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Local Community Based Strategy for Curbing Wood Fuel Shortages in Nyamache Sub-County, Kisii County, Kenya

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ABSTRACT

Wood fuel shortage has existed worldwide since the 1970s during oil energy crisis, accelerating wood fuels scarcity hence coping strategies. This study on local community based strategy for curbing wood fuel shortages was conducted in Nyamache Sub-county, Kisii County-Kenya. The study assessed the establishment of woodlots as an affordable strategy adopted by the households for wood fuel availability. The specific objective sought to evaluate the attitude of the local communities towards establishment of woodlots for wood fuel availability in Nyamache Sub-county. Descriptive research design was adopted in gathering information on establishment of woodlots for wood fuel availability in the study area. It was based on binary-choice model. A sample size of 379 households selected from a target population of 26,458 people was used. The study employed stratified purposive and snowballing techniques of both probability and non-probability sampling designs in selection of informants. Data was collected by use of structured questionnaire, observation checklist, Focus Group Discussion and key informant interview guides. The study data was of both primary and secondary sources. The data were analyzed using frequency distribution tables, percentages and Likert Scale. Using a Likert scale the attitude of the local communities living in Nyamache Sub-county towards establishment of woodlots for wood fuel availability was positive. This was manifested in their scores of response viz. very much willing (716) and willing (363) and close to two thirds positive response (68.5%). Statistical tables, charts, plates, maps and photographs were used to present the data. The study concluded that establishment of woodlots for wood fuel availability was significantly sustainable at (0.68<15.09 at df = 5) at 0.05. The study recommended that local communities' positive response on establishment of woodlots be adopted in the area, local communities engage in establishing woodlots and be positive in wood fuel scarcity alleviation strategies country wide and local politicians to sensitize households on woodlots established on their farms.

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Key Words

Wood fuel, woodlot, households, energy, biomass, fuelwood, charcoal

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INTRODUCTION

Wood fuel shortage is an energy problem that has existed worldwide since the 1970s when there was an oil energy crisis[1,2]. Wood fuel is regarded as energy produced from wood biomass. Bradley[3] argues that most of the households rely more on wood fuels for their vast domestic energy needs and inability to obtain alternative energy sources. Globally, households are establishing responsive strategies for wood fuel availability and accessibility sustainably[4]. Despite the local communities' positive response on establishment of woodlots as the adopted strategy for availability and accessibility of sustainable wood fuels, wood fuel shortage has been persistent in the developing countries and in particular Kenya[5,6].

Wood fuel shortage was first felt in 1973 when the households experienced constant increase of the world fuel prices uncontrollably[7]. It was in this time that wood fuels became the main source of energy that the households could afford for their vast domestic consumption[7]. Eckholm[7] further asserted that wood fuels were most preferred as alternative energy sources by more than three thirds of the world's households because of easy affordability. Consequently, there was desperate scramble for wood fuels by the households worldwide in particular the developing countries' households making wood sources scarce[3,8].

Studies have shown that consumption of wood fuels is on the increase globally[4,9]. The world average population dependency on wood fuels stands at 2.4 billion people per year[10]. The demand has not yet been fully met. Currently, majority of the population in the developing countries particularly Africa, continue to rely on wood fuel energy sources for their enormous energy needs[9,11]. Consequently, this has led to high dependence on wood fuel. Many authors agree that this phenomenon has intensified environmental degradation and forest devegetation at regional and national levels[7,12-14].

In East Africa region, wood fuels demand is also on a rise. It is estimated to be consumed by about 90% of the households[10]. Githiomi[2] asserted that besides being the most preferred source of energy by the regional households, wood fuel is also an important energy for running cottage and tea processing industries. Despite the importance of wood fuels in the region's economic development, wood fuel data on supply and demand are highly scarce[15]. Generally, studies carried out in East Africa on wood fuel showed that wood fuel shortage is a perennial problem which needs urgent measures for its sustainability[2,15]. However, no any governmental or international agencies' attentions that have been effected in relation to supply of wood fuels.

In Kenya particularly Nyamache Sub-county, Kisii County, majority of the households rely on wood fuel as a sole source of energy[16]. Although, wood fuels seem to be scarce both at national and local levels, households tend to depend on it prevalently because of its affordability and easy accessibility. However, the wood fuel sources are depleted vastly[17]. The demand is even exacerbated by high population using wood fuels, agricultural expansions and de-vegetation in major forested areas[18]. For instance, a study carried out on wood energy situation in Kitui County, Kenya indicated that wood fuel scarcity is as a result of overuse and constant unsustainable wood fuel production[9]. Despite the rapid increase in wood fuel shortages, households have advanced establishment of woodlots as a strategy in response to the scarcity of wood fuels in both theory and practice.

