Environmental Research Journal 4 (4): 272-280, 2010
ISSN: 1994-5396

Livelihood Diversification Strategies and Soil Erosion on Mount Elgon, Eastern Uganda: A Socio-Economic Perspective

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Abstract: Land resources in Uganda are continuously shrinking and getting degraded despite being the main livelihood assets for rural communities. Using the modified household economic model, this study examines the socioeconomic factors and conditions affecting household productivity and land degradation on the slopes of Mt Elgon. Primary data were obtained through household survey conducted in Tsekululu Sub County, Bubulo County, Manafwa District, Eastern Uganda between May and August 2008. The results reveal that agriculture and dependence on park environmental resources as the main sources of livelihoods for the communities surrounding the park. Extraction of environmental resources from the park is dominated by the energetic, young and productive age groups. About 90% of the respondents use environmental resources as medicine, firewood, animal fodder, for domestic, agricultural, socio-cultural and commercial purposes. Results further indicate that age of household head, type of dwelling, size of land owned, private land ownership and park encroachment significantly affect household productivity at the 95% ($p = 0.05$) confidence level. Slash and burn accelerates soil erosion and reduces soil fertility in the study area while crop rotation and mulching enhance soil conservation. The insecure land tenure of the communities adjacent to the park compromises their ability to adopt soil conservation measures. It is recommended that land policies addressing the security of park adjacent communities and agricultural interventions focusing on agro forestry be formulated and implemented in the area. The communities should be mobilized to form needs-driven cooperative groups.

Key words: Household productivity, livelihood strategies, soil erosion, soil conservation practices, Mount Elgon, compromises

INTRODUCTION

Land resources form the main asset for the derivation of livelihoods by most rural communities. Nearly 80% of the Ugandan population relies on land and agriculture for their primary livelihoods. However, the agriculture resource base has been both shrinking and degrading with the increasing population pressure and marginal lands with very steep slopes increasingly being brought under cultivation (ibid). This has led to intense land degradation due to soil erosion on mountain slopes. Resulting from this is low and in many cases declining agricultural productivity. Demographic projections by district suggest that as a country Uganda will be depleted of agricultural land by 2022 with the Eastern region running out of available agricultural land earlier than the other regions (Jorgensen, 2006). Finding ways to reverse these trends is an urgent need in Uganda and many other developing countries. Communities on Mt Elgon region derive most of their livelihoods from agricultural activities. However, literature on the socioeconomic factors affecting hill agricultural diversification strategies is rather still scarce (Buyinza *et al*., 2008). Previous studies including (Muwanga *et al*., 2001; Knapen *et al*., 2006; Claessens *et al*., 2007) have generally focused and developed soil erosion predictive models based on biophysical aspects. However, the socioeconomic conditions, factors and interactions that influence peoples land management decisions and their implications for sustainable productivity and land degradation are variable and complex. Addressing this information gap therefore requires urgent attention.

This study is based on a study carried out in Tsekululu Sub County, Manafwa District aimed at examining the relationship between household productivity and land degradation. To achieve this goal,

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the socioeconomic factors and conditions affecting household choices regarding income strategies and soil conservation of the communities adjacent to Mt Elgon National Park (MENP) are investigated.

MATERIALS AND METHODS

The study area: The study was conducted in Tsekululu Sub County located on the slopes of Mount Elgon in Bubulo County, Manafwa District, Eastern Uganda Fig. 1. The sub County lies adjacent to MENP ($1^0$25'N and $34^0$30^{1}E) which is situated approximately 100 km Northeast of Lake Victoria on the Kenya-Uganda border. Mt. Elgon, a solitary volcano is one of the oldest in East Africa. It rises to a height of about 4, 320 m above sea level. The region receives an approximately bimodal pattern of rainfall with the wettest months occurring from April-October.

The mean annual rainfall ranges from 1500 mm on the eastern and northern slopes to 2000 mm in the south and the west. Mid-slope locations at elevations between 2000 and 3000 m tend to receive more rainfall than either the lower slopes or the summit. On the lower slopes, the mean maximum temperatures increases from 25-28°C and mean minimum temperatures are 15-16°C (Buyinza and Nabalegwa, 2007).

