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Economic Value of Agricultural Land for Community Livelihoods within the Context of REDD+

N. A. Madalla[1*] and A. E. Majule[1]

[1]Institute of Resource Assessment, University of Dar es Salaam, Box 35097, Dar es Salaam, Tanzania.

Authors' contributions

This work was carried out in collaboration between all authors. Author NAM designed the research, managed the literature searches and field survey, performed the structural quantification and analyses of the study, discuss the conclusion and finally wrote the whole manuscript. Author AEM provided supervision and guidance on the whole process. All authors read and approved the final manuscript.

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ABSTRACT

A study was carried out in two villages of Mughunga and Pohama in Singida Rural District, central Tanzania, to assess the economic value of agricultural land for community livelihoods within the context of Reducing Emissions from Deforestation and Forest Degradation (REDD+). Market price valuation method was used to assess the economic value of agricultural land. Findings showed that a good number of people in both villages depend on agriculture (96.4%) and livestock keeping (90.1%) for their livelihoods. The economic value of agriculture land was revealed to be 35,871,750 and 49,259,382Tsh per acre for Mughunga and Pohama villages respectively, with high contribution from sunflower, followed by sorghum and maize crops. The study results revealed lower economic value, mainly of food crops such as maize and bulrush millet. This implicates changes in the agricultural land as these crops were valued high in the past. The major reasons for such changes include decline in agricultural production and increased pressure for land resources. For sustainability of agricultural land in the study area, efforts need to be scaled up towards conservation of agricultural land by all parties, that is, communities, government and private entities.

**Corresponding author: Email: noelmadalla@yahoo.com, amajule@ira.udsm.ac.tz;*

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1. INTRODUCTION

In recent years there has been a growing concern in understanding the economic value of agricultural land for community livelihood. Increasing global population within environmental limits has been identified to be the major reason for such concern. In Africa for example, 80 percent of the population depend on agriculture for their livelihoods [1]. Demand for food, energy, raw materials and animal feed drives agricultural land use change and thus resulting to massive deforestation, biodiversity loss and land degradation [2-5]. More recent studies conducted in Sub-Saharan countries revealed increased competition for land resources such as arable land for crop production and rangelands for grazing as well as forest and water resources. Climate change is placing additional stress on agricultural productive areas exacerbated by recent pressure for biofuels production. As a result, land conversion and land degradation are currently taking place at an alarming rate resulting to low agricultural productivity and substantial release of greenhouse gases when forests are cut. Apparently, it is estimated that agriculture accounts for about 30 percent of total carbon dioxide emissions and greenhouse gases [6]. Land-clearing for agricultural use, including croplands and shifting cultivation as well as deforestation are the most important sources of these emissions. In Tanzania for example, various sources have reported about the forest depletion and degradation [7-9] contributing to almost 20% of the total emission. This trend is expected to be much higher given the current pressure for agricultural development as well as the implementation of a strategic drive known as Kilimo Kwanza. The analysis of newly expanded agricultural land in tropical Africa during the 1980s and 1990s revealed in tropical African countries, agriculture is the primary cause of deforestation. Around 3 million hectares of forest is estimated to be lost across tropical Africa every year and research suggests that the majority of this is caused, at least in part, by the conversion of forests to cropland and pasture [10]. Throughout Africa as a whole, nearly 60% of new agricultural land was derived from intact forests and another 35% came from disturbed forests. The remaining 5% of new agricultural land was taken from shrub lands [2]. Another Landsat-based study in sub-Saharan Africa (1975–2000) confirms this general trend, estimating that 58% of new agriculture came from forests. However, land sources varied considerably across the continent (Fig. 1). For example, in Central Africa agricultural land was taken largely from intact forests, whereas East and West Africa used roughly equal amounts of intact and disturbed forests [2]. Shrub lands were converted primarily in regions with little forest cover and constituted a significant source of expanding agricultural land only in East Africa.

