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Firewood Accessibility among Rural and Urban Households in Trans-Nzoia and West-Pokot Counties, Kenya

Namaswa W.T.[1*], Mbego J.[1], Muisu F.[1] and Mandila B.[2]
[1]School of Natural Resource Management, University of Eldoret, P.O. Box 1125-30100 Eldoret, Kenya
[2]School of Natural Resource and Environmental Management, University of Kabianga P.O. Box 2030-20200 Kericho, Kenya
wektim.n9@gmail.com

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Abstract

This study investigated firewood accessibility in rural and urban areas of Trans-Nzoia and West-Pokot counties of Kenya. The aim was to avail scientific data for appropriate policy formulation to ensure sustainable firewood accessibility. The study employed independent group research design. Stratified random sampling technique was used to categorize households into rural and urban households. Convenience sampling was used to select Kolongolo and Kacheliba to represent rural areas of Trans-Nzoia and West-Pokot respectively. Purposeful sampling technique was used to select Kitale and Makutano to represent urban areas in Trans-Nzoia and West-Pokot correspondently. Systematic random sampling was used to select a total of 355 households from the study areas. Data was collected through questionnaires, interviews and observation; and analyzed using Kruskal Wallis Test, and Chi-square test of association. Firewood accessibility was measured based on distance (Km)/Kg, time (hours)/Kg, household monthly expenditure, cost (Kshs)/Kg, and budgetary allocation (%) on firewood used. Results indicated that average distance/kg of firewood collected in Kacheliba was 0.29 Km, while average time/Kg in Makutano was 0.38 hours. In Kitale, average cost/kg of firewood and household monthly expenditure were Kshs 8.2 and Kshs 1577.5 respectively. Average monthly budgetary allocation on firewood in Kacheliba was 32%. In terms of accessibility, firewood was accessible in Kacheliba but inaccessible in Kolongolo, Makutano and Kitale. Land tenure system, government policies, cookstove technologies, and family size were common factors influencing household's firewood accessibility. Analysis indicated significant differences in households' firewood accessibility levels in the four areas ($\chi 2=11.998_{(0.05,3)}$, N=249, p=0.007). $\chi 2$ -test indicated that firewood accessibility levels have insignificant association with existing government policies. We conclude that firewood is accessible in rural areas of West-Pokot and inaccessible in rural and urban areas of Trans-Nzoia, and urban areas of West-Pokot. In addition, existing government policies are either inadequate or poorly enforced to enhance sustainable firewood accessibility. Therefore, law enforcers need to pull up their socks in enforcing current government policies and/or policy-makers need to formulate appropriate policies that will enhance firewood accessibility.

Keywords: Accessibility, Firewood, Distance, Time, Budget, Expenditure.

Introduction

Globally, every nation is concerned about ensuring energy security to enhance sustainable development[1,2]. Among various energy sources, biomass especially firewood has been the main primary energy source since civilization, and it is expected to remain being the main source of household energy[3,4]. Firewood contributes about 7% and 76% of total energy consumed in the world and developing countries respectively[3]. In Sub-Saharan Africa, over 81% of primary energy for cooking and heating is derived from woodfuel[3-7]. In Kenya, over 70% of primary energy is obtained from woodfuel mainly firewood[8]. Apart from being a source of energy, woodfuel acquisition, preparation and utilization provide employment, foreign exchange, and enhance rural development[4,9]. However, firewood is derived from natural resources (trees), which have been depleting due to population growth, use of low efficient conversion and utilization technologies, and increment in urbanization; leading to fuelwood energy crisis everywhere around the world[1,3,6,7,9,10]. In Kenya, the situation is worse due to inadequate planning in the firewood sector and over dependency on firewood from natural vegetations[6].

The depleting forest resources and trees have led to the scarcity and inaccessibility of firewood both in rural and urban areas. This is evidenced from increased average distance to collection site by about 7km, an increase in firewood collection time by about 10 hours, increased firewood prices on the market, and increased households' budgetary monthly allocation on firewood[7,11]. The effects of firewood inaccessibility imply that people's socio-economic status have been affected negatively, thus calling for immediate attention. Some of the suggestions to deal with the problem include: increasing tree planting in farm lands; increased tree planting in gazetted forest for firewood; development of improved trees for short rotation systems; increasing adoption of improved and efficient utilization

technology devices; increasing the availability and use of alternative energy sources like kerosene, electricity and Liquid Petroleum Gas (LPG); strengthening of firewood energy institutional framework, reduced cooking times; turning to poor quality firewood species; and avoidance of cooking some foods[7,8]. Despite such interventions, enacting sustainable firewood production and utilization policies both at local, national and international levels has not received adequate emphasis[5,8]. This has been attributed to scanty and scattered scientific data on firewood accessibility that has led to poor planning and governance of the sector.