The vast area of the mountain is made up from lava debris blown out from a greatly enlarged vent during the Miocene period (12-20 million years ago). The relatively young and fertile calcium-sodium-potassium rich soils are shallow, dark, humus loams that are permanently moist. On the steep slopes in the high altitude moorlands, very shallow soils are found. However, red brown, clay loams have formed on the gentle slopes (MCEP, 1997).

The vegetation of Mt. Elgon reflects the altitudinally controlled zonal belts commonly associated with large mountain massifs. Four broad vegetation communities are recognized namely mixed montane forest up to an elevation of 2500 m, bamboo and low canopy montane forest from 2400-3000 m and moorland above 3500 m (Howard, 1991).

According to the 2002 census, the Sub County had a population of 28,836 persons (14,582 males and 14,254 females) with a corresponding population density of 588 persons km^{-2} compared to 126 persons km^{-2} for Uganda as a whole. The mean household size was 4.6 persons per household (UBOS, 2002). The population has been steadily increasing over the years with a growth rate of 3.3% per annum (ibid). This is attributed to the high birth rates and the limited immigration. Up to 95% of the population lives in the rural areas. The number of females almost equals that of males with the indigenous population comprising Bamasaba (95%). The other tribes include Banyole, Iteso, Babukusu and Sabaot (Manafwa Local Government, 2007).

Land in Tsekululu Sub County is divided between areas designated as National Park and land used for farming. Farmland in the sub county is itself divided

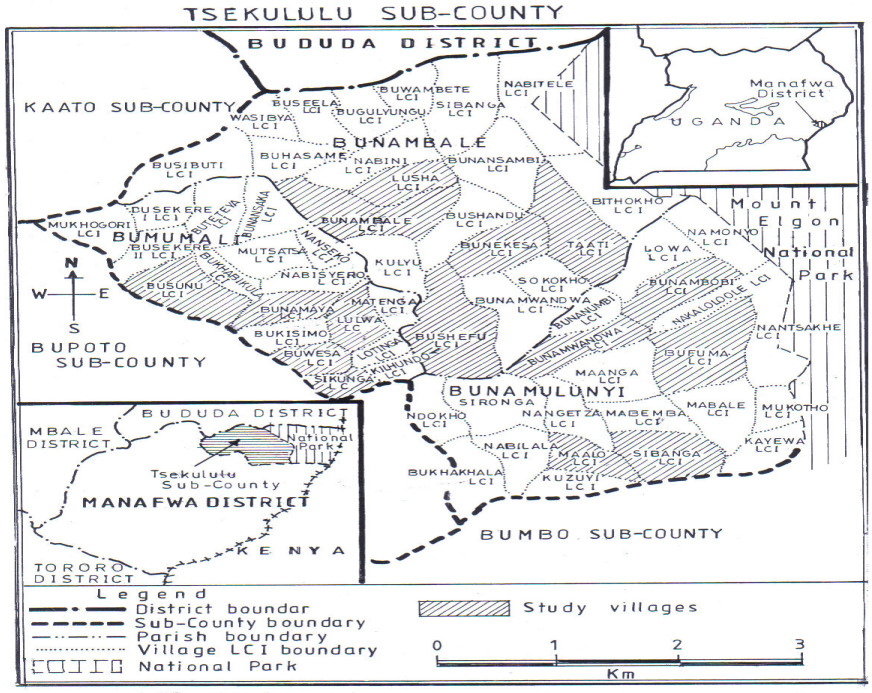

Fig. 1: The study villages

Table 1: Sampled villages from each of the three parishes

Parish	Sampled villages (LC 1)
Bumumali	Sikungu
	Buwesa
	Bunamaya
	Busunu
	Lulwa
Bunambale	Bunambale
	Lusha
	Bunekesa
	Taati
	Bushifu
Bunamulunyi	Bunamwandwa
	Bufuma
	Sibanga
	Maalo
	Bunambobi

LC1: Local Council 1

between two topographic zones, an upland zone characterized by intensive coffee and maize farming and a lowland zone where beans, yams and onions are grown. Arabica coffee and bananas are traditionally the major cash crop and staple food of the Sub County, respectively however, there is increasing reliance on maize and beans for food and food crops are also sold for cash. Other crops include Irish potatoes, rice, soybeans, millet, wheat and green vegetables such as cabbages, tomatoes and spinach. Most households also keep livestock, particularly dairy cattle utilizing zero grazing regimes for sale and own consumption of milk and meat as well as small stocks of goats, sheep, pigs and chicken.