On the other hand, while all these are happening, global efforts to mitigate climate change call for national implementation of REDD+ policies. Reducing Emissions from Deforestation and Forest Degradation (REDD+) is a new global climate policy initiative designed to reduce the emissions of greenhouse gases from deforestation and forest degradation. According to Dixon et al. [11] it is anticipated that, REDD+ policies might limit the expansion possibilities of agricultural land use. The restriction of land by REDD+ policies might change comparative advantage and will influence competitiveness, agricultural prices, trade, production and land use impacts across the world [11]. Over years, agricultural land in Tanzania has undergone significant changes [12-14]. The major change has been increased land degradation and transformation of forestland to agricultural land [15]. These changes influence its economic potential and ultimately undermine productivity from agriculture. More recent studies conducted in the study area have established that, Mgori forest, which is among potential REDD+ area, is subject to increasing pressures as a result of high demand for agriculture land causing resources degradation. For example, woodland decreased by 53.8% within a period of 10 years from 1990 to 2010 on the expense of bushland which increased by 22.9%. In general agricultural land also increased by 4.8% and this was linked to expansion of crop land due to much dependence on community livelihoods by between 65 and 70% [12]. However, experience from other potential REDD+ regions in Tanzania, such as Manyara, based on landuse cover change analysis for specified periods (1990, 2000 and 2010) indicated that, with the context of REDD+ natural forests appears to be well managed as such land areas increased from 2005 to 8198 ha between 1990 and 2000. In this view, it should be noted that REDD+ project may present challenges and opportunities to agricultural land and forest resources. Moreover, various reviewed literatures in Tanzania and other parts of the world clearly showed that the economic value of agricultural land has not comprehensively studied and to date little information exists on economic value of agricultural land and its implications to community livelihoods. Such information is crucial in the formulation of countries agriculture policy, planning investment on agriculture land and support the implementation of REDD+ project. The merely information available on land resources valuation in Tanzania include the work by Majule et al. [16]. The study assessed the economic value of land resources, ecosystem service and the cost of land degradation in Tanzania. The focus of this attempt was more on valuing selected land resources with little attention paid to investigate changes in economic value of agriculture land. Similarly, another study conducted by Abiama [17] focused on examining land rights and land value in Tanzania and does not assess changes in the economic value of agriculture land. Also much of the studies that show previous experience of similar case in other countries provide general information on land resources and those that quantify the economic value of these resources are somewhat limited to local and regional scales. For example, a study by Soussan and Sam in [18] on the values of land resources in the Cardamom Mountains of Cambodia assessed the contribution of land resources to national development, while Chabala et al. [19] study the value of land and the costs of land degradation in Zambia. All these studies focused more on the valuation of land resources in totality, neither of these focused on agriculture land. In this regard, it is therefore very imperative to investigate the dynamics of agriculture land value over years and establish possible implications to community livelihoods particularly within the context of REDD+. Therefore, the present research assessed the economic value of agricultural land to villages adjacent to Mgori forest. The information accrued from this study is expected to be used by stakeholders including scientific communities and policy makers alike, to address rampant problem of land degradation in Tanzania as well as making suitable decisions on land uses in agriculture.

