I Use Firewood but I Do Not Grow Trees: An Analysis of Tree Planting Exercise among Rural Households in Ghana

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Abstract

Fuel wood is still the world's major source of energy at a time that the world is advocating conservation of our natural resources as well as finding ways to deal with climate change. As a result, this study examined rural households tree planting activities in Ghana. Relying on primary data gathered from 207 household heads selected from rural areas within the tropical forest and savannah zones of Ghana, the study found that majority of the interviewees rely on firewood for cooking and heating of water. However, only 15% of those respondents who use firewood indicated they plant tree and this could be attributed to lack of proper education on tree planting.

Keywords: Natural resource, Rural, Energy consumption, Households.
JEL Classification: C2, C3, C 180, Q2, Q3, Q4, Q5.

1. Introduction

A lot of concerns have been raised on the effect of tree cutting on forest and non-forest ecosystems particularly climate change as the demand for the byproduct of trees is so high such that the past two decades have seen increased attention from the world towards forest resources conservation and use (Boon *et al.*, 2009). Forest economic system offers numerous benefits. For instance forests help in the sustainable development of every society (Boon *et al.*, 2009), provide non-timber forest products as well as presenting supports and protection to a wide range of production and consumption processes (Emerton, 2001). They also give livelihood to the rural poor and serve as energy source (Moyini, 2001). Using wood for fuel is one of the major sources of energy, and firewood which consists of any unprocessed woody biomass used to fuel a small fire, most often for cooking or warmth (May-Tobin, 2011) forms a major part. The use of unprocessed wood as fuel for energy has been the habit seen in the rural areas (Moyini, 2001; Babanyara and Saleh, 2010) where the dwellers in such places according to Food and Agriculture Organization of the United Nations (FAO) (2010) use the firewood as their source of cooking energy which is either self-collected or purchased from small dealers (May-Tobin, 2011). In most parts of Africa, firewood collection for household consumption may be considered as sustainable (Hiemstra-Van Der Horst and Hovorka, 2009) since the materials collected are mostly already dead branches with slow collection rate, typically below the regeneration rate (May-Tobin, 2011).

Again Schlag and Zuzarte (2008) have added that firewood is prevalent in Sub-Saharan Africa because it is readily available and the cost of collecting them mostly by women is low. But the impression that firewood collectors are primarily the female gender (women and girls), cannot always be the case since evidence from Asian and African countries indicate that both men and women are involved in firewood collection (Cooke, Köhlin, and Hyde 2008 cited by May-Tobin, (2011)). Also increase in prices of oil and petroleum products in some African countries may compel the rural dwellers to completely rely on firewood and some urban dwellers also to switch to firewood. However, certain circumstances such as rapid increase population; increasing costs of other fuels; depletion of forest resources; inadequate reforestation; competition between commercial and non-commercial users of wood fuel (Baidya, 1986) have contributed to the scarcity of the firewood commodity in developing countries which manifests itself in some farmers buying firewood or selling it as a way of getting extra income and such situation is a recipe for conflict (United Nations Interagency Framework Team For Preventive Action, 2010). Given the ecological and socio-economic importance of forest resources, (Majumdar *et al.*, 2009) and Sohel *et al.* (2010) among others have examined the effects of human activities on forest. In the same spirit, firewood resource, its pattern of utilization, conservation and regeneration have been a subject of interest to researchers and biodiversity conservationists. As a result some studies (see (Jan *et al.*, 2012)), (Lindmark and Andersson, 2010); (Annecke,

1999; Démurger and Fournier, 2010; Njong and Johannes, 2011; Onoja and Idoko, 2012) have generally focused on factors affecting the choice of fuel wood as energy, with relatively few studies including Kwakwa *et al.* (2013) and Mensah and Adu (2013) that have centered on Ghana.

