

# **AGROFORESTRY: A PROFITABLE LAND USE**

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# THE ROLE OF AGROFORESTRY IN FUELWOOD FOR DOMESTIC AND INCOME GENERATION ACTIVITIES- A CASE STUDY OF THREE COMMUNITIES IN THE SUNYANI DISTRICT OF BRONG AHAFO REGION GHANA.

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**Abstract:** Residents of the Tain II forest fringe communities of Sunyani district located in the forest transition zone continually experience forest fires and fuelwood shortages. There is tendency to depend on neighboring towns for cooking energy supplies.

Using survey data from 240 respondents; the study's objective was to identify and investigate the forms, sources of and constraints to fuelwood supply and income generation; and why they tend to be so.

Evidence showed that availability and price are the most important determinants of fuelwood choice. Distance and transport challenges constrain gathering readily available forest floor prunings to meet the rising household demands. This stimulates the fuelwood business.

Sawmill waste from Sunyani and charcoal from Wenchi and Kintampo is heavily relied on in time of shortages. Sunyani charcoal burners loose the market due to tree species preferences for charcoal. Nonetheless, many fuel based businesses stifle due to high cost of fuelwood among other factors.

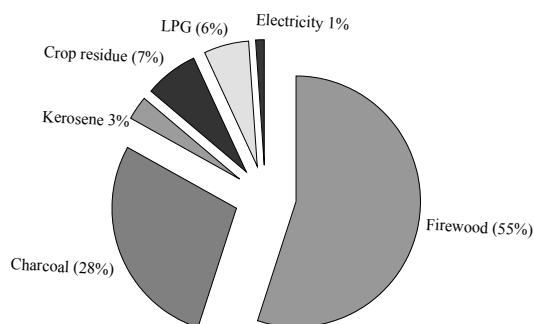
Average weekly expenditure on fuelwood was found to be 27.7 percent of cash income. 14.5% of respondents were found to be engaged in the fuelwood supply business. *Celtis zenkeri* was the most preferred fuelwood tree species. *Tectonia grandis* was considered a must have component of woodlots for timber cash.

The study concludes that the fuelwood supply business opportunity is underexploited in these communities. It consequently recommends agroforestry interventions such as privately managed woodlots and home gardens to suitably supplement and ensure a sustainable year round fuelwood supply and help improve rural incomes.

**Keywords:** fuelwood, income, availability, forest, sustainability

## INTRODUCTION

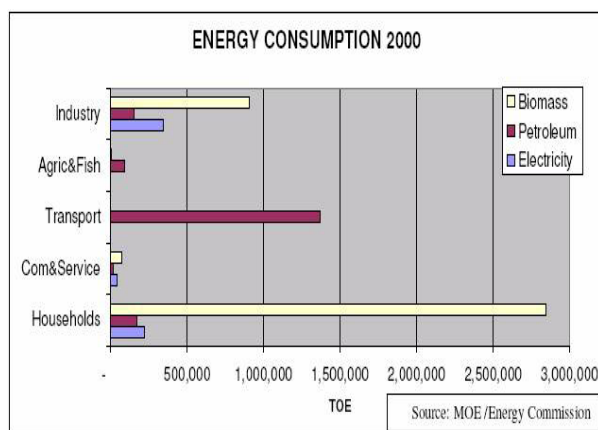
Agriculture, including forestry, is the backbone of the Ghanaian economy. It provides 43% of the Gross Domestic Product, 50% of export earnings and 70% of total employment. Forestry as a sub-sector accounts for 6% of the GDP, 11% of export earnings and employs a labour force of 100,000 people (FOSA 2003). According to the Ghana Living Standards Survey in 2000, over 84 percent of household cooking fuel is fuelwood (fig.1). supply and overdependence on fuelwood has created conditions such as increasing difficulty in harnessing fuelwood and escalating prices of fuelwood (Abakah 2011).



