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Socio-Economic Implications of Rural Energy Exploitation and Utilisation on Sustainable Development in Gombe State, Nigeria

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KEYWORDS Energy; female; fuel wood; woodlands; household

ABSTRACT This study examined female farmers' rural energy supply and use pattern in rural communities in Kaltungo Community in Gombe State, Nigeria. The study revealed that fuel wood is the primary source of fuel and females are responsible for its collection. Farmers' average weekly collection, time spent, number of days, distance covered and amount collected were 53.3 kilograms, 17hours, four days and 11kilometres respectively. Collection strategies developed include Short Span of Trek (SPOT) with Low Frequency (LF) is 13.3% while Short Span of Trek with High Frequency is 20 %. Thirty percent belong to Long Span of Trek with Low Frequency and Long Span of Trek with High Frequency occurred among 36.67%. All farmers stored fuel wood for consumption, sale and barter traditionally. Constraints to effective and efficient rural energy supply and use identified were education, labour, capital, time, credit, decreasing fuel wood availability, and contact with extension. The study concluded that farmers' participation in fuel wood production and utilization is frequent and continuous. However, the depletion of the woodlands combined with persistent dependency on fuel wood pose a serious problem for household energy provision and the environment. Woodlots and access to alternate, affordable, renewable, energy system would reduce the pressure on the forests and amount of time and efforts women devote to obtaining fuel wood. Therefore further research and development of an integrated energy package using community based participatory mechanisms become imperative for sustainable rural development in Nigeria.

INTRODUCTION

Most rural communities of developing countries have less access to energy sources and essentially depend on traditional fuel (Biomass) mostly procured by women for virtually all their energy requirement. Fuel sources of Biomass origin (woods, twigs, leaves, charcoal, animal dung, and crop residue) account for more than 50% of the total energy consumption in rural areas of developing countries. It currently accounts for about 20% of the world's energy supply and is the most important source of energy for about 75% of the world's population (FAO, 1999).

In Africa biomass accounts for about 90% of total energy use and two – thirds of this consumption is household energy for the most part procured by women (FAO 1999). The story is not different in Nigeria where as high as 86% of rural households are primarily dependent on biomass as their source of energy. About 90% of the total annual round wood products serve as fuel wood and 60% of this total is consumed for household purposes (Williams, 1998). Nigeria's ever growing population and growth in the household sub-sector has further resulted in increased demand on its energy sub-sector. The gap between energy supply and demand is widening with limited solutions in sight. Rural areas of Nigeria are characterized by lack of sufficient energy sources on the one hand, and exploitation of forest for fuel wood creating ecological imbalances on the other. Although evidences exists on women's involvement in rural farm production (FAO, 1999; WHO, 1998; Williams, 1998), such has not been the case regarding their involvement in rural energy production and utilization. Therefore, this paper is an enquiry into female farmers' rural energy supply and use pattern, particularly it seeks to identify socio- demographic characteristics of women farmers, primary sources of energy and its end-use, energy related tasks borne by women and coping strategy of fuel wood scarcity. Implications of the findings for research, extension and governmental policy on rural energy supply and utilization are discussed.

MATERIALS AND METHODS

Data for this study was obtained from a

random sample of three hundred female farmers from Kaltungo community in Gombe State. It is situated in the Northern Guinea Savannah at longitude 11.30[l] to 11.40[1] East and latitude 9.30 [1]I 10.30[1] North. It has short rainy season starting from June to October and dry season of more than six months. The rainfall averages 1600mm. The soil type is sandy – drift soils low in nutrients (Ezenwa, 1986). A sampling frame, consisting of names of 1,264 registered female farmers was obtained from the Women in Agriculture (WIA) unit of Kaltungo Local Area Extension Unit. Using a simple random sampling procedure, 300 respondents were selected and questionnaire administration followed in their homestead. The analytical procedure used for achieving the objectives of the study was purely descriptive statistics involving frequency counts and percentages.

RESULTS

This sub-section is in two parts. The first gives background information on the socio-economic characteristics of female farmers while the second part covers the energy related issues.