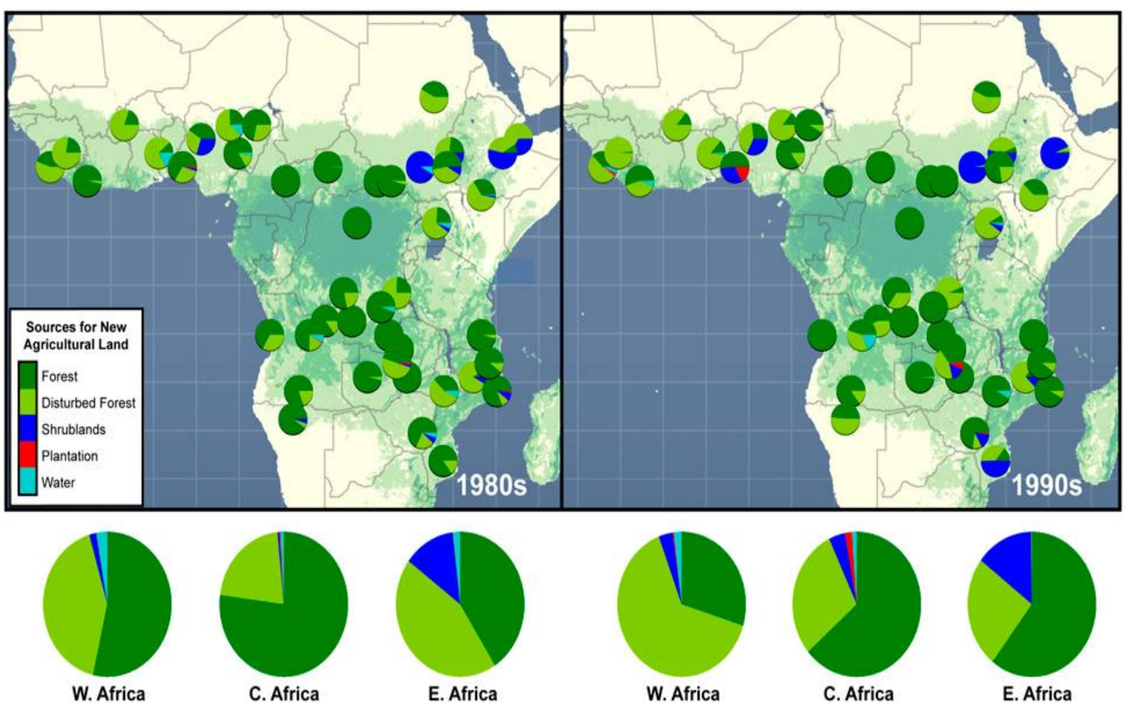

Fig. 1. Sources for newly expanded agricultural land in tropical Africa during the 1980s and 1990s source [2]

Objective of the Study

The overall objective of this study was to investigate the economic value of agriculture land and assess implications for community livelihoods within the context of REDD+. Specifically the study;

(i) Quantified the economic value of agriculture land utilization activities in the study area.
(ii) Investigated implications of changing agriculture land value on community livelihoods in the study area.
(iii) Identify specific livelihoods opportunities of the valued agricultural land for poverty reduction.

2. RESEARCH METHODOLOGY

2.1 Description of the Study Area

This study was carried out in Singida Rural District of Singida region, Tanzania. The district lies between latitudes 3º and 7º South and longitudes 34º and 35º East, covering an area of 12,164 Km^2 and is divided into 7 division, 28 wards and 146 villages (Fig. 2). It forms part of central plateau of Tanzania, an area of flat and gently undulating plains broken in places by prominent hills and has Mgori forest situated in the northern part of Singida Rural District with *Miombo* woodland constituting the largest portion of about 40000ha. The forest has valuable tree species such as *Pterocarpus angolenensis*, *Afzelia quenzensis* and *Dalbergia melanoxylon*. Singida Rural District was selected because is among the district potential for the implementation of global climate policy namely Reducing Emissions from Deforestation and Forest Degradation (REDD+). This is because of the presence of woodlands as well as experience of communities on forest governance under Community-based Forest Management (CBFM). Mughunga and Pohama, evidenced to have been experiencing agricultural land use change, are villages selected to assess changes in the economic value of agriculture land and their livelihoods implications to communities living adjacent to Mgori forest. Mughunga village is located in Mughunga ward about 45km from Singida town on the western part of Singida Rural District with a total population of 1891. Whereas Pohama village is located in Ngimu ward about 47km from Singida town on the Eastern part of the Singida Rural District with a total population of 2956.