**Figure 1.** Household cooking fuel share Ghana.

Source GLSS (2000)

The popular charcoal production is concentrated in the transition zones between the forest and the savanna woodlands. Most of the wood comes from drought and fire resistant trees species, which are felled for this purpose, and also from logging residues. (FOSA Ghana). For most country studies, data show that trees outside forests appear to supply a large share of overall fuelwood output, highlighting the importance of non-forest resources (Arnold and Persson 2003). The depletion of the woodlands combined with the persistent dependency on fuelwood will eventually pose a serious problem for household energy provision Brouwer (1997).



**Figure 2.** Energy consumption in Ghana (2000)

Source: Ahiataku-Togobo, 2002

(Ampadu-Agyei et al. 1994) projections of fuel consumption in Ghana (table 1) shows the growth rate of fuelwood needs over the years whereas energy consumption of the year 2000 (fig.2) shows consumption to be far more than projections.

Fuel		1995	2000	
LPG	6	11.55	22.24	14.0
Kerosene		168.6	170.3	0.6
Charcoal		812.9		5.0
Fuelwood				2.5

**Table 1.** Projections of fuel consumption (‘000 tonnes) 1995-2000

Despite LPG having the highest growth rate, the share of the LPG consumers in Ghana is far less than 10% (fig 1). Fuelwood availability for the lion share of consumers can therefore not be underestimated. Various widespread misconceptions hamper the development of the wood energy sector. These include: “fuelwood has little value”,

“only poor and rural households use fuelwood”, “Most fuelwood originates from forest lands”, “fuelwood is collected for free”, “wood energy cannot be planned because of lack of data” and “fuelwood production is a marginal sub-sector”. Fuelwood supply is a thriving business though production is hardly accurately documented especially in developing countries. Cheaper fuelwood implies reduced cost of living and production for both rural and urban users. There is the need for sustainably renewable, easily managed and environmentally friendly but cheap production of fuelwood in rural areas to meet the needs of a largely fuelwood dependent populace.

Agroforestry has the potential to contribute to exploiting the opportunities of fuelwood production and supply business in these communities. It is thus the aim of this study to stimulate interest among stakeholders towards possible intensification of alternative approaches such as agroforestry to improve and sustain fuelwood supply and consequently, a better socio-economic well-being of the inhabitants. The main objective of this study was to explore and describe the nature of the forest fringe communities’ domestic and income generation activities’ fuelwood needs and fuelwood supply. First, it sought to identify the sources and constraints of fuelwood availability for domestic and fuelwood based income generation activities and secondly to identify the sources and constraints of fuelwood supply business and subsequently how it could be improved through agroforestry.

## METHODOLOGY

### Study area

The study areas are all located within the Sunyani district of Brong Ahafo region of Ghana. The region is considered the bread basket of the country. It lies within the middle belt of Ghana and is in the forest savannah transition zone. It has a population of 1.8 million people (Census 2000) and the second largest region in Ghana, with a territorial area of 39, 557, 08 sq kms. The economy of Sunyani is predominantly agrarian (48%) with 24%, 15% and 13% of active population engaged in service sector, commerce and industry, respectively. The district has a population density of 24.9 persons per square kilometer and an average annual growth rate of 3.1%. It has several for-



est reserves including the Tain I, Tain II, Yaya, Sawsaw and Nsemere reserves which are sources of timber mainly constituted of *T.grandis*. These experience frequent fire outbreaks razing trees and crops. The Tain II forest reserve, a government gazetted forest reserve is currently part of the implementation of a government forest rehabilitation plan, based on the active participation of the communities. According to the national timber inventory (2002) the Tain II Forest Reserve is the largest area of forest reserve and the most degraded reserve in the Brong-Ahafo Region. The benefit sharing agreement stipulates that at least 5% of trees planted must be indigenous (FC 2002: 4.9). The Tain II forest fringe communities surveyed include three villages namely, Ayakomaso, Dumasua and Fiapre. These villages have populations of about 300, 600 and 2500 respectively (census 2000) and are 0.12km, 1km and 5km respectively from the Tain II forest reserve. Fiapre, Dumasua have one sawmill each whereas Ayakomaso has seven. Sunyani is the capital of the region and also the district capital. Fiapre is the closest to Sunyani and is quickly growing into an urban community.