Socio-Economic Profile: Eight variables – experience, educational level, income, social participation, contact with extension, sources of information, membership of social organization and age distribution were considered (Table1). Data presented on the table covering experience in farming, household energy supply and utilization, most of the respondents are vastly experienced. Forty percent of female farmers have over 30years of farming experience; while 33.3% have 21-30years experience in farming and household energy supply. Other issues covered are educational attainment which reveals that slightly above one –fifth of the sample (21.3%) did not have any form of education. Others dropped out of primary (14.3%) and secondary (11.7%) schools. However, some portion of those interviewed had some form of education ranging from completed primary school (20%); Teachers college (10.7%) to adult literacy (16.7%).

In terms of income, 36.7% of respondents had incomes below ₦ 1000, while 33.3% had between ₦ 1000- ₦ 2999 and 16.6% had ₦ 3000- ₦ 4999). Only 13.3% of the respondents had ₦ 5000 and above as average income per annum.

Regarding social activities, the result indicated that 13.3% of the respondents did not belong to any association. From the remaining who associates with more than one group, all of them attends meetings and participate in

Table 1: Socio-economic characteristics of respondents

Variable	*Fre-quency*	*Percent-ages*
A. Experience In Farming and Household Energy Supply and Use (Years)		
1-10	30	10
11-20	50	16.7
21-30	100	33.3
>31	120	40
Total	300	100
b. Education Level		
Non-literate	64	21.3
Adult literacy	50	16.7
Primary uncompleted	43	14.4
Primary completed	60	20
Secondary uncompleted	35	11.7
Secondary completed	16	5.3
Teachers college	32	10.6
Total	300	100
c. Average Income Per Annum (₦)		
£1000	110	36.7
1000-2999	100	33.3
3000-4999	50	16.7
>5000	40	13.3
Total	300	100
d. Social Participation		
Yes	260	86.7
No	40	13.3
Total	300	100
e. Contact With Extension		
Had contact	120	40
No contact	180	60
Total	300	100
f. Sources of Information		
Community leaders	100	33.3
Family members	70	23.4
Friends/ neighbors	40	13.3
Farmers individual groups	60	20
Radio	30	10
Total	300	100
g. Age Distribution		
Under 21	29	9.7
21 – 30	40	13.3
31 –40	86	28.7
41 – 50	100	33.3
>50	45	15
h. Membership of Social Organization		
National Council for Women Society	142	47.3
Women in Nigeria	200	66.7
Family Support / FEAP Cooperatives/ Farmers Organization	118	39.3
Federation of Muslim Women Association of Nigeria (FOMWAN)	240	80
Christian Women Fellowship	80	26.7
Rotary Credit Society	190	63.3
	210	70

Table 2: Mean days, hours spent and quantity of fuel wood procured by female farmers by fuel wood procurement strategies.

Ladi ro kaji teeshi	*Short Span of Trek (SPOT-33.33%)*		*Long Span of Trek (LSOT-66.67)*	
	Ladi ro kaji somjom SPOT LF 13.30%	*Ladi tal kaji teeshi SPOT HF 20%*	*Ladi tal kaji somjom LSOT LF (30%)*	*LSOT HF (36.67%)*
Total Frequency (Days)	3	5	2	4
Total Weekly Collection Time (Hour)	6.3	9.2	17.6	10.2
Total Amount Of Fuelwood Collected (Kilograms)	28.8	34.17	22.17	53.3

Key:
Short Span–under 5 kilometres trek from homestead
Long Span - 5-10kilometers trek from homestead
Low Frequency (LF)-under 3 days per week with less than 3 hours collection time
High Frequency (HF) - 3-5 days per week with 3-4 hours collection time
Female 18-60 years.

community programmes very often, indicating high social participation.

Associations female farmers were involved include National Council for Women Society (47.3%), Women in Nigeria (39.3%), Family Support/FEAP (66.7%), Cooperatives/ Farmers group (80.0%), Muslim Women Association (26.7%), Christian Women Fellowship (63.3%), and Rotary Credit Society (70%). By these estimates, it is evident that farmers belong to more than one or two social organizations. Data on age distribution of farmers indicates that majority of the farmers are in their active years as 85% of these farmers falls within 20 and 50 years of age. Of this proportion, 28.7% are between 31 – 40 years and 33.3% between 41 and 50 years of age.