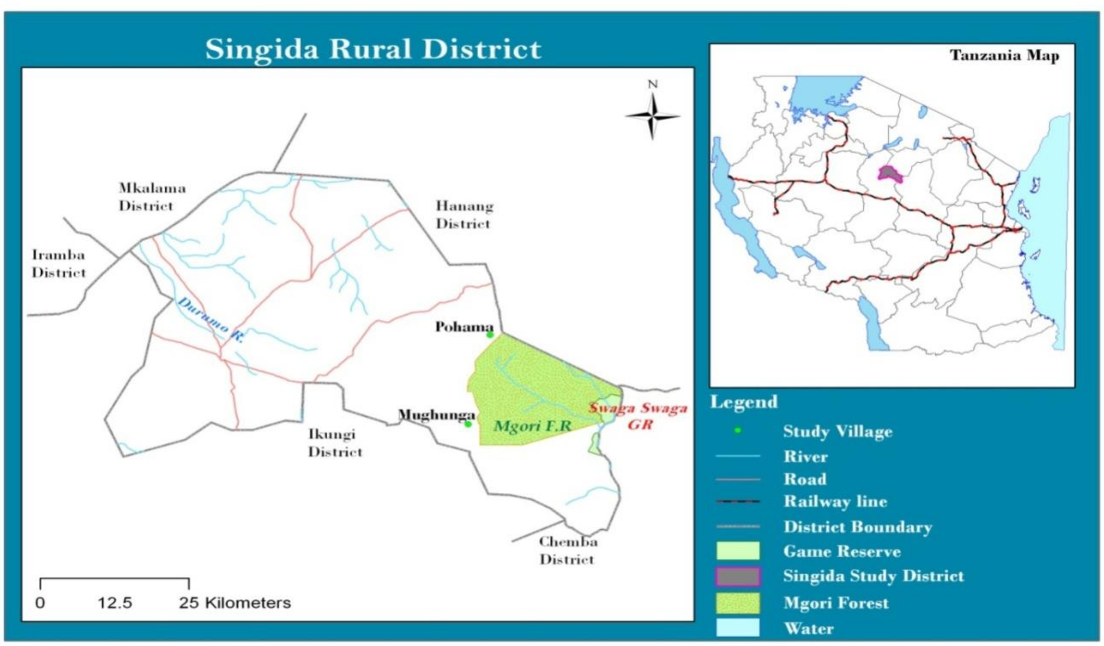

Fig. 2. Map of singida rural district showing the location of study village

2.2 Climatic Characteristics

A large part of Singida region is arid and the rainfall amount decreases from north to south of the region. The average annual rainfall ranges between 500–800 millimetres. The highest and more reliable rainfall is recorded in the northern part of the region where rainfall exceeds 750 millimetres in most seasons. The western part of Manyoni district has the lowest rainfall. In normal circumstances, rainfall usually takes place from mid November ending in April or early May every year. Temperature in the region ranges between 15ºC and 30ºC depending on season and altitude. This region described as one of the "drought-prone" areas in Tanzania.

2.3 Data Collection and Sampling

Various qualitative and quantitative methods or and techniques were used in this study to complement each other and to generate information. Both primary and secondary data sources were used to collect data on physical and socio-economic data. Primary data sources included household survey, in-depth interviews, participatory rural appraisal (PRA), key informants as well as physical observation. Secondary data was obtained from reviews of both published and unpublished literature from various sources. For Focus Group Discussion (FGD), a total of 15 people in each village were involved. For household interview a total of 50 and 61 head of houses were interviewed using a semi structured questionnaire and two Figs. represent 10% of the total number of households for Mughunga and Pohama villages respectively. Simple random sampling was used for household interviews where every household had an equal chance of being selected [20]. The methodology used in data collection and analysis is quite similar to that reported by Mwakalobo [21] and Lema and Majule [22]. Key informant interviews and FGD generated general information about the villages on utilization activities triggered agricultural land use changes in the study area and also social economic information. On the other hand, household data validated critical information generated during FDG.

2.4 Data Analysis

Qualitative data from various sources were examined and presented in different forms. Quantitative data were edited, coded and entered in a computer and the Statistical Package for Social Science (SPSS) software version 20 spread sheet was used for the analysis. Descriptive statistics were run to give frequencies and then cross-tabulation was undertaken. Multiple response questions were analyzed so as to give frequencies and percentages. Tables and bar charts were used to present different variables. Cross-tabulation allowed a comparison of different study parameters in the two villages. Data on agricultural land and forest were analyzed using Microsoft Office Excel 2007 to present productivity trends in the form of graphs.

2.5 Market Price Valuation Method

For the purpose of this study, market price valuation method was also used. This method quantified the annual value of agricultural land using local prices and production quantities to detect changes occurred to prices and production of agricultural products particularly those transacted in the formal market in a year. The total productivity of each crop per households per year was calculated then multiplied by a crop average price to get the annual values. For those products which have no formal markets, respondents were asked on their willingness to pay in order to purchase such a product. Various studies have also used similar method [see for example 23-26]. Most of such studies consider prices of different crops relative to production quantities of various crops.

3. RESULTS AND DISCUSSION

3.1 Socio-economic Profile of the Respondents

The socio-economic profile of the respondents is shown in Table 1 and the parameters included are age, sex, education, household size and wealth group. Referring to the age of the respondents, most of them laid between 20 to 50 years (64% and 73.8% in Mughunga and Pohama villages respectively), then followed by those aged below 20 years and above 50 years by (2% and 0%) and (34% and 26.2%) for Mughunga and Pohama villages respectively. The larger number of young population could imply increased pressure on agricultural land and therefore momentously affect its economic value. The chi- square tests also indicated no significant ($P>0.05$) difference in age between villages. On the other hand, out of the total sample, (62%) and (59%) of the respondents were males in Mughunga and Pohama villages respectively. Females respondents were (38%) in Mughunga and (41%) in Pohama. These findings reveal the presence of more males than females in both study villages. The chi-square tests as well showed no significant difference (P>0.05) in sex between villages. Educational wise majority (88% and 75.4% in Mughunga and Pohama villages respectively) of respondents had completed primary school education, followed by those with none formal education (6% in Mughunga and 14.8% in Pohama), while those attained secondary education were 6% in Mughunga and 8.2% and Pohama. Very few of them have attended adult education (0% in Mughunga and 1.6% in Pohama). The chi-square test indicated significant difference (p<0.05) in education level between villages. These results show that majority of respondents' attained primary education, thus indicating low level of education in the study area. It further reveals minimal application of land management practices in the study villages, which partly could be caused by low level of education, amongst other factors.