This study therefore investigated firewood accessibility among households in rural and urban areas of Trans-Nzoia and West-Pokot Counties in Kenya. The study determined firewood accessibility levels based on distance and time per Kilogram (Kg) of firewood collected, monthly household expenditure and budgetary allocation on firewood, and potential factors influencing firewood accessibility.

Methodology

This research was carried out in West-Pokot and Trans-Nzoia Counties in Kenya. West-Pokot County occupies an area of about 9169.4 Km^2, lies between latitude 10° 10'N and 30° 40'N, longitudes 34° 50'E and 35° 50'E, and its altitude ranges from 400 m to 1500 m above sea level. Annual rainfall ranges from 400 mm and 1200 mm in the lower and highland areas respectively. Average temperatures vary from 10°C to 30°C[12]. Lowland areas including Kacheliba have infertile sandy soils that encourage nomadic pastoralism, while highland areas including Lelan have fertile soils that support mixed farming. Based on 2009 Kenya national population census, the county has a total population of 512,690 people, with a population density of 56 persons/Km^2. The County has a poverty level of 69.4%, with age dependency ratio of 100:122. The state of education in the county is poor as teacher to student ratio in public schools is at 1:27.

Trans-Nzoia County covers an area of 2,495.5 Km^2, and lies between latitudes 0° 38'N and 1° 18'N, and longitudes 34°38'E and 35° 23'E. Average annual rainfall is about 1296.1 mm. Temperatures vary from 10°C to 30°C. The county has well drained, dark red loam to sandy loamy soils that encourage mixed farming. However, there are some areas in the northern parts which have low fertile soils. The county has a population of 818,757 people and a population density of 328 persons per Km^2, with poverty level of 50.2%, and dependency ratio of 100:99[13]. The state of education is also poor as there are 471 and 120 primary and secondary schools respectively, with 1:52 teacher student ratio in public schools.

The study employed an independent group research design that entails categorizing participants into groups, and each group subjected to only one condition of independent variable (location of resident). The design best suits the study's purpose of testing significant differences among accessibility levels between independent groups of people found in different conditions; either urban or rural, and in different counties.

Multi-stage sampling technique was employed in the study. Stratified random sampling categorized households into urban and rural areas to ensure a representative sample. Convenience sampling based on the easiness to access was used in the selection of Kolongolo and Kacheliba sub-locations to represent rural areas of Trans-Nzoia and West-Pokot Counties respectively. Purposeful sampling technique was employed in the selection of Kitale and Makutano towns to represent urban areas in Trans-Nzoia and West-Pokot respectively.

The two towns were selected because they are the largest in terms of population size and business activities in the respective Counties. Individual households were selected based on systematic random sampling, where every other 10^{th} household was selected after randomly selecting the starting point. Sample size was determined based on sample size algorithm by Israel 2012 at t ±10% precision, 95% Confidence Level. As an effect, 95, 91, 91 and 78 households were selected out of 2003, 935, 1325, and 605 households in Kolongolo, Kacheliba, Kitale and Makutano respectively. Households not using firewood were eliminated from the study.

Self-administered questionnaires were used to collect information about the household's number of trips made per month to collect firewood (N), average number of head-loads per trip (h), average weight per head-load (w), average quantity of firewood collected per trip in kilograms (m) calculated as indicated in equation 1, quantity of firewood in Kilograms (Kg) collected per month (Ww) calculated based on Equation 2, average distance per head-load in meters (d), amount of time taken to collect and bring a head load of firewood home in hours (t), average household's head monthly income (i), average cost per head-load (c), average household's monthly expenditure on firewood (ac) calculated using Equation 3, household's monthly budgetary allocation in percent (B) calculated using Equation 4, and possible factors influencing the time taken, distance travelled, cost and budgetary allocation. Face-to-face key informant interviews were conducted on 10 leaders in government and non-governmental agencies. Field observations were also conducted to identify type and quality of firewood collected in terms of size, and types of firewood cookstove technologies in the area.