Even though in Ghana it was estimated before the millennium year that 70% of total energy consumption in the country is from biomass (Nielsen, 1996), there is a lack of information to give a more accurate picture of the pattern of consumption and attitudes towards regeneration of firewood at the community level currently. Thus studies on the ecological conservation especially agro forestry have not revealed a lot about tree planting practices among consumers of firewood in Ghana. Meanwhile aimed at preserving the nation's vegetation, the government of Ghana over the past few years has been subsidizing liquefied petroleum gas (LPG) in addition to increasing the electricity grid lines. However, majority of the Ghanaian population still rely on fuel wood (Ghana Statistical Service, 2008). Thus even though government of Ghana may be committed to sustaining the natural vegetation, the role of those who consume forest products as energy towards its sustainability needs to be looked at. In other words it is a concern that if the government's effort towards sustaining natural vegetation in Ghana seems not to be enough is there any way that the households that use/consume firewood can help in the conservation process? One obvious way such consumers can help in forest conservation is through tree replanting. But such knowledge is not well known in the literature on Ghana. Accordingly, the study aims at assessing the tree planting exercise among rural dwellers in Ghana. The outcome of the study offers guidelines to policy makers when it comes to ensuring sustainability of the natural vegetation. Specifically, it reveals the need to offer some level of education to the public on a range of issue concerning tree planting exercise towards environmental sustainability. The paper also makes contribution to the general literature on tree planting activities among households as it provides evidence from Ghana, where such studies are rarely available.

The rest of the paper is organized as follows: Section two reviews the literature; section three focuses on the materials and methods; section four is on the discussion of results and section five concludes the study with recommendations.

2. Brief Literature Review

Verheij (2004) has stated that trees play a number of roles that are important to nature including the fact that they provide shade for man and beast, serve as wind breaks, help maintain fertility of the soil and influence the climatic condition of an area. Dwyer *et al.* (1991) has also noted that trees beautify the environment in addition to the symbolic importance they offer people and religion. Trees increase resilience to climate change, improve air quality, provide economic value to an area and offers some health benefits (Forestry Commission, 2010). This implies that society and nature lose at least some of this importance from trees if we do not replace those that are cut or that die.

In the light of the above, agro forestry has been identified by a lot as an avenue to ensure the world has enough trees. Agro forestry according to Lundgren and Raintree (1982) involves the deliberate combination of trees, agricultural crops and/or animals on the same land management unit in some form of spatial arrangement or temporal sequence (Franzel, 2005). This practices offer some importance to farmers and pastoralists who grow fodder trees and shrubs to feed their livestock, helps in soil conservation, offers a source of fuel wood and helps in honey production (Franzel, 2005). Tewari (2008) has also mentioned that the agro forestry has the capacity to control poverty, ensure food security, empower women farmers and other less-advantaged rural residents, reduce deforestation and pressure on forest, increase buffering capacity of farmers, improve soil health and augment the accessibility to medicinal trees. Mcadam (undated) also states the importance of agro forestry ranging from animal welfare to economic production. Other importance of agro forestry has been explained by Dasskey *et al.* (2012).

It is worthy to note that despite the importance of trees and agro forestry not all individuals would embark on tree production. To examine the decision for a household to plant trees, we make inference to the factors that influence farmers to practice agro forestry since all the two practices involve the cultivation of trees although agro forestry takes place along farming or pastoral activities and tree replanting may involve agro forestry as well as cultivation of tree outside the farm land. The decision for farmers to plant certain trees on portion of lands they can grow other agricultural crops depends on a number of factors including the profitability of planting that tree (Dasskey *et al.*, 2012). Thus to Simmons *et al.* (2002) it is an economic decision for farmers to practice agro forestry and this calls for government support. This means that for individual households who consume firewood to plant trees they must expect to get some returns from it. Institutional factors like land and tree security, extension services and information sources also have effect on household's decision to plant trees (Ewnetu and Bliss, 2010). Moreover, other characteristics have been explained to affect tree planting decision. These include household income, livestock, distance to market, labour availability and size of holding (Ewnetu and Bliss, 2010). In addition to the above, getting access to credit and marketing assistance (Godoy, 1992), has been cited by Simmons *et al.* (2002) to have influence on the decision to adopt agro forestry by individual households. Other characteristics that determine tree planting decision are age, gender, education and the number of adults in the family (Ewnetu and Bliss, 2010).