Data collection: Three study parishes including Bunamulunyi, Bunambale and Bumumali were sampled and stratified according to their distance from the Park boundary. Bunamulunyi and Bunambale parishes were selected because they are adjacent to the Park boundary whereas Bumumali is >15 km away from the Park boundary Table 1. Five villages or Local Council1 (LC1) were randomly selected from each of the parishes.

From each of the villages, 10 households were randomly selected for the interviews making a total of 150 respondents. Key informants included local leaders, clan elders and Uganda Wildlife Authority (UWA) Staff. The clan elders provided agricultural, land degradation and cultural information that was relevant in explaining environmental resource use and household productivity strategies.

The local leaders and UWA staff described their roles and current policies regarding access to park resources and the relationship between them and park adjacent communities. The above were coupled with own field observation of land degradation particularly soil erosion and landslides in relation to slope angle. Secondary data were obtained from reading policy documents from UWA, the District Environmental Reports and other relevant documents.

Table 2: Factors affecting household productivity in Tsekululu Sub County

Variables	Variable definition
Age	Age of Household Head (1 if 20-29; 2 if 30-39; 3 if 40-49; 4 if 50-59; 6 if 60-69; 7 if 70-79; 7 if 80+years old
MS	Marital status (1 married; 2 single; 3 widow/widower; 77 no response
ED	Education level of household head (1 none; 2 primary one to primary seven; 3 senior one to senior four; 4 tertiary education)
OCC	Occupation of household head (1 farmer; 2 teacher; 3 civil servant; 77 no response)
AGP	Age productivity of household members (1 =<; 2 if 16-34; 3 if 35-64; 4 if => 65 years old)
TD	Type of dwelling (1 temporary; 2 semi permanent; 3 permanent)
HHW	Household Wealth as ranked by elders (1 rich; 2 well off; 3 comfortable; 4 poor; 5 very poor; 77 no response)
SFL	Size of farmland (1 if <1; 2 if 1-5; 3 if 6-9; 4 if =>10 hectares of land)
ALU	Land use (1 if all land is used for grazing and cropping;2 if otherwise)
LT 1	Private land ownership (1 if yes; otherwise 0)
LT 2	Land inherited from parents (2 if yes; otherwise 0)
LT 3	Communal land ownership (3 if yes; otherwise 0)
AFS	Access to financial services (1 if yes; 0 if no)
PSA	Participation in social programs and organizations (1 if yes; 0 if no)
DP	Distance from park boundary (0 =<1 km; otherwise 1

Data analysis: Primary data collected through the household survey was analyzed using the Statistical Package for Social Scientists computer package (SPSS Version 16). Descriptive statistics such as frequencies and percentages were performed to establish the socioeconomic profile of the study area. A linear regression model was run to establish the socioeconomic factors affecting household annual net per capita income. The household annual net per capita income was calculated by subtracting the annual total costs involved in the production of goods and services from the annual gross income.

The following were considered as predictor variables; age, marital status, education level and occupation of household head, age productivity of household members, type of dwelling, household wealth, size of farm land, agricultural land use, land tenure systems, access to financial services, participation in social programs and organizations and distance from the Park boundary (Table 2).