Dry weight (Dw) of firewood collected per month was determined by subtracting moisture content (M.C) of firewood from wet weight (Ww) as indicated in Equation 5. The M.C of firewood was determined based on Laboratory Test, and calculated based on the wet-weight basis as indicated in Equation 6. Equation 7, 8 and 9 were used to calculate distance and Time per Kg of firewood collected by households, and cost per Kg of firewood purchased respectively.

$$m = (h * w)Kg \quad (1)$$
$$Ww = (N * m)Kg \quad (2)$$
$$ac = (c * h * N) \quad (3)$$
$$B = (ac/i) \quad (4)$$
$$Dw = (100\% - M.C\%)Ww \quad (5)$$
$$M.C = (\frac{Ww-Dw}{Ww})\ 100 \quad (6)$$
$$\text{Distance per Kg of firewood collected} = (N * h * d) \div Dw \quad (7)$$
$$\text{Distance per Kg of firewood collected} = (N * h * t) \div Dw \quad (8)$$
$$\text{Cost per Kg of firewood collected} = (c) \div Dw \quad (9)$$

Where:
m = Quantity of firewood collected per trip (Kg)
h = Number of head loads per trip
w = Average weight per head load (Kg)
Ww = Wet weight of Firewood collected per month (Kg)
N = Number of trips per month
ac = Average household's monthly expenditure on firewood
c = Average cost per head-load
B = Household's monthly budgetary allocation in percent on firewood
I = Average household's head monthly income
Dw = Dry Weight of firewood consumed (Kg)
MC = Moisture Content
d = Distance travelled to collect one head load of firewood
t = Time taken to collect and bring home one head load of firewood

Accessibility levels of firewood based on distance (Km)/Kg, time hours/Kg, cost (Kshs)/Kg, monthly expenditure and budgetary allocation were categorized into very accessible, accessible, inaccessible and very inaccessible (Table-1).

Average household firewood accessibility values were determined using equation 10,

$$Cal = (Cd + Ct + Cc + Ce + Cb)n \quad (10)$$

Where:
Cal = Average accessibility level
Cd = Accessibility level based on distance (Km/Kg)
Ct = Accessibility level based on time (Hours/Kg)
Cc = Accessibility based cost/Kg of firewood
C = Accessibility level based on monthly expenditure
Cb = Accessibility level based on budgetary allocation
n = Number of individual measures of accessibility used in determining average accessibility level

The resultant average household accessibility values were subjected to final accessibility grading in Table-2.

Kruskal Wallis Test was used in testing the significant differences in accessibility levels between the rural and urban areas of Trans-Nzoia and West-Pokot Counties. In case of significant differences, pair-wise analysis through Mann Whitney *U* test was used to determine exact locations with significant differences in accessibility levels.

Table-1
Accessibility Grading

Accessibility level	Grade	Distance (Km/Kg)	Time (hours/Kg)	Cost (Kshs/Kg)	Monthly expenditure in rural areas (Kshs)	Monthly expenditure in urban areas(Kshs)	Budgetary allocation (%)
Very accessibility	1	<0.1	<0.1	<7	<450	<500	<5
Accessible	2	0.1-0.3	0.1-0.3	7-14	450-900	500-1000	5-10
Inaccessible	3	0.3-0.5	0.3-0.5	14-21	900-1350	1000-1500	10-15
Very inaccessible	4	≥0.5	≥0.5	≥21	≥1350	≥1500	≥15

Table-2
Final Accessibility Grading

Accessibility level	Average accessibility value from equation 10
Very accessible	0-1.5
Accessible	1.5-2.5
Inaccessible	2.5-3.5
Very inaccessible	≥3.5

Factors influencing accessibility levels were also determined through chi-square test of association that tested the significant relationships between different accessibility measures and factors including cookstove technology, family size, government policies and regulations, and land tenure. Analytical tests were conducted at 95% confidence level.

Results and Discussion

Firewood Accessibility: Distance per Kilogram of firewood collected in Trans-Nzoia and West-pokot Counties: Results indicated that the mean distance per Kg of firewood collected were in the order of Kitale > Makutano > Kolongolo > Kacheliba (Figure-1).

Time per Kilogram of firewood collected in Trans-Nzoia and West-Pokot: Figure-2 indicated that the mean time per unit weight of firewood collected were ranked in the order of Makutano > Kolongolo > Kitale > Kacheliba.

Cost per Kilogram of firewood in Trans-Nzoia and West-pokot Counties: Figure-3 indicated that the cost per Kg of firewood was lower in Kacheliba (Kshs 5.79), and higher in Kitale (Kshs 8.2).