### Data collection and analysis

Simple random sampling was used for households whereas purposive sampling was used for fuelwood based income generating activities. Data sources include questionnaire interviews, field notes of observations and focus group discussions from a total of 240 respondents including charcoal burners and suppliers, domestic users of fuelwood, Forestry Services Division - FSD staff, sawmill operators and village heads. Data was processed and analyzed using Microsoft Excel and the SPSS software version 15.

## RESULTS AND DISCUSSION

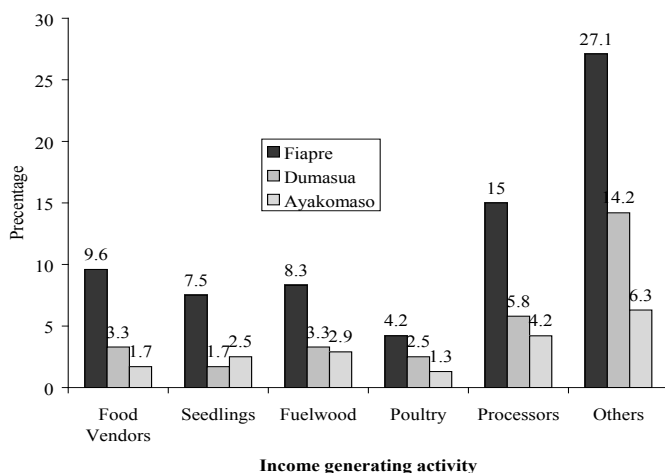
	Fi- apre	Du- masua	Ayakomaso
Male	10	3.3	5.4
Female	48.3	22.5	10.4
Education			
Nil	8.3	5.8	3.8
Basic	37.9	16.7	9.2
Secondary	9.6	2.9	2.5
Tertiary	2.5	0.4	0.4
Age range			
<36			
	31.3	22.9	4.2
36-53	14.6	6.3	5
>53	8.75	10	2.1

**Table 2.** Demographics of communities (%)

Respondents were found to be largely very young and have at least basic education but several drop outs. Many respondents did not enjoy the current free basic education while others regret not taking advantage of the opportunity of basic and secondary education which has denied them various better job opportunities. Table 2 shows northerners to be the second largest among respondents. These are migrants in search of a better living and are particularly skilled and popular in charcoal burning.

## Income generation activities and constraints

Many respondents were found to have multiple sources of income. 31.7% of respondents were found to be casual labourers of the FSD. 40.7% of respondents see the Modified Taungya System (MTS) as a reliable source of income, hence a major livelihood option, whereas 59.70% (n=54) saw it as a safety net. Many farmers expressed concern that although at present the MTS is a main source of income, they worry about available plots in the future once almost all degraded portions of the reserves close to them are planted with trees. Respondent's income activities are diversified and dependent on the seasons and what pays. Cash incomes were found to be generally low (table 3) although it was difficult to tap the real cash incomes of respondents. These were mostly quotes for market days. Most respondents were commonly involved in at least two different income activities. However, Abakah (2011) asserts that quantity of fuelwood consumed in Ghana negatively and positively correlates to real incomes and inflation levels respectively. Higher bracket of incomes earned is majorly by fuelwood dealers, food vendors and a few processors. It is important to note that these higher bracket income earners were not included in the computation of the averages of incomes earned. Salaries were also not included.