RESULTS AND DISCUSSION

Socio economic and demographic characteristics of the respondents: About 77% of the respondents were males (Table 3). Almost 80% of them were aged between 35-64 and therefore old and productive. While 96% of the respondents were married. About 64% of them were educated up to primary school level. Where 95% were farmers and about 86% owned <1 ha of land of which 97% were cultivating and grazing on all the land. While 49%

Table 3: The socio-economic and demographic characteristics of the respondents

Variables	Frequency	Percentage
Sex		
Male	115	77
Female	35	23
Age group		
16-34	6	4
35-64	130	87
=65	14	9
Marital status		
Married	145	96
Divorced	4	3
Single	1	1
Educational level		
None	25	17
Primary	96	64
Secondary	27	18
Tertiary	2	1
Occupation		
Farmer	143	95
Teacher	3	2
Civil servant	3	2
No response	1	1
Size of land owned and tenure		
<1	129	86
1-5	21	14
Private	36	24
Inherited	74	49
Communal	1	1
Park encroachment	35	23
Rent from neighbor	4	3
Land utilization		
All land used for grazing and cropping	146	97
No response	4	3
Type of dwelling		
Temporary	21	14
Semi permanent	129	86
Household wealth as ranked by elders		
Well-off	13	9
Comfortable	101	67
Poor	23	15
Very poor	12	8
No response	1	1

had inherited the land from their parents while 23% encroached on the Park for their livelihood. Almost 67% were ranked by elders as comfortable households in terms of wealth. While 86% of the dwellings were semi permanent.

The main sources of household income and livelihood activities

On-farm income: Results indicate that the primary sources of income include the production and sale of agricultural products. The main crops grown by the sampled households include maize, cassava, coffee and beans. Other crops include Irish potatoes, onions, passion fruits, tomatoes and peas. Majority (86%) of the respondents own <1 ha of land of which 97% use all the land for crop and livestock production. The production takes place from owner occupied farms of which 49% were inherited from parents while 23% privately own the land. About 23% encroach on the National Park (Table 3).

Table 4: Agricultural land productivity of different crops (Buyinza *et al.*, 2008)

Parameters	Variables	Number
Agricultural land	Total cultivated area (ha)	53.55
	Average farm size	0.66
	Lowland	0.25
	Upland	0.62
Land utilization (%)	Cereal crops	80.00
	Cash crops	7.00
	Fruits	3.00
	Forest/pasture	10.00
Area (ha) and	Maize area	28.12
productivity (kg)	Productivity	1176.00
	Rice area	9.38
	Productivity	2257.00
	Millet area	2.27
	Productivity	867.00

At a region-wide level Buyinza *et al.* (2008) estimated that about 80% of the cultivable land in Mt. Elgon forest watershed is used for growing cereal crops, 7% for cash crops and 3% for fruit crops. Mt. Elgon forest watershed supplies all the water used for agricultural activities in the region.

Two crops are mainly grown in a year. In case of lowland, only a single crop of rice is grown as summer crop and only a few farmers have recently started growing wheat as winter crop after rice. Some farmers have also grown spring maize in lowland before rice. The other crops grown in upland lands are maize, millet, wheat, Soybean and legumes. Details on agricultural land, productivity of different crops and input use are shown in Table 4.

The average yield of maize and rice was estimated to be 1560 and 2550 kg ha^{-1} which were increased by 32 and 13%, respectively as compared to the year 2000 (MAAIF, 2005). Their productions are still low as compared to the district average except for legumes and Soybean crops which show an increasing trend (Fig. 2).

Farmers that have adopted and established technologies such as contour hedgerows register positive results on agricultural productivity. However, the inadequate participation of most rural farmers in agricultural technology development is partly responsible for their inability to take full advantage of the improved agricultural technologies.

Agricultural technology development among smallholder farmers is still very low. It is therefore imperative that appropriate technology that suits the local economic, cultural and geographical conditions of the region is developed and promoted (Buyinza *et al.*, 2008).

Local breeds of chicken, cattle (both indigenous and exotic) and goats are the main livestock owned. Other animals include pigs and Turkeys. A mixture of improved and local breeds of livestock is kept by the farmers.