Household monthly expenditure on firewood in Trans-Nzoia and West-Pokot Counties: Figure-4 indicated that among the four study areas, the average household's monthly expenditure on firewood was high in Kitale.

Household's budgetary allocation on firewood: From Figure-5, monthly budgetary allocation on firewood based on household's head monthly income was high in Kacheliba (32%), and low in Makutano (15.9%).

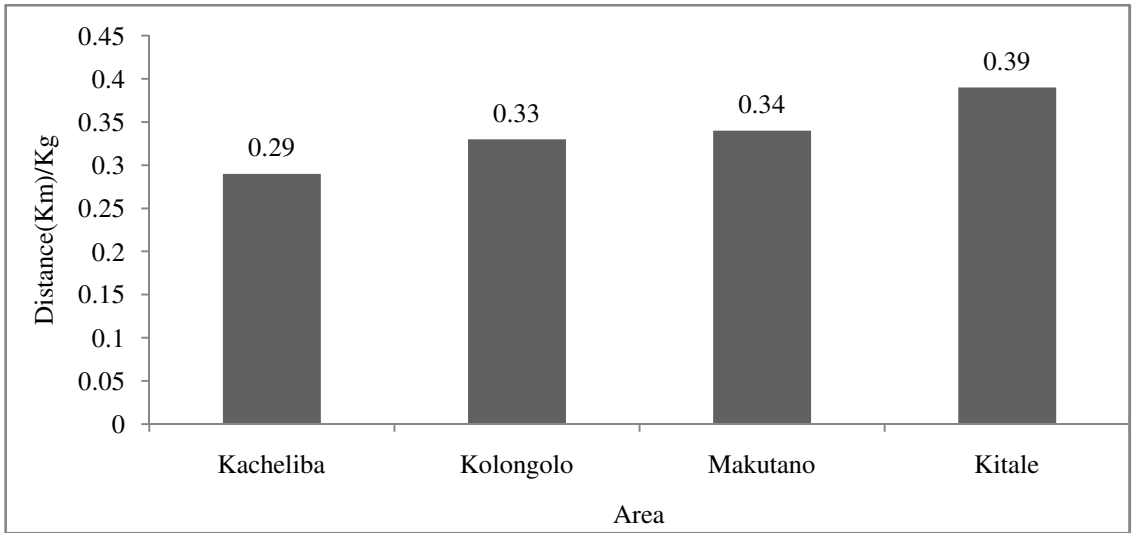

Figure-1
Distance per Kilogram of Firewood Collected in Trans-Nzoia and West-Pokot Counties