**Figure 3.** Distribution of income activities

Food vendors and agric produce processing activities had the highest percentage of respondents especially in Fiapre (fig.3). This seems to be obvious since many buy breakfast and lunch for themselves and their school going children. Most of these which have immense fuel needs are run by women especially agro processing for popular staple meals, medicine etc. 14.5 percent of respondents deal in fuelwood production (charcoal burning) and supply. It is important to note that whereas some of these serve as principal income source, others serve as a safety net. For instance, 125000 people were found to produce or sell charcoal for use in the city of Dares Salaam, Tanzania in the 1990s (SEI 2002)

### Fuelwood sources, expenditure and Constraints

Fuelwood supply sources were found to include Tain II forest floor pruning (fig. 4), Wenchi and Kintampo suppliers of charcoal and firewood. Other sources include the farm, open vegetation of schools and homes. The MTS and fuelwood business is a major contributor to migration of northerners into these communities. It is said that the pattern of migration changed from rural–urban to relatively permanent rural-rural in the Brong-Ahafo region as they farm lands and burn charcoal which puts pressure on the natural resource base increasing deforestation with increasing energy demands of the ever increasing population. (Abdul-Korah 94).

	Minimum	Maximum	Average.
Fiapre	4.5	30	4
Dumasua	3.0	20	3.7
Ayakomaso	3.0	15	3.2

**Table 3.** Weekly average income earned.

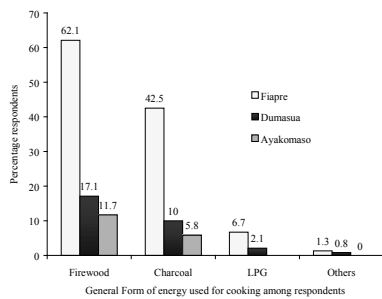


**figure 4.** Kia truck load of forest pruning



**Figure 5.** Fuelwood supply business dotted all over.

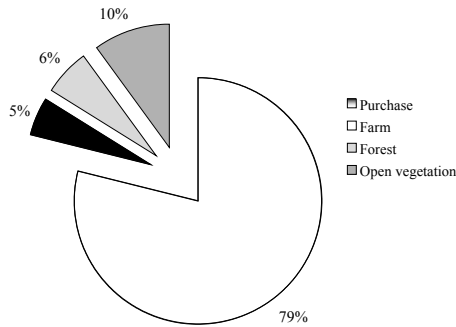
Fuelwood business including its production and sales (fig 5) was found to be a flourishing income generation activity that has a lot of potential but seems to be underexploited. 12 charcoal burners burn at least once a month, whereas 7 fuelwood suppliers delivered once a week from Kintampo and Wenchi districts on market days. A sawmill worker sold a minimum of 2 truckloads a month at the time of survey. Fuelwood wholesalers sold averagely 30 bags weekly.



**Figure 6.** Cooking energy among respondents

It is obvious that firewood and charcoal is still dominantly used for cooking by 62.1 and 42.5 percent respectively of respondents (Fig 6). Fiapre in particular seemed to be using more of charcoal than fuelwood. Focus group discussions revealed that charcoal is most preferred because it is cleaner, more convenient to use, easily relit

but rather more expensive. This is confirmed by Kammen and Lew(2005) assertion of charcoal preference over other biomass fuels because charcoal has a higher energy density than other biomass fuels and can be stored without fear of insect problems. Several multipurpose trees for fuelwood are

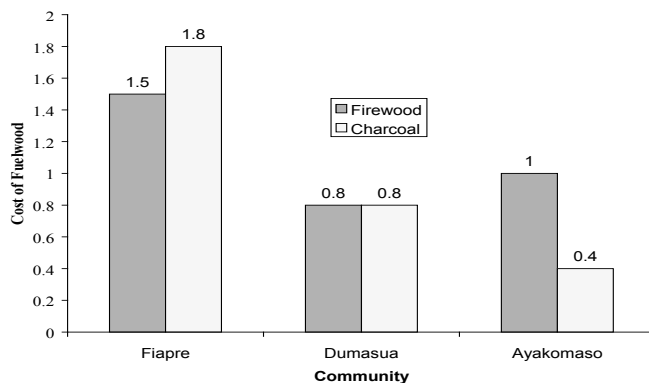


**Figure 7.** Respondents' dominant source of fuelwood

preferred among respondents for several reasons depending on the activity it is used for. Top priority if firewood is used at all is the ease of split. For instance, *C. M* is one of the favorite firewood species but really tough to split. *Cassia spp (S.siamea)*

is favorite for charcoal in Sunyani because of its clean, intense and elongated heat. Taxes paid for charcoal supply on market days. *T.grandis* pruning is used for cooking but disliked because the ash flares and makes cooking a dirty and choking experience.