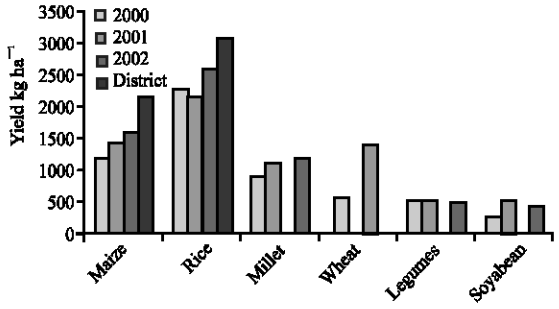

Fig. 2: Comparison of different crop yields with Mbale District production average (MAAIF, 2005)

Off-farm income: Off-farm income sources such as wage labour on other people's farms were reported by only 3% of the respondents. Arrangements such as in-kind payments like harvest share systems and other non-wage labour contracts were not captured by this study. However, most landless people do not want to admit that they work for others for fear of being embarrassed, therefore leaving the off-farm income source uncovered making agriculture, environmental and non-farm activities as the main livelihood strategies in the Mt. Elgon area (Buyinza and Nabalegwa, 2008).

Environmental resources: The Park contains a wide range of environmental resources which are of great value to the communities living around it. These resources include; medicinal plants, firewood, fodder for livestock, sticks for hoes, poles for building, vegetables, thatch grass, wild fruits and craft material.

About 35% of the respondent use the park resources for domestic purposes, 33% for agricultural purposes and 30% are looking for grazing land while 2% seasonally visit the park in search of particular plant species, soil and honey for socio-cultural reasons notably circumcision rituals. Buyinza and Nabalegwa (2008) found out 31.3% of the total environmental income for Mt. Elgon adjacent communities was derived from firewood much of which was from the National Park.

Access to these resources is regulated through the Collaborative Forest Management (CFM) initiative of UWA in which the park adjacent communities are allowed to access certain parts of the forest during specific periods of the year. Resource extraction quotas are imposed as a way of ensuring sustainability. Under the same arrangement, mechanisms and practices have been put in place by UWA with a view of having communities and Park staff share in the benefits and responsibility for the management of the Park ecosystem Table 5. However, illegal access to restricted zones and lack of adherence to resource harvesting quotas are still major management problems posed by the communities (UWA, 2000). The conflict between resource users and resource conservers has been the greatest hindrance in the conservation of Mt. Elgon. The ever increasing illegal access to the Park is partly a result of local leaders who are more inclined to tolerate encroachment and exploitation of protected areas due to local political pressures and economic interest than conservation (UWA, 2000).

Table 5: Community dependence on park resources (N = 697)

Park resources	Frequency	Percentage
Firewood	122	17.5
Wild fruits	29	4.2
Medical plants	182	26.1
Small animals: birds, mice	1	0.1
Thatch grass	39	5.6
Poles for building	63	9.0
Sticks for hoes	74	10.6
Rope materials	1	0.1
Craft material	26	3.7
Fodder	104	14.9
Vegetables	56	8.0

Non-farm income: Trade in park environmental resources was reported by 52% of the respondents. The trade items mainly included bamboo shoots (31%), timber (29%) and firewood (28%). Other minor items included charcoal, bricks and handcraft which collectively accounted for 13%. The people engage in trade in order to buy food and other basic items, expand and diversify their income sources, buy seeds and to respond to the demand for goods.

Although, the respondents could not attach direct economic costs involved in the extraction and processing of these raw materials, it is obvious that the extraction of these raw materials is labour intensive, restrictive and requires walking long distances inside the Park. For example bamboo shoots can only grow at an altitude range of 2400 and 3000 m above sea level. Given the fact that most of the settlements lie within 1000-1800 m above sea level and that most of the slopes are steep ranging between 36 and 58% grade, it then becomes apparent that accessing these resources requires a lot of energy. Moreover, trade in environmental resources was dominated by the young and productive (16-34) and mature and productive (35-64) age groups taking 36 and 94%, respectively.

Income from school teaching and civil service was accounted for by only 4% of the respondents. This could be related to the low level of education of the respondents were by majority (64%) (Table 3) had attained just primary school education and therefore could not be formerly employed.

The socio-economic asset profiles and external factors affecting household productivity: Results indicate that the variables age of household head, type of dwelling, amount land owned and size of farm land, land tenure systems (especially the private ownership) and encroachment on the National Park resources significantly affect household productivity at the 95% ($p = 0.05$) confidence level.