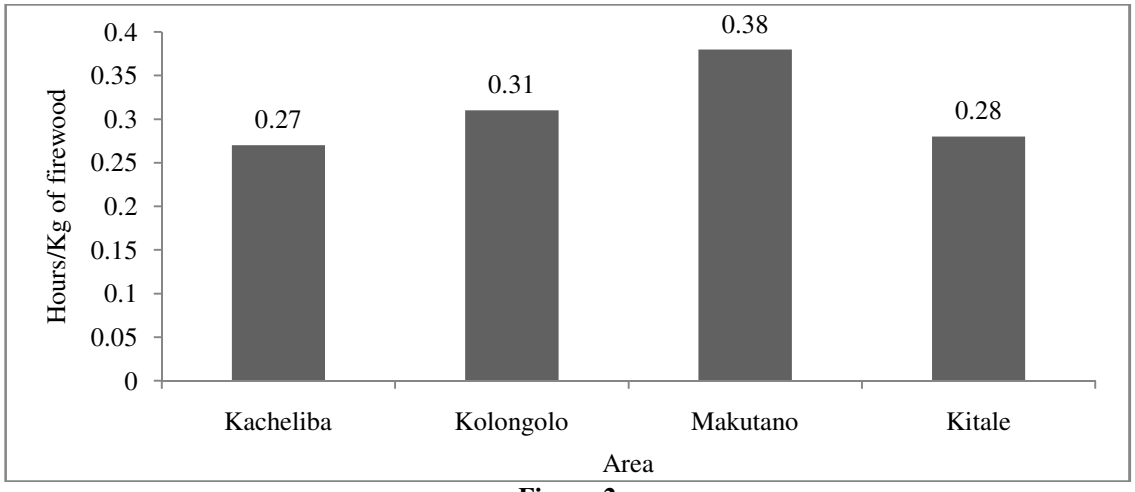

Figure-2
Time per Kilogram of Firewood Collected in Trans-Nzoia and West-Pokot

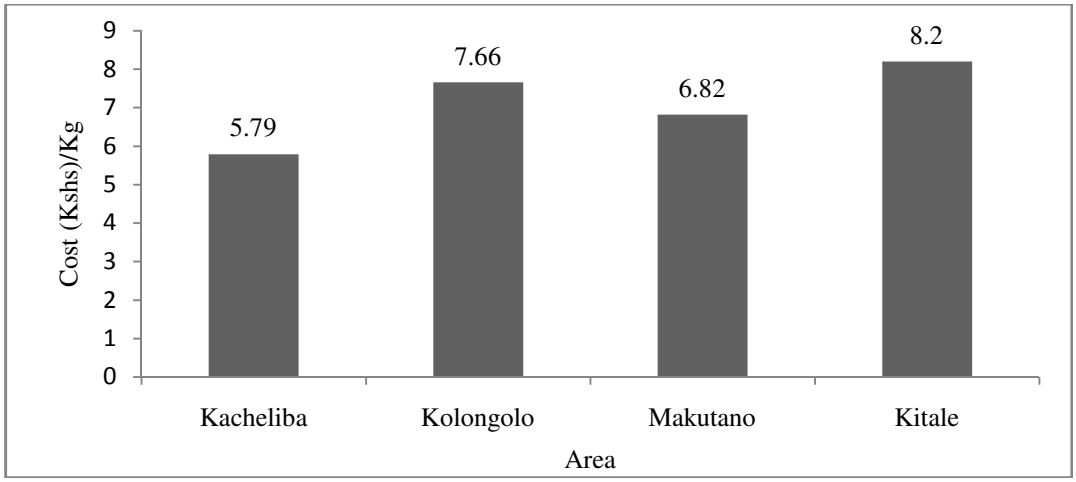

Figure-3
Cost per Kilogram of firewood in Trans-Nzoia and West-pokot Counties

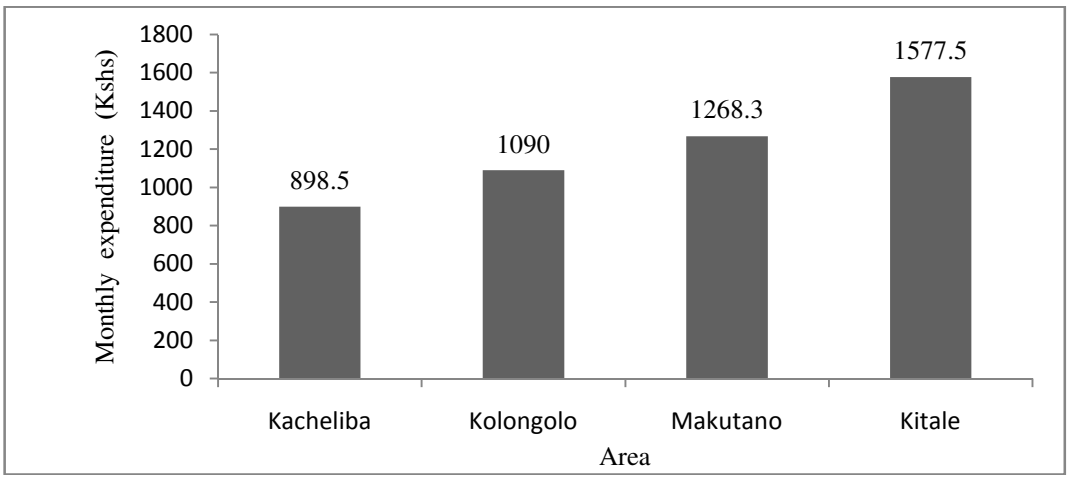

Figure-4
Households' Monthly Expenditure on Firewood in Trans-Nzoia and West-Pokot