The Kenyan households have recognized the role of woodlots establishments and the contribution to their livelihoods as paramount[19]. This has necessitated a positive comprehensive adoption response towards establishment of woodlots as a strategy to address persistent wood fuel shortages. However, a sustainable wood fuel has not been achieved. Most researches in Kenya have focused on establishment of woodlots as the impact on the environment[20-24]. However, less emphasis has been put on establishment of woodlots as a strategy for curbing wood fuel scarcity. The study therefore, assessed the local community based strategy for curbing wood fuel shortages in Nyamache Sub-county, Kisii County.

Objectives of the study: The purposeof this study is to make an assessment of the establishment of woodlots for wood fuel availability in Nyamache Sub-county, Kisii County, Kenya. The specific objective was to evaluate the attitude of the local communities towards establishment of woodlots for wood fuel availability in Nyamache Sub-county.

Description of the study area: The study area was in Nyamache Sub-county (Fig. 1). Nyamache Sub-county is located in Bobasi constituency in Kisii County. It lies in western Kenya between latitude 0° 47′ 00″ South of Equator and longitude 34° 50′ 00″ East of Greenwich Meridian and is placed at an altitude of 1700 m above sea level[25]. It is relatively located as follows: Kisii Central Sub-county to its north, Gucha South Sub-county to the south, Trans Mara Sub-county to the North East, Kenyenya Sub-county to the West and Sameta Sub-county to the North West. It is approximately 20 km from Kisii town which is the head-quarter of the county government of Kisii.

According to the 2009 census, Nyamache Sub-county in Kisii County had 5 administrative locations namely: Bassi Central, BassiMasige East, BassiMasige West, Bassi Bogetaorio and Nyacheki. The sub-county where the study was carried out covers an area of 162.5 km^2 and it supports a population of 126,262

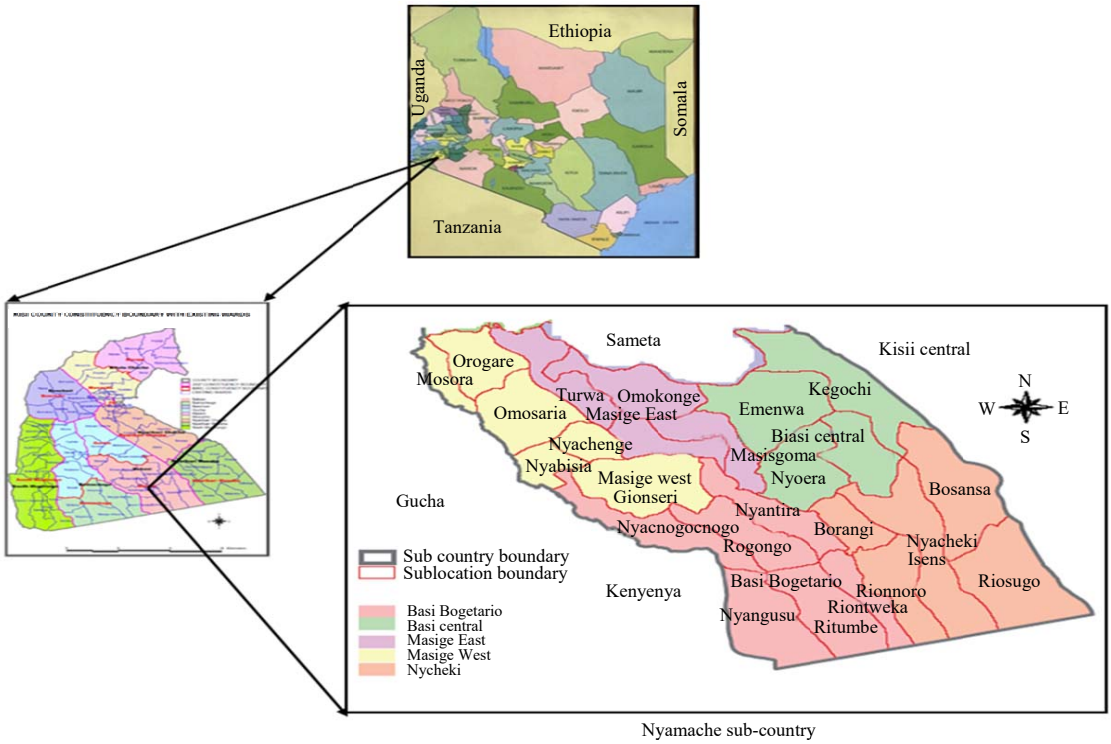

Fig. 1: Map of Kenya showing the relative position of Nyamache sub-county

Table 1: Description of Nyamache Sub-county as per the 2009 Census

Location	Households	Population	Area in sq. Km	Density
Bassi Central	4,923	23,346	33.1	704
Bassi Masige East	4,100	19,170	21.1	909
Bassi Masige West	3,755	18,492	27.6	671
Bassi Bogetaorio	5,328	12,385	14.6	849
Nyacheki	8,352	52869	66.1	904
Total	26,458	126,262	162.5	807.34