Human capital: Age of household head also significantly affects household annual net income. The average age of the household heads in this case was 45 while the range was between 15 and 80. Investments and savings are often long term projects whose benefits take long to be realized. It is therefore understandable that older people will have accumulated bigger savings and investments and therefore bigger return on investments than their young counterparts. In fact, as an investment in human capital, older the people had more children who contributed farm labour, farming being the main stay of the area constituting over 95% of the respondents occupations. With limited income opportunities and higher unemployment, larger families are likely to rely on the labour intensive environmental resources to meet their basic needs, this being made possible by the human capital existing within these families (Buyinza *et al*., 2008).

Marital status, occupation, education level of the household head, age productivity, household wealth as ranked by elders, land utilization and distance from the park boundary are variables found not to have significant effect on the household's annual net income at the 95% confidence level. Similar results were obtained by Buyinza and Nabalegwa (2007) where sex, age and educational level of the household head did not yield significant results when regressed against forest income.

Physical capital: Land holding ranges between from 0-6 ha and the mean was 1.5 ha. Households which own more land are likely to earn more income from working on the land. Therefore, land size is expected to have a positive impact on household net incomes. This is because the land can be utilized in the generation of on-farm incomes including crop and livestock production. However, the amount of land owned and size of farmland were found to have negative effects on household productivity. This indicates that management, labour and other constraints limit the ability of larger farmers to be as productive as smaller farmers. This therefore suggests that smaller farmers attain higher productivity from their land than their larger counterparts, conforming to a number of studies which have built upon the ideas of Boserup (1965) about the potential of agricultural intensification under conditions increasing population density and shrinking land holdings. As posted by Adams and Mortimore (1997) increasing population densities have positive consequences and not negative consequences for the economy and environment.

Table 6: Factors affecting annual net per capita income

Predictor variables	t-ratio	p-values
Age	0.90	0.030
MS	-0.13	0.470
ED	0.38	0.540
OCC	-1.34	0.800
AGP	-0.96	0.960
TD	1.76	0.010
HHW	-1.12	0.490
SFL	2.26	-0.002
ALU	1.01	0.770
LT 2	0.46	0.286
LT 1	-0.48	0.015
LT 3	1.03	0.579
AFS	0.39	0.086
PSA	1.26	0.078
DP	0.23	0.480

Standard error of estimate = 405.4; $R^2 = 15.5\%$; R^2 (Adjusted) = 5.5%; $p = 0.05$; Sample

Studies in Kano Close-Settled Zone (KCSZ) and nearby areas of Nigeria and Niger and in Machakos District in Kenya reveal that despite population pressure, agricultural intensification can take place while avoiding the land degradation through investment in proper land management techniques (Ellis-Jones and Tengberg, 2000). Under the right conditions, small scale farmers can and will invest in their land as population rises, thereby enhancing their livelihoods (Brookfield, 1984).

In the linear regression model as shown in Table 6, the variable type of dwelling has a positive effect on the annual net per capita income of the households ($p = 0.01$). This could be explained in terms of permanence of the housing structures vis avis land tenure. Results revealed that 86% of the households were semi permanent while only 14% were temporary (Table 3). The permanency of a household is partly determined by the land tenure systems existing in an area. In this area 49% of the land was inherited from parents while 24% was privately owned. These two tenure systems give the land owner the freedom to use the land optimally. It should also be noted that 23% of the respondents encroach on the National Park. This insecure and uncertain arrangement often compels people to maximize utility from such land whenever they get chance.

Social capital: Participation in agricultural training and extension does not significantly affect household productivity ($p = 0.086$). This can be attributed to the ineffectiveness of such organizations and programs in the study area as reported by the respondents. Notable among these programs are; The National Agricultural

Advisory Services (NAADS) and the Plan for Modernization of Agriculture (PMA) both government programs aimed at enhancing and modernizing agricultural productivity in the country. Interviews with the respondents revealed that the majority of the people (95%) do not have knowledge about the existence of such programs where to find them and how to benefit from them. Those who expressed knowledge about them complained that the people concerned were inaccessible. Access to such programs and extension services could be enhanced if farm households are mobilized to form needs-driven cooperative groups. Agricultural extension should be focused on promoting agro forestry in the highland areas because of its ecological, economic and social benefits.