Empirical studies by Mekonnen (1998) showed that family size, gender, male labour, income, education, and livestock holding influenced households' tree-plating behavior (Gebreegziabher *et al.*, 2010). Simmons *et al.* (2002) also realized that a statistically significant relationship existed between tree planting and tenure security in Brazil and Panama while Neupane *et al.* (2002), found in Nepal that factors like females aged between 10 and 59 years, male membership in a local NGO, female education level, sex of the head of the household, the amount of lowland, livestock population, extension, farmer's perception toward agro forestry, and migration of household member were positively associated with agro forestry adoption. Gebreegziabher *et al.* (2010) carried out a study in Tigrai, Northern Ethipioa that used information from 200 rural households collected in 2000. The finding was that the decision to plant trees and the quantity of trees planted were both influenced positively by land size, exogenous income, age, gender, and education. Again, while they found no significant relationship between intra-household or sex-age patterns of resource endowments and tree planting and quantity planted, institutional issues like perception of tenure security was found to affect such decision and quantity.

Mekonnen and Damte (2011) found in Ethiopia that households which lend money and own houses with corrugated roofs, were less likely to grow trees but households with a separate kitchen, farther away from towns, owning livestock, with more adult males, with higher off-farm income, and located in kebeles with more biomass available were more likely to grow trees. They used data gathered by the Environment for Development (EfD) Center in Ethiopia covering 10 districts from four regions of the country. Ewnetu and Bliss (2010) found that the number of years farmers have resided and farmed on land, training of farmers and female headed households reduced the likelihood of growing trees whiles size of land holding increased the likelihood of growing trees in Southern Ethiopia. The study also showed that income of farmers, size of land holdings and farmers perception of land tenure positively affected the number of trees grown and distance from household to nearby road and female headed households reduced the number of trees grown.

3. Methods and Materials
3.1. Study Area and Data Source
In order to accomplish the research's objectives, information on existing household firewood energy was gathered from rural communities in the tropical forest vegetation zone and the savannah vegetation zone of Ghana. Research assistants were sent to gather information from the households in rural areas around Koforidua, Kumasi, Tarkwa and Ho in the tropical forest zone, while rural areas around Tamale and Wa were selected in the savannah zone. Although the research used the two zones for the study, much information was from the tropical forest zone. In the light of this condition, it was convenient not to do any comparison analysis. A semi structured questionnaire was developed and administered to the households' heads to gather information necessary for the study between December 2011 and February 2012. In all a total of 207 questionnaires well and completely answered, were used in the final analysis. The data collected among others concerned the characteristics of the households size, marital status of household head, sector of employment, uses of the various energy and the associated challenges. The data was processed and analyzed using SPSS and Stata.

3.2. Estimation Technique
In this study, the logit model is used to identify households' decision to (re)plant trees. The model predicts the probability of occurrence of a discrete variable and is utilized under the condition that the variable has two outcomes only (Nketiah-Amponsah *et al.*, 2012). Thus the logit regression model is used because each dependent variable is binary. The dependent variable takes on the value of one (1) if the respondent grows trees and zero (0) if otherwise. The logit model is given below:

$$p_i = E(y = 1 \mid x) = x'\beta \dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(1)}$$

Where p_i is the probability of occurrence, x is a vector of explanatory variables, y is the dependent variable taking the value 0 or 1 and β is a coefficient vector. The explanatory variables included in the questionnaire are the gender, age, family size (measured by the number of children in the household), marital status, education, employment income, electricity usage, kerosene and LPG usage.

4. Findings and Discussion of Results
4.1. Demography of the Interviewees
In all 207 inhabitants were interviewed with 81.8% being females while 18.2% were males. The average age of the interviewees were 38.1(SD=18.1; Max.=98, Mini.=15) years and 64.2% had formal education while 35.8% had no formal education. On income level, 48.3% earned less than GH¢100, 42.1% earned between GH¢ 100-500 while 7.3% earned GH¢ 500-900 and the remainder (2.2%) earned above GH¢ 900 (at the time of reporting the exchange rate was US$1: GH¢2).