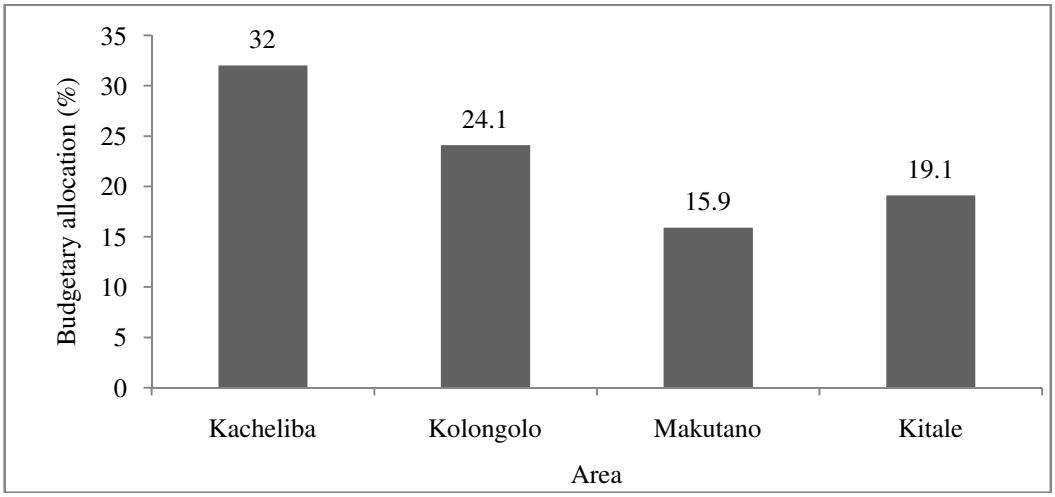

Figure-5
Households' Monthly Expenditure on Firewood

Firewood accessibility levels in Trans-Nzoia and West-Pokot: Table-3 indicated average firewood accessibility levels in the rural and urban areas of Trans-Nzoia and West-Pokot Counties. The grading was based on the information in Table-1 and Table-2.

Kruskal Wallis Test indicated that the mean ranks of firewood average accessibility values in Kacheliba, Kolongolo, Makutano and Kitale were significantly different [$\chi^2_{(3,95)}$=11.998, N =249, P = 0.000). We therefore reject the null hypothesis that firewood accessibility levels in the rural and urban areas of Trans-Nzoia and West-Pokot are statistically similar.

Pair-wise analysis in Table-4 indicated that firewood was more accessible in Kacheliba than Kolongolo, Makutano, and Kitale. This was because the average accessibility values for firewood in Kacheliba were significantly lower than the average accessibility values of firewood in Kolongolo, Makutano and Kitale.

The lower accessibility values in Kacheliba were attributed to shorter distances (Km/Kg), shorter time (hours/Kg) and lower monthly expenditure on firewood as compared to other areas. Shorter distances and time per unit weight of firewood collected in Kacheliba were attributed to availability of firewood from natural vegetations. This was because the inhabitants of Kacheliba were pastoralists that preserve natural vegetations for livestock grazing, browsing and edible fruits. Although small twigs of firewood (Figure-6) were available at door steps, people preferred walking a considerable distance and spent time collecting quality firewood in terms of species (acacia), moisture content and preferred size (Figure-7). Firewood collectors in Makutano also preferred walking longer distances to obtain quality firewood. However, quality firewood in Makutano is not readily available as Kacheliba, meaning that firewood collectors walk longer distance and spend more time fetching quality firewood. This concurred with Egeru *et al* that firewood collectors spend more time and walk longer distances because of overdependence on natural vegetations and in search of quality firewood[7].

In Kolongolo and Kitale, firewood collectors walk and spent considerable distance and time due to firewood scarcity. This was attributed to intensive agricultural activities and settlements, leading to clearance of natural vegetations preferred for firewood. Mugo and Gathui also noted that intensive agricultural activities lead to clearance of formerly vegetated lands; lengthening firewood collection distance and time[14]. While some farmers in Kolongolo were practicing on-farm tree planting just as in Uganda[7], inadequate land to accommodate trees and food crops hindered other farmers from adopting the practice. Longer distances to firewood collection sites in Kitale resulted to changes in means of transporting firewood as motorcycles were being used to carry firewood; leading to a general reduction in the total amount of time spent on firewood collection.

Table-3
Firewood Accessibility Grading in Trans-Nzoia and West-Pokot

Study site	Accessibility levels based on the individual variables					Average accessibility value	Accessibility Grade
	Distance/Kg	Time/Kg	Monthly expenditure	Cost/Kg	Budget allocation		
Kacheliba	2	2	2	2	4	2.4	Accessible
Kolongolo	3	3	3	2	4	3	Inaccessible
Makutano	3	3	3	2	4	3	Inaccessible
Kitale	3	2	3	2	4	2.8	Inaccessible