Source: KNBS[25]

people with a population density of 807.34 persons/km^2 and 26,458 households[26]. The population density was expected to grow at 1.5% annually. However, the high population has put a lot of pressure on resources wood fuels inclusive, which would continue to increase over the coming years. Description of Nyamache Sub-county is highlighted in the Table 1.

MATERIALS AND METHODS

This study adopted descriptive research design in which qualitative and quantitative data collection procedures, methods and analysis were described to understand the research problem[27]. It was to assess the local community based strategy for curbing wood fuel shortages in Nyamache Sub-county, Kisii County-Kenya. The researcher used, questionnaires, key informant interviews, observation and Focus Groups Discussion as the main tools for collecting data. They were mainly concerned with views and perceptions of the household respondents. The study was both explorative and interpretive in nature by surveying physical barriers faced by the households in accessing wood fuel and generating information from both quantitative and qualitative data using inferential statistics respectively[28].

The targeted population was 26,458 households who were drawn from the five locations of Nyamache Sub-county with a total population of 126,282 people. According to KNBS, the five locations purposively selected in the sub-county included; Bassi Central, Bassi Masige East, Bassi Masige West, Bassi Bogetaorio and Nyacheki. The target population constituted all the household units, in particular those who have had great interaction with woodlots establishment for wood fuel availability. Also government agents such as forest department officers and NEMA officials in the sub-county were contacted and their information sought which generated relevant data for this study.

The study sample size of 379 households out of the target population of 26,458 consisting of men, women and children was used. The sample size was arrived at by carefully taking into account the

Table 2: Sampling frame per location in the study area

Location	Households	Proportion	Sample size
Bassi Central	4,923	0.19	72
Bassi Masige East	4,100	0.15	57
Bassi Masige West	3,755	0.14	53
Bassi Bogetaorio	5,328	0.20	76
Nyacheki	8,352	0.32	121
Total	26,458	1.00	379

Source: KNBS[25]

objectives being studied using the Krejcie and Morgan's formula. This sample size was justified by the Morgan and Krejcie's table and graph for determining sample size from a given population and sample size vis-a-vis total population respectively, calculated as follows:

$$S = \frac{X^2 NP(1-P)}{d^2(N-1) + X^2 P(1-P)}$$

Where:

S = Required sample size
X^2 = Table value of chi-square for 1 degree of freedom at the confidence level, which is
N = Population size
P = Proportion assumed to be
d = Degree of accuracy expressed as a proportion which is

$$S = \frac{3.841 \times 26,458 \times 0.5 \times 0.5}{0.05^2(26,458-1) + 3.841 \times 0.5 \times 0.5} = 379$$

This number, 379 households, was again purposively stratified proportionately into different location strata as indicated in Table 2. A sample of 72 households in Bassi Central, 57 households in Bassi Masige East, 53 households in Bassi Masige West, 76 households in Bassi Bogetaorio and 121 households from Nyacheki locations respectively were purposively selected for this study.

RESULTS AND DISCUSSION

Socio-demographic characteristics of the household respondents: The characteristics of the household respondents in relation to establishment of woodlots for wood fuel availability in Nyamache Sub-county, Kisii County-Kenya, were tabulated and recorded as per the data. These characteristics included the following: Sex, age, marital status, occupation, educational background, dependents and size of land as were tabulated from the questionnaires. Results indicated that more than half of the household respondents (62.7%) were females while 37.3%. This was an apparent reflection of the major role played by women in wood fuel collection in the African set up[8]. Majority of the respondents (52.8%) were aged between 30 and 49 years whose mean age of 38.4 of the households authenticated the results of this research given the Kenyan age of above 18 years in the constitution of Kenya.