In terms of contact with extension service, 60% of female farmers interviewed had no contact with extension agents while 40% do have contact with extension services. Results further indicate that respondents obtain information mostly through community leaders (33.3%), family members (23.4%) and farmers' groups (20%). If information available on this variable is broadly classified into interpersonal and mass media contacts, 90% obtain information from interpersonal sources.

Energy Related Tasks Borne By Females: All interviewees indicated that females were exclusively responsible as prescribed by culture for collection, processing, storage for consumption, barter and sales of fuel wood. The study reveals that, Averages per week for all farmers, for the number of days devoted to fuel wood procurement stood at four (4), time spent was seventeen (17) hours, distance trekked was eleven (11) kilometres and quantity of fuel wood collected was fifty three (53.3%) kilograms. Since biomass (fuel wood) predominates as the source of fuel in the study area, female farmers developed strategies for its collection.

As seen in Table2, fuel wood collection strategies adopted by respondents in the study area include Short Span of Trek (SPOT-33.33%) and Long Span of Trek (LSOT-66.67%). Further classification on the basis of either low or high

Table 3: Reasons for evolving LSOT strategy (n=200)

Reasons	*F*	*%*
a. No. of Farmers' Children Under 5 Years		
Under 10	160	80
10 and Above	40	20
b. No Females in Household (10-60 years)		
under 10	90	45
10 and above	110	55
c. Farmers' Experience in Household Energy Provision and Utilization (Years)		
Under 30	50	25
30 and above	150	75
d. Average In Income (₦)		
Under ₦ 5,000 hire labourers	90	45
₦ 5,000 and above	110	55
e. Seasonality		
Post Harvest Season	140	70
Rainy	60	30
f. Source of Drinking Water		
Near	125	62.5
Far	75	37.5
g. Social Participation		
Low	80	40
High	120	60
h. Number of Farm Plots		
Under 5 less farm work	130	65
5 and above	70	35

frequencies by farmers reveals the following:
Short Span of Trek Low Frequency = (SPOT (LF)-13.00%)
Short Span of Trek High Frequency = (SPOT (HF)-20.00%)
Long Span of Trek Low Frequency = (LSOT (LF)-30.00%)
Long Span of Trek High Frequency = (LSOT (HF)-36.67%)

In another dimension, Table 3 highlights socio-demographic variables influencing the adoption of the Long Span of Trek High Frequency (*ladi tal kasi somjom*) by the majority to collect high quality fuel wood in large quantities. These are; the number of farmers' children under the age of five, number of females in farmers' households, experience, income, seasonality, social participation and number of farms plots belonging to respective farmers

DISCUSSIONS

The study shows that respondents were above the national mean age for marriage (seventeen years) and mostly in their reproductive years. Two- thirds were lactating and at third pregnancy. This study falls in line with the finding of Robinson (1995) who reported that majority of females in several Nigerian samples were either pregnant or lactating. The tasks of household energy supply, farm work, pregnancy, breast feeding, childcare, cooking and other domestic chores traditionally are carried out by female farmers. This practice is seen to consistently pose a great demand on their time, energy and leisure. Hence, it's a great challenge for the survival and wellbeing of female farmers coupled with existing maternal role and occupational burden

Sampled representative farmer in the study area has considerable experience in farming and household energy provision and utilization. Williams (1998) held the same view. A farmer practices only what she knows and has been practising. Successful farm and household operations require more than the presence of the required inputs. Some salient factors such as knowledge, experience, drives motivations as well as capabilities make a good farmer and a home manager. Educational status of respondents was very low. Farmers are likely to be risk aversive. In contrast educated farmers are likely to accept risks and adopt new innovations. This study supports (FAO, 1999) that reported lack of education as a barrier for proper skills, abilities, adoption proneness and a catalyst to poverty.