4.2. Households Firewood Usage
From the survey it was found that 74.5 % of the interviewees used firewood. But the breakdown in Table 1 below shows that majority 65% used firewood always and 4% used firewood once in a while. Respondents used firewood normally for cooking and boiling/heating water.

Table-1. Frequency of firewood usage in rural Ghana

Frequency of fuel wood usage	Firewood(% of interviewees usage)
Not at all	25.5
Always	65.0
Sometimes	5.5
Once in a while	4.0
Total	100

Meanwhile, the majority of the household (77%) said they get their supply from trees from farm, whiles another 48.68% purchased theirs. Natural vegetation is the least source of firewood to 40.13% of rural households (Table 2).

Table-2. Sources of firewood

Source	Percentage of respondents
Trees from farms	77.00
Natural vegetation	40.13
Purchase	48.68
Fallow land	40.79

4.3. Tree (Re) Planting Exercise

Out of the number of households who used firewood, 15% said they embark on tree (re)planting activities and the majority 85% said no. Table 3 below shows the logistic regression to examine some determinants of households' decision to (re)plant tree.

Table-3. Logistic regression for determinants of tree (re)planting (Standard error in parenthesis)

Explanatory variable	Model 1 coefficients	Model 2 coefficients	Model 3 coefficients	Model 4 coefficient
Gender (Male =1)	-0.125 (0.0003)	-0.397 (0.7548)	-0.370 (0.7509)	-0.233 (0.7078)
Age	-0.086 (0.084)	-0.078 (0.0912)	-0.077 (0.0904)	-0.109 (0.0926)
Age Squared	0.0004 (0.001)	0.0002 (0.001)	0.0008 (0.001)	0.0005 (0.001)
Household size	0.286** (0.1415)	0.560** (0.2223)	0.530** (0.1951)	0.425** (0.1822)
Marital status	1.085 (0.8505)	1.400 (1.0182)	1.129 (0.9580)	1.215 (0.9187)
Education	-0.435 (0.8645)	-1.188 (0.9753)	-1.153 (0.9624)	-0.585 (0.9008)
Formal employment sector (yes=1)	-1.752** (0.8727)	-0.694 (1.1581)	-0.873 (1.0158)	-1.471 (0.9803)
Income	0.003 (0.1012)	-0.019 (0.0142)	-0.014 (0.0137)	-0.005 (0.0113)
Electricity usage (yes=1)	0.7420 (0.8324)	-2.295* (1.1936)	-2.136** (1.0686)	
LPG usage (yes=1)		0.453 (1.0458)		-0.614 (1.1421)
Kerosene usage (yes=1)		-2.757*** (1.3909)	-2.693*** (1.0186)	-1.719** (0.7920)
Log likelihood	-33.395	-28.760	-28.813	-31.069
Prob> chi2	0.0696	0.0087	0.0053	0.025
Pseudo R2	0.192	0.3042	0.3029	0.248

***,**,* represent 1%, 5% and 10% level of significance respectively

The regression from the four models shows that between 19% to 30% of the explanatory variables, account for changes in the household decision to grow trees. The first model based on the assumption that the household is not using LPG and kerosene, found only household size and employment as the significant variables influencing tree replanting decision. While the number of dependent children increased the probability of growing tree, an employment reduced such probability.

In the second model the household is assumed to be using electricity, LPG and kerosene, the regression shows that household size is positively associated with household decision to grow tree but electricity and kerosene usage relate negatively with such decision. When it was assumed that the household is not using LPG in the third model, we have the same results as the second model. The final model is under the assumption that the household does not use electricity and the results indicate that kerosene usage reduces tree planting but household size increases the probability for a household to grow trees. Meanwhile age, age squared, marital status, income, sex of household head and education are not statistically significant in all the models. The insignificant coefficient of age, income, sex of household head and education contradicts studies like Neupane *et al.* (2002), Gebreegziabher *et al.* (2010), and Mekonnen and Damte (2011).