Financial capital: Results indicate that credit facilities and institutions do not exist in the study area. When regressed against household net per capita income, access to markets did not give statistically significant results ($p = 0.078$). This could be attributed to the subsistence level of production where most households produce items for home consumption. Similar findings were obtained by Buyinza and Nabalegwa (2007) where many households in adjacent to Mt. Elgon depend on social norms to access credit and loans whose collateral property are standing crops such as coffee and maize. The loans are paid back after selling the season's surplus crop harvests. As agricultural modernization and commercialization proceeds in Uganda access to markets, infrastructure and credit are much more important. Mechanisms should be put in place to ensure that communities access this infrastructure in order to enhance household productivity thereby improving livelihoods.

Land tenure: Of all the land tenure arrangements existing in the study area, private land ownership significantly affect household productivity ($p = 0.015$). This can attributed to the fact that private owners are more likely to invest in soil and water conservation measures in order to recoup the costs of their investment in buying the land. This therefore, leads to increased productivity and reduced land degradation. A total and opposite contrast exists for those owning land through inheritance and communal arrangements under the customary tenure system where such initiatives are unlikely to be undertaken since beneficiaries do not have capital investments on the land upon acquisition.

The dominant land tenure system in the study area was customary (49%) with the majority of respondents having inherited the land from their parents. This was followed by private lease owners (24%). About 23% were landless and therefore were encroaching on the National park land. About 3% were either renting or borrowing land from neighbours for a specified time period. Crop harvest share systems and non wage labour contracts were the main modes of land rental.

More land degradation forms were observed on the encroached and rented land than on inherited and privately owned land. Encroachers and tenants on rented land were unlikely to invest in soil and water conservation measures citing the uncertain future and short term periods on rented land. Owners of purchased land and tenants using cash rental may have more incentive to produce cash crops and apply inputs to be able to recoup the costs of their investments. In fact, land management practices including mulching were more pronounced on privately owned land, thus further strengthening the argument that private owners are more likely to invest in land and soil conservation measures.

Distance from the park boundary: Distance from the park boundary was found not to have a significant relationship with household annual net income ($p = 0.48$). This could be due to the fact while it is easier and cheaper for park adjacent communities to access and trade in park environmental resources; those far away find it more economical to concentrate on farm, off-farm and non-farm activities. This in return balances the economic benefits that each of these communities accrue from the pursuit of its income portfolio. This argument is reinforced by Buyinza and Nabalegwa (2007) where a negative relationship was found between per capita forest income and distance to the forest.

Soil erosion and conservation practices: Soil erosion, deforestation and overgrazing are key factors of decreasing per capita income in the Mt. Elgon catchment (Buyinza and Nabalegwa, 2008). The small land holdings are as a result of very rapid population growth and inappropriate cultivation techniques. They further observe that more serious soil erosion problems occur on the marginal slopes ranging between 36 and 58% grade which dominate the Mt. Elgon catchment.

This study did not attempt to measure the intensity of the different soil erosion forms; field observations coupled with respondent interviews were used to elicit information about soil erosion in the area. Sheet, rill, gulley erosion and landslides are very common in this region. Farming activities take place at very steep slopes which are susceptible to landslides. Findings similar to Buyinza and Nabalegwa (2008) were obtained when the slope angles of the observed landslide sites were measured (Mugagga and Kakembo in prep).

Table 7: Land use and cover changes in the recent past

Changes	Frequency	Percentage
Reduction in crop quality and yield	126	84.0
Rapid loss of vegetation cover	9	6.0
Loss of soil fertility	9	6.0
Increased land use due to increased soil conservation	1	0.7
New settlements and encroachment	1	0.7
NR	4	2.7
Total	150	100.0

NR = No Response

The majority of respondents reported that soil was being washed down from their sloping land and 84% have felt the reduction in crop quality and yield was due to soil erosion. A small number of the farmers that had identified soil quality as the main factor causing declining yield did not know how to improve the soil quality (Table 7).

The main factors influencing the rate of soil erosion include rainfall, runoff, wind, soil, slope, plant cover, population density and the presence or absence of conservation measures (Bagoora, 1988). Precipitation levels in the study area are high and intense, slopes are very steep, deforestation is wide spread, population densities are high and few conservation measures are used. On-going farming practices such as ploughing are also responsible for aggravating soil erosion. Farmers hold the false belief that exposure of land to the sun, rain and air for a long period helps to improve soil fertility (Buyinza *et al*., 2008).