Local communities' attitude towards the establishment of woodlots: The attitude of the local communities living in Nyamache Sub-county towards establishment of woodlots was attested using Likert scale as in Table 3[29]. In addition, the expected activities in line with wood fuels production was tested in Table 5. The local communities living in NSC were positive towards the establishment of woodlots for wood fuel availability. This is manifested in their scores of response viz. very much willing (716), willing (363) and a close to two thirds positive response (68.5%). Contradictorily, less than half (43.6%) of the respondents claimed sustainable wood fuels from the established woodlots at the household farms despite a relatively high rating as very efficient (988) and efficient (192). This was in postulation that woodlots establishment has not sustainably been adopted by both urban and rural households[23].

More than half (65.6%) of the respondents indicated that they frequently consumed wood fuels harvested from the established woodlots with the highest rate (1135) (Table 3). This was followed by a quarter (25.7%) of the respondents who agreed to have accessed and availed wood fuels through establishment of woodlots. However, woodlots established in the study area were unsustainable despite the continued harvest of wood fuels. There was a low rate 57 of the respondents who rarely consumed wood fuels from their established woodlots as compared to 52% of the households who claimed sustainable wood fuels from established woodlots in the study area. This was closely followed by very low rating 11 of the households who never used wood fuels.

Slightly less than three quarter 71.4% of the respondents confirmed that establishment of woodlots was very efficient in production of wood fuels (Table 3). Through interviews, households with established woodlots agreed that they rarely experience a shortage of wood fuels when their woodlot farms are ever grown and coppice regularly. Despite the efficiency of wood fuel production woodlots adoption have not been fully established. 18.5% of the respondents also indicated that woodlots

Table 3: Likert scale for the attitude of the local communities towards establishment of woodlots for wood fuel availability in Nyamache Sub-county (n = 346)

Questions	Response (%)	Scores	Rate
In your opinion do you think woodlots establishment has helped mitigate wood fuel shortages in NSC?			
Strongly agree	237 (68.5)	237×4	948
Agree	073 (21.1)	073×3	219
Disagree	019 (05.5)	019×2	038
Strongly disagree	017 (04.9)	017×1	017
How often do you use wood fuel supplied by established woodlots in NSC?			
Always	089 (25.7)	089×4	356
Frequently	227 (65.6)	227×5	1135
Rarely	019 (05.5)	019×3	057
Never	011 (03.2)	011×1	011
How efficient is the adoption of woodlots establishment for wood fuel availability in NSC?			
Very efficient	247 (71.4)	247×4	988
Efficient	064 (18.50	064×3	192
Less efficient	021 (06.1)	021×2	042
Never efficient	014 (04.0)	014×1	014
Are you willing to establish woodlots as a strategy to access and avail wood fuel for use in NSC?			
Very much willing	179 (51.7)	179×4	716
Willing	121 (35.0)	121×3	363
Unwilling	027 (07.8)	027×2	054
Very much unwilling	019 (05.5)	019×1	019
Are there enough woodlots established in NSC to meet the present wood fuel demand?			
Yes	151 (43.6)	151×3	453
No	109 (31.5)	109×2	218
Do not know	086 (24.8)	086×1	086
Is establishment of woodlots in NSC does assist households for other reasons besides wood fuels?			
Yes	283 (81.8)	283×3	849
No	018 (05.3)	018×1	018
Do not know	045 (13.0)	045×2	090
Which are the products collected from woodlots in large quantities in NSC?			
Wood fuels	180 (52.0)	180×5	900
Timber	028 (08.1)	028×1	028
Traditional herbs	046 (13.3)	046×3	138
Construction posts	047 (13.6)	047×4	188
Fencing materials	045 (13.0)	045×2	090

Researcher's field data and NSC: Nyamache sub-county

Table 4: The local communities' attitude towards establishment of woodlots in Nyamache Sub-county (n = 379)

	Locations					
Reasons	Bassi Central (N = 66)	Bassi Masige East (N = 52)	Bassi Masige West (N = 48)	Bassi Bogetaorio (N = 69)	Nyacheki (N = 111)	Total (N = 346)
Production of wood fuels	64 (97.0)	50 (96.2)	45 (93.8)	66 (95.7)	105 (95.6)	330 (95.4%)
Aesthetic values	56 (84.9)	40 (76.9)	39 (81.3)	57 (82.6)	82 (73.9)	274 (79.2%)
Harvesting of timber	57 (86.4)	41 (78.8)	41 (85.4)	50 (72.5)	73 (65.8)	262 (75.7%)
Collection of NTFP	46 (69.7)	46 (88.5)	45 (93.8)	45(65.2)	46 (41.4)	228 (65.9%)
Recreational use	53 (80.3)	37 (71.1)	41 (85.4)	41 (59.4)	83 (74.8)	255 (73.7%)
Habitats for wild life	55 (83.3)	41 (78.8)	34 (70.8)	59 (85.5)	90 (81.1)	279 (79.9%)

Researcher's Field Data

establishment is efficient in provision of wood fuels. Contradictorily 4 and 6.1% of the respondents claimed that woodlots were never and less efficient in wood fuel production respectively (Table 3). This small section of the households was a representation of the population in urban centres who use other sources of fuels.