It is only a natural misconception that people of forest fringe communities do not have problems with fuelwood supplies. This was not the case in the communities surveyed. 79% were found to purchase fuelwood (figure 7). Permit fee is charged by the FSD to allow access to fuelwood dealers to clear the forest floor of pruning. Access roads are also very bad especially in the rainy season contributing to shortages in fuelwood supply and thus higher priced fuelwood.



**Figure 8.** Average weekly expenditure on fuelwood in GHc

It should be noted that exchange rate is USD1.0 = GHc1.45. Expenditure on household fuelwood is shown in fig 8. It is important to note that fuelwood is supplemented by supplies from other free sources due to cash constraints. A majority of households used charcoal alongside firewood for cooking and heating but not on a daily basis especially because it is more expensive. Demonstrating the relationship between household income and energy use, charcoal is often the main and first 'transition' fuel shifted to first from firewood (Barnes et al. 2002). Firewood is often used by food

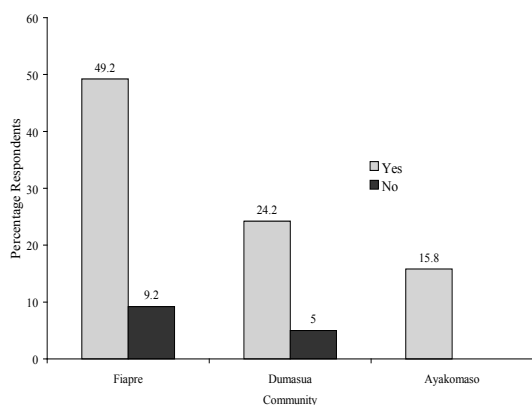
vendors for commercial cooking and heating purposes. Bread bakers for instance need much larger sizes and quantities of firewood to heat their clay ovens and as such depend on T.grandis which is the most abundant of fuelwood. Price is not the only, or even the major factor of consideration in household fuel choices. In many cases, the availability of fuel supplies determines preferences. (Ribot,1993). Some who use LPG use it only as backup when there is an acute shortage, cash constraints or there is an emergency.

Though urban demand usually is much larger, rural demand for purchased fuelwood is also growing. For instance, in Ghana, in 1991-92, 27% of all fuelwood was purchased by households and 13% of charcoal was bought by households in rural areas (Townson, 1995). A Kia truck load (Fig.4) of saw mill waste costs sixty Ghana

Cedi (GH¢ 60). Also, a Kia truck load of deadwood other than teak (especially indigenous species) costs GH¢ 100 whereas a Kia truck load of fuelwood from the forest floors which constitutes mainly of teak costs seventy Ghana Cedi (GH¢ 70). C.milbraedii is sold for GHc 120 per kia truck load. Also, a push truck load of firewood costs four Ghana Cedi (GHc 4). Smaller bundles of firewood are sold for GHc1.0 and GHc 0.50. A bag of charcoal (jute bag ) costs six Ghana Cedi (GH¢ 6.0) and GH¢ 2.8 for a 25kg rice bag full which is almost half of the jute bag. Generally, the price of fuelwood has been consistently on the rise due to inflation and makes it more difficult for a switch. A common coping strategy is dependence on sawmill waste wood. The challenge that comes with the use of sawmill waste is splitting to fit the tripod stands and its unusual length. This is easier to use at the Notre Damn Secondary School boarding house that use extra large tripod stands.

Fuelwood wholesalers have a profit margin of GHc1.0 per jute bag and complain of cash to pay up for the full truck load of charcoal. Credit sales are not reliable anymore and so suppliers want cash payments for their supplies instead. The ability to buy enough bags of charcoal for a week's supply is almost impossible. It was observed that many are not bank clients but credit scheme members. Though this helps especially with no other alternative, interest rates are quite high.