Thus, it can be seen that the decision to grow tree by rural households is a positively related with the number of household size but negatively with formal employment, kerosene usage, LPG usage and electricity usage. A larger household size means more hands available during growing of trees and this can account for the positive effect found from the logistic regression which also confirms Mekonnen (1998). A possible explanation to the negative relationship between electricity usage, LPG usage and kerosene usage is that households using such alternative energy in addition to firewood may have higher tendency to careless about the future availability of firewood.

4.4. Households Motives for (Re) Planting Trees

To complement the results from the logistic regression, other reasons were sought from the households to identity why they engage or not in tree (re)planting. When asked why they do re(plant) tree, seven of them stated that there is shortage of firewood in their area and so they are compelled to plant some. One respondent clearly stated that:

"I plant trees because firewood is scarce here."

Others also do this exercise to ensure firewood is always available:

"Tree planting is to make sure that there is constant supply of firewood."

Similar to the above reasons is the idea given by another three respondents who stated their motives are to ensure the continuity of the natural vegetation:

"This is done to help preserve and maintain trees around us."

While some have the natural vegetation in mind for planting trees, others do so for commercial purpose. Someone said:

"I grow trees so that I can sell it to others."

Another person also does so for his own interest:

"I grow them for personal usage".

Interestingly, one person also stated he does it for the fun of it:
"I do plant trees just for pleasure."
Again, tree re (planting) in rural Ghana is embarked upon by some people because they have been informed of the need to do that or they are members of group that re(plant) trees:
"I have been educated to plant trees."
"There is a group here which plants trees and I am a member of them."
Other reasons stated by respondents are as follows:
    i.   Trees are valuable,
    i.   Because of bush fires,
    ii. Distance from farm to get firewood is far, and
    iii. For shade

4.5. Reasons for Not (Re) Planting Trees
The majority 85% that do not plant trees gave a number of reasons for that.
Thirty of them stated they just engage in the pruning of existing plants and that is enough:
"I embark upon plant pruning."
Another set of people believe that tree growth is a natural process that requires no effort of any one:
"Trees grow by themselves."
To some four people, there is no need to plant trees. This is what they said:

"There is no importance for planting trees."

While some respondents do not grow trees because there is no need to, 19 others who are willing to are faced with constraints from land, seed, money and time. They commented:

"It is difficult to get seed for such activities."
"There is lack of land to grow trees."
"I do not have the money and time."

Culture's role of decision to plant tree came to light when two women stated that:
"Women are not allowed to grow trees here."

And another person also said that:

"I am afraid I will die if the tree I plant does not grow well."

Also, one person said he does not grow because there is plenty firewood around:

"Firewood is available that is why I don't grow trees."

Other reason given by respondents for not re(planting) trees are:
    i.   Lack of education that one has to plant trees,
    ii. Inadequate rainfall to support plant growth,
    iii. There has been no command to grow trees, and
    iv. It takes too much time to mature

5. Conclusion and Recommendation
The aim of this study has focused on assessing firewood usage and tree planting behavior among rural households in Ghana in the face of climate change. This paper used primary data collected from rural communities in the tropical forest and savannah zones of Ghana. Relying on 207 respondents, it was revealed that majority of rural households relied on firewood as domestic energy for cooking and boiling water. Trees on farms served as the major source of firewood for households and this was followed by those who purchase them from suppliers while trees from natural vegetation was the last source of firewood. Out of the 74.5 % of those using firewood majority 85% stated they do not engage in tree planting for a number of reasons ranging from cultural to financial factors. The few 15% that do under take tree planting do so for reasons like preserving the forest, for personal uses, ensuring constant supply of firewood and commercial purpose. A logit estimation showed that individuals who use kerosene and LPG are less likely not to grow tree. The study goes on to reveal that reasons like lack of education, lack of time, inadequate rainfall to support plant growth and longer gestation period of trees were cited by the majority as some of the reasons for not planting trees. Based on the results it is recommended that the government of Ghana and other agencies should intensify education on tree planting in the rural areas of the country to help conserve the forest. Again an urban – rural comparison study is also recommended.

6. Acknowledgements

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