Table-4
Pair-Wise Analysis of Firewood Accessibility Levels

Area	Kolongolo	Makutano	Kitale
Kacheliba	Mann-Whitney $U_{(1,95)}$=255.000, N=181, p=.000	Mann-Whitney $U_{(1,95)}$=1103.000, N=127, p=.004	Mann-Whitney $U_{(1,95)}$=965.000, N=123, p=.004
Kolongolo		Mann-Whitney $U_{(1,95)}$=1286.000, N=126, p=.070	Mann-Whitney $U_{(1,95)}$=3639.000, N=122, p=.193
Makutano			Mann-Whitney $U_{(1,95)}$=245.000, N=68, p=.057

While monthly expenditure on firewood was high in Kolongolo, Makutano and Kitale, it was low in Kacheliba because of cheap firewood resulting from high proximity to firewood resources. However, family sizes especially in Kacheliba and Kolongolo played a significant role in determining monthly expenditure as family size dictated household's energy demand. This was in line with literature that family size determines the amount of energy required by households especially in rural areas[15-17]. On the other hand, monthly budgetary allocation on firewood was high in Kacheliba because of low family income[18].

Factors Affecting Firewood Accessibility: Table-5 indicated information about response percentages on different factors affecting firewood.

Land tenure: Chi-square test of association results in Table-6 indicated that land tenure system was significantly associated with monthly household's expenditure in Kacheliba and Kolongolo. In Kolongolo, freehold tenure was encouraging famers to adopt on-farm tree practices because it enhances the owner to enjoy tree rights. This enabled farmers to supplement purchase and on-farm collection; hence reducing monthly expenditure. This contradicted Minang *et al*. that land tenure has no effect on acquisition of on-farm resource accessibility because neighbors enter each other's plots to obtain natural resources including firewood[6]. In Kacheliba, communal land tenure system was allowing people to collect firewood beyond clan lands, resulting to lower monthly expenditure on firewood as people can collect firewood for free. However, individuals practicing freehold systems were not allowed to collect firewood in other people's lands. This was in line with literature that land tenure systems dictates the person that access resource in a particular piece of land[4]. The association between land tenure and budgetary allocation was significant in Kolongolo (Table-6). Households practicing freehold land tenure system have the ability to practice multiple income generating activities from their farms as compared to households practicing others system. This increases their household monthly income as compared to households practicing other tenure systems like leasehold that discourage heavy investments on leased land.

Government policies: Chi-square test results in Table-6 showed that existing government policies and regulation have no significant association with any measure of firewood accessibility (distance, time, cost, monthly expenditure and budgetary allocation) in all the study areas. This was because firewood transportation permits are not applied in case of transporting small quantities of firewood at household level. This contradicted existing literature that most regulations and policies encourage taxation on firewood, making the product more expensive[5]. However, the results concurred with Minang *et al*. that most policies are poorly enforced to ensure to influence sustainable firewood accessibility[6].

Table-5
Factors Affecting Firewood Accessibility in Trans-Nzoia and West-Pokot Counties

Factors		Response (%)			
		Trans-Nzoia		West-Pokot	
		Kolongolo	Kitale	Kacheliba	Makutano
Land Tenure	Customary	0.0	0.0	79.1	0.0
	Freehold	85.6	35.5	17.6	37.1
	Leasehold	14.4	64.5	3.3	62.9
	Public	0.0	0.0	0.0	0.0
Government Policies	Yes	17.8	35.2	71.4	20.5
	No	82.2	64.8	28.6	79.5
Cookstove Technology	Open-Fire	53.3	60.0	73.6	60.0
	Improved firewood	46.7	20.0	26.4	76.5
	Ordinary metallic	0.0	20.0	0.0	20.6
Family size	(1-3) members	23.3	22.6	5.5	22.9
	(4-6)members	53.3	67.7	46.2	71.4
	7-9)members	17.8	9.7	36.3	5.7
	≥9members	5.6		12.1	