Female farmers' resource base was very poor. Robinson (1995) reported the same for females. Poverty among female farmers is one of the main causes of natural resource degradation. Therefore, reduction in poverty levels of females will improve natural resource management. This implies political, institutional and legislative policies that recognize local reality especially for females.

The study revealed high degree of group activities beneficial to respondents. This findings fall in line with William's (1998) assertion that females traditionally have always worked together in groups to improve their welfare and that of their children. Through a process of socialization a lot of group norms, values and cultural beliefs about agriculture, energy and other relevant information are learnt. The sharing of beliefs may also influence their view on extension message. Extension professionals should encourage their clientele in group activities as success of a development project depends on local participation.

In terms of contact with extension service most of the female farmers had no contact. Farmer's poor educational status, gender gap in research - farmer- extension agent ratio and religion could be explanatory variables. This study agrees with Oladele (1998) and Majindadi (1993). When farmers come in contact with extension agents, the agents impart knowledge to the farmers. However, it is pertinent to note that the process is interaction based where learning cannot be one sided but 2-way, since both the extension agents and the clientele learn something from each other after each interaction which paves way for mutual learning. Therefore, active farmer interaction with extension (FARINEX) is advocated.

In recognition of numerous problems associated with energy utilization by females in households, respondents were quick to point out lack of education or awareness as the pillar of the problem. Nevertheless, as clienteles of extension service females are always marginalized. Both earlier and recent studies (Mijindadi, 1993; Oladele, 1998 and Williams 1998) stated that the focus of Extension Service with respect to agriculture and energy sector development have been on men.

Respondents obtained information through interpersonal contact. This finding agrees with

FAO 1999. It was observed during the survey and data collection that household energy practices observed were those that emanated within the culture. In any given society information in any area of human endeavour evolves within or outside it. Also, every society has ways of disseminating information in addition to its existing structures of achieving this. As revealed by this study, respondents mostly disseminate information mainly through interpersonal contact. It could therefore be asserted that farmers utilize mostly their cultural information in their day-to-day activities.

All respondents had no access to formal credit. Similarly FAO 1999 reported preponderance of rural women in the informal savings market as savers as well as lenders. It is therefore inferred that females in the study area depend on unorthodox institutions for credit. Credit is a key element of modernization. Acceptance of new technologies as an integral part of the process of commercialisation of the rural economy that is basically in the hands of women has implication for removing financial constraints among female farmers who are the backbone of agriculture in Nigeria.

The study reveals that fuel wood is the primary source of fuel and in high demand for cooking. Both earlier and recent empirical studies held the same view (Boserup, 1970; LIN, 1975; Cecelski, 1987, 1998; Canela, 1997) as they reported sole dependence on fuel wood as household cooking fuel in rural areas of Nigeria and other developing countries.

As the primary source of fuel in the area is derived from biomass (fuel wood), the averages of four days, seventeen hours, eleven kilometres devoted to collecting fifty-three kilograms of fuel wood per week is indicative of high demand, persistent dependency on fuel wood and serious exploitation of the woodlands, thus very active and progressive deforestation are on a high magnitude in the study area. Similar trend reported earlier by Cecelski (1995) indicated that rural women in Indonesia, Burkina Faso, India and Nepal where collectors spend an average of sixteen hours per week on fuel wood procurement. If the demand for fuel wood continues to grow at its current pace, woodlands will be completely depleted producing an ecological disaster and making fuel wood completely unavailable in the study area. This has a serious implication on the physical environment and rural energy supply.

Female farmers in the study area adopted the *Long Span of Trek High Frequency* as a coping strategy for diminishing fuel wood supplies. They spend more time, trekking long distances to collect large quantities of high quality fuel wood frequently. All farmers lamented that both low and high quality fuel wood in nearby distances are completely unavailable, and that since they must seek ways and means of supplying household fuel, they evolved *The Long Span of Trek High Frequency Strategy***.** This finding falls inline with earlier studies (Boserup, 1970; Cecelski, 1987, 1995) that reported rural women in Africa are the ones always finding ways and means to handle decreasing fuel wood problems.