In attempt to find out the degree of awareness among respondents, it was noted to be quite positive (fig 9). The term however is not familiar to them but on explanation they identified with biomass transfer, green fences, woodlot, taungya etc.



**Figure 9.** Distribution of Agroforestry awareness

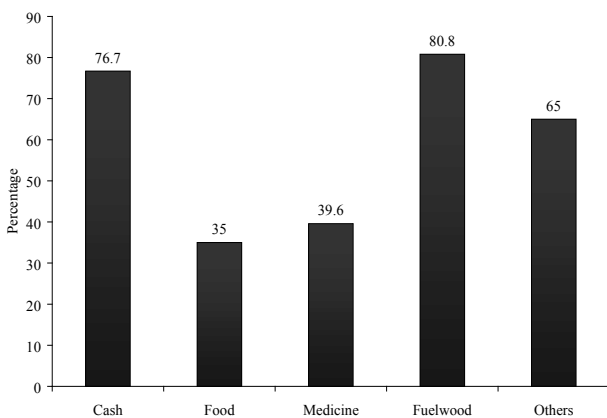
Respondents identified cash and fuelwood most as tree benefits among others (fig 10) due to awareness of the value of the T.grandis tree plus premium and commercial tree species of Ghana. No wonder cash was rated a tree benefit by 76.7% of respondents.

Preferred fuel species	Source	Quality	Challenge
Celtis zenkeri	Savanna	Burns clean	Tough to split
Ceiba petandra	sunyani	Burns clean	Scarce
Tectonia grandis	Tain II	Intense heat	Distance
Magaritaria discoidea	Savanna	Intense heat	Scarce
S.siamea	Fences	fast coppice	Sheds leaves
Magnifera indica	Homes	clean burn	Sheds leaves
Antiaris toxicaria	savanna	Burns clean	Scarce

**Table 4.** List of some preferred tree species

In line with this, it was reported by a few respondents and confirmed by FSD staff that the queen mother of Abesim – a neighboring community has developed 8 acres of S.siamea plantings privately which is harvested within 2-3years rotation and is gradually expanding.

Also, it was noted that fuelwood was rated of value among respondents because preferred wood species for fuelwood are hardly available. Middle men suppliers are an indication that fuelwood constraints is hitting harder and thus a good business opportunity. Fire was generally feared to destroy even basic farm trees and woodlot trees due to history of frequent occurrence.



**Figure 10.** Tree benefits identified by respondents



This conforms to Arnold and Dewees' 1998 conclusion that trees in farming systems are not seen as a part of forest resource, but rather in terms of how they contribute to their livelihood needs and survival strategies. Some commonly utilized tree species for firewood include the above listed (Table 4) but the most preferred for firewood were the Celtis species specifically *C.zenkeri*, and the most preferred indigenous specie for charcoal was identified to be *Magaritaria discoidea*.

### **Summary**

Although communities are forest fringe communities, fuelwood is not free but is purchased by as many as 79% of respondents as the main source of cooking energy. Fiapre is noted the heaviest consumer of charcoal. Fuelwood supply employs a fair share of community respondents-up to 14.5 %. Many farmer respondents were noted to have tree management skills. Woodlots effort is likely to expand towards supplying other communities and urban areas if they are successful at expanding their capacity in the fuelwood production business.

### **CONCLUSION**

Since increasing population, urbanization and rates of consumption of fuelwood exceeds replenishing rates, fuelwood needs

especially charcoal is on the increase within these communities and constraints of accessing fuelwood and inflation is steadily escalating prices.

Access to free fuelwood from open vegetation and forest pruning is increasingly difficult due to distances travelled, bad roads and increasing transport due to rapid rates of inflation. These escalate fuelwood prices.

Agroforestry interventions for fuelwood production have the potential to improve and even salvage the situation.

### **RECOMMENDATION**

Home gardens including several multipurpose trees should be encouraged to help meet several needs of inhabitants.

Fire resistant and fast growing tree woodlots could be established and commercialized to help supply the growing fuelwood needs of the communities especially charcoal.

### **ACKNOWLEDGEMENT**

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