Table-6
Chi-square Test of Association

Factors	Pearson Chi-Square	Exact Sig. (2-sided)	Pearson Chi-Square	Exact Sig. (2-sided)
	Kolongolo		**Kitale**	
Distance and land tenure	2.643[a]	.453	1.333[a]	1.000
Distance and regulations	.317[a]	.980	2.880[a]	.467
Distance and cookstove technology	9.007[a]	.125	5.317[a]	.563
Distance and family size	9.083[a]	.489	9.400[a]	.176
Time and land tenure	2.698[a]	.475	2.286[a]	.456
Time and regulations	1.755[a]	.650	.629[a]	1.000
Time and cookstove technology	7.187[a]	.292	.865[a]	1.000
Time and family size	19.471[a]	.016	12.286[a]	.022
Monthly expenditure and land tenure	16.113	0.02	13.572	.053
Monthly expenditure and regulations	.947	.828	1.965	.737
Monthly expenditure and cookstove technology	5.791	.395	8.127	.536
Monthly expenditure and family size	24.309	.002	8.224	.270
Budgetary allocation and land tenure	8.533	.034	3.308	.619
Budgetary allocation and regulations	4.398	.245	33.443	.344
Budgetary allocation and cookstove technology	7.229	.317	3.071	.988
Budgetary allocation and family size	18.003	.035	6.657	.359
	Kacheliba		**Makutano**	
Distance and Land tenure	4.086[a]	.700	1.041[a]	.820
Distance and regulations	2.660[a]	.479	1.053[a]	.818
Distance and cookstove technology	2.222[a]	.540	3.685[a]	.126
Distance and family size	1.261[a]	1.000	2.980[a]	.849
Time and Land tenure	5.393[a]	.476	3.968[a]	.274
Time and regulations	1.343[a]	.750	1.989[a]	.783
Time and cookstove technology	2.286[a]	.543	1.007[a]	.837
Time and family size	6.079[a]	.751	2.636[a]	.837
Monthly expenditure and land tenure	41.017	.001	3.085	.395
Monthly expenditure and regulations	1.457	.722	3.452	.325
Monthly expenditure and cookstove technology	5.544	.126	8.602	.547
Monthly expenditure and family size	17.717	.037	10.111	.101
Budgetary allocation and land tenure	6.766	.330	2.238	.556
Budgetary allocation and regulations	.545	.936	1.782	.687
Budgetary allocation and cookstove technology	9.406	.023	9.155	.467
Budgetary allocation and family size	9.171	.411	4.386	.662

Cookstove technologies: From Table-6, the adopted cookstove technology was not influencing distance, time, and household's expenditure on firewood except budgetary allocation in Kacheliba. This was because most improved firewood cookstoves technologies like those in Figure-8 were of poor standards, and mostly used by children that are inexperienced in using them.

These results to insignificant impacts on the quantity of firewood consumed. This contradicted literature that improved cookstoves are disseminated and adopted with the aim of reducing energy demand; hence cutting down household's expenditure on firewood[15,19,20]. On the other hand, the results concurred with Raman *et al*. that inadequate knowledge on improved cookstove usage hampers the stove from reaching its maximum efficiency[21].

Family size: Table-6 indicated that Family size significantly influenced time/Kg of firewood collected in Kolongolo and Kitale, monthly expenditure on firewood in Kolongolo and Kacheliba, and Budegtary allocation in Kolongolo. This was because an increase in family size increases household energy demand, translating to higher expenditures on firewood per month. Literature also noted that family size dictates the amount of energy required by a household[16,17]. Significant association between household's monthly budgetary on firewood and family size concurred with literature that family size influences household budgetary allocation on firewood because family sizes increase daily expenditure on firewood[18].

Figure-6
Less Preferred Firewood in West-Pokot

Figure-7
Preferred Firewood in West-Pokot

Figure-8
Improved Firewood Cookstove

Conclusion

In West-Pokot, firewood is accessible among households residing in rural areas, and inaccessible among households in urban areas. In Trans-Nzoia, firewood is inaccessible to households in rural and urban areas.

Distance per Kg of firewood collected in the rural and urban areas of Trans-Nzoia and West-pokot is neither influenced by land tenure system, family size, cookstove technologies, nor government policies and regulations. On the other hand, family size and land tenure systems influences household expenditure on firewood in rural areas of Trans-Nzoia and west-Pokot. Budgetary allocation on firewood in rural areas of Trans-Nzoia is influenced by land tenure system, while budgetary allocations in rural areas of West-Pokot are influenced by cookstove technology.

Recommendations: To improve the situation: i. Agriculture and forest extension officers should educate people in Trans-Nzoia on agroforestry practices and technologies to improve woodfuel accessibility by reducing distance, time, monthly expenditure and budgetary allocation on firewood. ii. In West-Pokot County, the local communities and other stakeholders should engage in planting firewood preferred tree species instead of waiting for natural regeneration, which has low survival rates. iii. Law enforcers need to pull up their socks in enforcing current government policies and regulations like Forest Policy 2006, Agricultural Act 2010, and Energy Policy 2006 to ensure that their effective effects are felt by firewood users. Policy-makers need to formulate new policies that will guide the design standards of improved cookstoves.

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