The decision to adopt the long span of trek high frequency strategy by farmers is not accidental but rather predicated upon conscious efforts by them to define their problem and seek solution. Contrary to popular belief that female farmers are fatalistic, lack of knowledge, unskilful, and wait on extension agents for solution, female farmers in the study area were able to diagnose their environment, ascertain depletion problems and develop coping mechanisms even without extension contact as reported earlier in this study. It could be asserted that female farmers in the study area took advantage of their familiarity with their environment, use their inherent and local knowledge of nature and management expertise to diagnose their environment and evolve solution. Both local and scientific knowledge have weaknesses and strengths vis-à-vis local circumstance at any given time. Both are complimentary in their strengths and weaknesses and if combined they may achieve what one could not achieve in isolation. This is a great challenge for extension practitioners should combine both and make use of viable options for their clientele.

Findings further reveal that socio-demographic variables played vital role in strategies developed in the study area for fuel wood collection. Farmers collecting large quantities of high fuel wood farthest away and most frequently were caretakers of very few vulnerable children, with more females in households, long standing experience and high income and participate actively in group activities. Also, they had few farm plots and source of drinking water near their homesteads.

Summarily, the study revealed that as mothers and caretakers of children, respondents indicated the care of two children (under five years); release

time and energy; more female helping hands (at least five) enhances division of labour and release time and energy; at least thirty-one years of experience enhances expertise; independent cash of at least ₦ 5, 000 on the average per annum predisposes hiring of labour for other tasks; active participation in group activities enhances pooling of labour and income; close proximity of drinking water to farmers' homestead releases time and energy for other tasks and the fewer the farm plots (at most three) owned by a farmer, the lesser agricultural tasks performed and the more time, and energy are released. All these variables combined to release time, energy and labor hence respondent's ability and readiness to engage in fuel wood production there by adopting the long span of trek high frequency strategy. This study falls in line with several empirical studies (Boserup, 1970; Oladele, 1998 and William, 1998) that asserted that socio-economic and demographic characteristic of respondents are influencing variables in peoples daily lives and activities.

From this study, it could be inferred that ignoring socio-demographic variables in natural resource conservation or project with direct or indirect impact on the physical environment may lead to conflict between people and nature especially in the study area.

CONCLUSIONS AND RECOMMENDATIONS

This study examined female farmers' rural energy supplies and use pattern. The study showed that farmers are in their reproductive years and are pregnant or lactating, uneducated, with inadequate access to extension, income and credit. The primary source of energy identified is fuel wood. Their participation in its exploitation and utilization is frequent and continues using various strategies. In addition, farmers identified fuel wood scarcity characterised by decreasing availability, finance, labour, and time constraints as challenges in rural energy exploration and utilization.

In view of the above findings, the following recommendations are postulated to enhance rural energy exploitation and utilization on a sustainable basis:

1. In view of challenges inherent in rural energy exploitation and utilization, there is need for a permanent programme of reforestation providing for the planting of wood species that are ecologically suitable, socio-culturally compatible and economically feasible and products harvested under controlled and best practices. This is the spring board to address rural energy issues and other inter-related concerns like food production, food preparation, soil erosion and desertification.
2. To counter the rampant deforestation reported, intensive grassroots information campaigns and awareness is very crucial. Female farmers as key and vital elements in the fuel wood sector should be informed and sensitize on the need for sustainable fuel wood harvesting and adoption of fuel saving technologies compatible with prevailing socio-cultural practices.
3. Its high time for governments at various levels to come up with the necessary legislation and to promulgate rules and plan for rural communities to ensure that communities' forest resources are exploited on sustainable basis.
4. Education for female farmers is very vital therefore intensive grassroots awareness campaign and mobilization is necessary through relevant institutions such as National Agency for Mass Literacy, Adult Education Agency, Extension Service and the Mass Media should be tackled seriously and speedily for amelioration of the general problem of female illiteracy and natural resource degradation.
5. Gender aspects should be built into all energy policies and projects such as environmental concerns.

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