As environmental conditions in the study area are likely to exacerbate soil erosion, the limited use of soil conservation methods by most farmers is probably a significant factor relating to soil erosion, declining soil fertility and decreasing crop yields. With the exception of contour ploughing and terracing, use of soil conservation methods increases with distance from the National Park boundary. Farmers living far from the Park boundary use far more soil conservation methods. The low proportion of farmers using soil conservation methods in and around the park is mainly due to the insecure land tenure. There is a widespread fear of eviction amongst people who live in the park and until they are certain that they will not be evicted, they are not prepared to invest resources in improving the quality of their land. Buyinza and Nabalegwa (2007) concluded that settling land tenure conflicts was of prime importance if sustainable resource use was to be adopted by the communities living around MENP.

The most common land conservation practices used by the people in the study included were use of slash and burn to prepare the fields (20%), application of mulch (16%), household residues (15.1%), incorporation of crop residue (14%), crop rotation (13%) and application of manure or composit (12%). Use of fallow had declined and the use of organic and inorganic sources of fertility was still very limited, contributing to perceived declines in soil fertility and crop yields in the study area. Of all the land conservation practices, crop rotation and mulching were observed to have a big effect on agricultural productivity. Farmers noted that rotating crops season after season coupled with mulching helped much in restoring soil fertility and reducing problems of pests and diseases.

Slash and burn is a very common and continuously increasing practice in the non-irrigated marginal cultivated uplands of the Mt. Elgon catchment area (Buyinza and Nabalegwa, 2008). Various forms of erosion (including rills, gullies and sheets) were observed on fields that had been reportedly prepared using this method. Burning denatures the physico-chemical properties of the soil and therefore exposes it to the agents of erosion. Use of inorganic fertilizers is not very common in the study area. This can be attributed to the costs involved in acquiring these fertilizers, bearing in mind that most of the farming is of subsistence nature. Crop rotation contributes to long term productivity by helping to restore soil fertility and reducing problems of pests and diseases.

This study did not investigate the factors influencing the adoption of different soil conservation strategies by farm households. However, Buyinza *et al*. (2008), observed that the adoption of soil conservation strategies varies from one farmer to another, depending on several ecological, social and institutional factors including; availability of extension services, farmers tribe affiliation, agricultural labour force size, land holdings, farmers training, schooling period of farm household head, participation in joint soil conservation activities and landslide density in farmlands.

With regard to the above, agricultural extension work should be promoted and focused on promoting agro forestry techniques which address the environmental, social and economic needs of the highland areas of Uganda.

CONCLUSION

The study has revealed that on-farm agricultural activities and dependence on park environmental resources are the main sources of livelihoods for the communities adjacent to Mt. Elgon National park. Several socio-economic factors such as the age of household head, the type of dwelling, land ownership, private land tenure and encroachment on park resources affect household productivity. There is no significant relationship between household productivity and distance from the park boundary.

While soil conservation practices are more pronounced with communities that are far away from the park boundary, those adjacent to it are reluctant to invest and adopt soil conservation practices due to the insecure land tenure. However, apart from the prevailing

environmental conditions, the wide spread use of slash and burn as the main land preparatory/ conservation practice is a significant factor relating to soil erosion, soil fertility and decreasing crop yields among farm households.

There is therefore need for policy makers to address land tenure security of the communities surrounding the park. This will not only motivate farm households to invest in soil conservation techniques but also improve their livelihoods. The communities on the other hand need to be educated about the dangers of using slash and burn as a land preparatory method. Agricultural extension work should be promoted and focused on promoting agro forestry techniques which address the environmental, social and economic needs of the highland areas of Uganda. The communities will benefit better if they are mobilized to form needs-driven cooperative groups.

ACKNOWLEDGEMENT

The researchers gratefully acknowledge the research grant from the Department of Research Capacity Development of Nelson Mandela Metropolitan University, Port Elizabeth, South Africa.

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