoal-making species. The situation would also confirm the view of Kokou et al. [9] that the choice of the resource was not only related to the energy quality but also to the availability. This would further explain the selection of *Triplochiton scleroxylon*. For example, a species described as soft and light with density at 15% moisture content was reported to be 24 lb. per cu ft. or 385 kg/m³ compared to the density of *Anogeissus leiocarpus* reported as 65 lb. per cu ft. or 1,040 kg/m³ [14]. According to Pereira et al. [7], the basic density can be considered as one of the main criteria for selection of species and clones for charcoal production. Some of these charcoal-making species are also sources of edible products. For example, *Icacina oliviformis*, one of the non-traditional charcoal-producing species, is described as a small drought-resistant shrub forming dense stands in the West African and Central African savannas. Its three edible products are fruits, seeds and tuberous roots [15].

5. Conclusions

The study in the Volta Region of Ghana recorded 35 species belonging to 31 genera. Five of the species

are non-traditional charcoal-making species. Global warming is already posing a threat to biodiversity. Expanding the range of the woody plant species used for charcoal production means that the threat is going to be much worse with implications for people, land and biodiversity conservation. Ten of the 34 species used for producing charcoal in Togo are among the 35 species exploited in the Volta Region of Ghana. The potential threat to these ten species is implicated to be greater than the threat to the other species.

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