Table 3 showed that besides establishment of woodlots for wood fuels availability woodlots were for collection of other products viz: Provision of construction posts (13.6%), harvesting of medicinal herbs (13.3%), fencing posts (13%) and timber production (8.1%). This was attested by the majority (81.8%) of the household respondents who accepted the additional benefits extracted from the woodlots.

Table 3 showed that majority (95.4%) of the respondents reported that production of wood fuels was the main reason for establishment of woodlots. This was statistically significant as an important aspect for wood fuel availability at (0.68<15.09 at df = 5 at 0.01) level of significance as per Table 4. More than three quarters (79.2%) of the local communities concurred that established woodlots can improve the aesthetic values of the country however, statistically insignificant at (16.47>15.09 at df = 5 at 0.01) level of significance (Table 4). This was authenticated by the Kenya Forestry Reserve (KFR) which attributes that forests add beauty to our Kenyan land.

In addition, more than three quarters of the local communities 79.9% indicated that woodlots established at the common parcels of land act as habitats for wild life animals (Table 5). This was an additive reason to the shared woodlots in the study area and could be used to earn the households extra improved living standards. Households interrogated indicated that when woodlots are established in their farms wild animals such as monkeys, snakes, water parks and antelopes shelter. This makes the household owners scared to access anticipated firewood hence scarcity of wood fuels.

Table 5: Summated chi-square of local communities' attitude towards establishment of woodlots in Nyamache Sub-county (n = 346)

	Local communities' attitude			
Reasons in collaboration	Observed	Expected	χ^2-calculated	χ^2-tabulated
Production of wood fuels	330	346	0.68	15.09
Aesthetic values	274	346	16.47	15.09
Harvesting of timber	262	346	20.43	15.09
Collection of NTFP	228	346	43.91	15.09
Recreational use	225	346	26.39	15.09
Habitats for wild life	279	346	12.93	15.09

Researcher's Field Data and NTFP: Non-tree forest products

Statistically therefore, habitats for wildlife was considered as important aspect in the community at (12.93<15.09 at df = 5 at 0.01) levels of significance (Table 5). The following were also reasons for establishment of woodlots though statistically insignificant as per Table 4 viz. harvesting of timber responded by 76.8% of the household respondents but insignificant at (20.43>15.09 at df = 5 at 0.01) level of significance, collection of NTFP accepted by slightly more than half (66.0%) of the respondents but insignificant at (x^2 = 43.91>15.09 at df = 5 at 0.01) level of significance and recreational use claimed by slightly below three thirds of the household respondents but insignificant at (x^2 = 26.39>15.09 at df = 5 at 0.01) level of significance.

CONCLUSION

Based on the research findings the study concluded that establishment of woodlots helped mitigate wood fuel shortages statistically significant at (0.68<15.09 at df = 5) at 0.05. This is because wood fuel was the most preferred source of fuel by majority (79.5%) of the household respondents in the study area. It is crystal clear that established woodlots play a vital role in provision of wood fuels to the households' demand[30]. However, establishment of woodlots has not been widely adopted by the rural households at the local levels. Woodlots establishment as an affordable strategy for curbing wood fuel shortages has been widely adopted by majority (90.5%) of the household respondents. However, the rate at which households adopt the establishment of woodlots has been very slow both in theory and practice. Using a Likert scale the attitude of the local communities living in Nyamache Sub-county towards establishment of woodlots for wood fuel availability was positive. This was manifested in their scores of response viz. very much willing (716) and willing (363) and close to two thirds positive response (68.5%). Contradictorily, less than half (43.6%) of the respondents claimed sustainable wood fuels from the established woodlots at the household farms despite a relatively high rating as very efficient (988) and efficient (192).

RECOMMENDATION

The researcher therefore, recommended that establishment of woodlots be adopted in the area, local communities engage in establishing woodlots and be positive in wood fuel scarcity alleviation strategies country wide and local politicians to sensitize households on woodlots established on their farms. However, there is need to formulate clear policies and by-laws to guide and escalate well adoption mechanisms of woodlots establishments. Additionally, the local politicians whose influence is immense on the electorates should offer moral and financial support to achieve this objective.

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