Regarding wealth group, large proportion of respondents were economically poor by 56% in Mughunga and 65.6% in Pohama, followed by very poor (38%) in Mughunga and 27.9% in Pohama and better off were 6% in Mughunga and 6.6% in Pohama. The chi-square test indicates further no significant difference (p>0.05) in wealth between villages. These results imply that majority of respondents in both villages are economically poor. On the other hand, majority of respondents in Mughunga (52%) and Pohama (45.9%) had household size range between 7 to 10 household members. 1 to 3 households' members were 6% in Mughunga and 24.6% in Pohama, while 20(40%) in Mughunga and 15(2.6%) in Pohama had 4 to 6 households' members. Few respondents by 2% in Mughunga and 4.9% in Pohama had more than 10 households' members. Chi square test also indicate high significant difference (P<0.05) in the size of households between villages.

Table 1. Summary of socio-economic profile of the respondents in study villages

Respondents characteristics	Mughunga		Pohama	
	Frequency	**Percentages**	**Frequency**	**Percentages**
Age				
Below 20 years	1	2	0	0
20-50	32	64	45	73.8
50 and above	17	34	16	26.2
χ^2 = 2.156, df = 2, Pvalue = 0.05				
Sex				
Male	31	62	36	59
Female	19	38	25	41
χ^2 = 0.102, df = 1, Pvalue = 0.749				
Education				
None formal education	3	6	9	14.8
Primary school	44	88	46	75.4
Secondary school	3	6	5	8.2
Adult education	0	0	1	1.6
Post secondary	0	0	0	0
χ^2 =10.125, df = 4, Pvalue = 0.038				
Wealth group				
Economically poor	28	56	40	65.6
Very poor	19	38	17	27.9
Better off	3	6	4	6.6
χ^2 = 1.55, df = 2, Pvalue = 0.524				
Household size				
1-3 people	3	6	15	24.6
4-6 people	20	40	15	24.6
7-10 people	26	52	28	45.9
More than 10 people	1	2	3	4.9
χ^2 = 11.750, df =2, p=0.003				

3.2 Population Trends in the Study Area

Findings from the study show that human population in the studied villages has been increasing over time. The population has been increasing due to both a natural increase and in-migration. Such increases may imply increased pressure on available resources. An interview with key informants has revealed that, most of people migrated into the study area around the mid 1980s and between 1990s to-date. Declined productivity of crops such as sorghum and maize in the nearby villages, as well as searching for agricultural land was mentioned to be the main reasons for in–migration of people into the study villages. However it was further revealed that, despite hyper increases in population, there is no a room for further expansion of agricultural land to support the increased population, this is because even the present agriculture land is not yet enough and therefore already under pressure. Villagers are as well expecting more consequences following the current initiative of REDD+ project implementation.

3.3 Major Economic Activities in Study Villages

Results of this study have established that, farming is the major economic activity for majority of villagers in the study areas for about 98.4% of the respondents in Pohama and 94% in Mughunga growing both food and cash crops. It should be noted however, farming by most of the household is on substance basis and carried out by smallholder-farmers, which most of them do not use improved farming practices. As a result, yield per acre is relatively very low. Apart from farming, livestock keeping also have great potential contributing to the village's economy by 96.7% in Pohama and 82% in Mughunga (Fig. 3). It was however observed that, all livestock keepers are also farmers and none of the respondents was keeping livestock alone. Petty business is the third economic activity in both villages. This activity has appeared to be of less important to Mughunga (14%) as compared to Pohama (6.6%) due to the fact that Pohama village is within Ngimu ward which is more urbanized. The fourth and fifth economic activities in both villages were 14.9% for beekeeping and 10.9% for people employed in the formal sector. Given the fact that, farming and livestock keeping are main economic activities in both villages, it further implies that, the current changes occurring to agricultural land will have a far-reaching effect on the lives of many people in the study area, since majority depend upon these resources for their livelihood sustenance. The discussions with villagers in both villages' reveals more minor economic activities. These include; selling of local brew, which is common in Pohama and mainly done by women, charcoal production is common in Mughunga and mainly undertaken by men as well as collection of firewood done by both. It was further observed that, most of these emerging activities are non-farm activities.

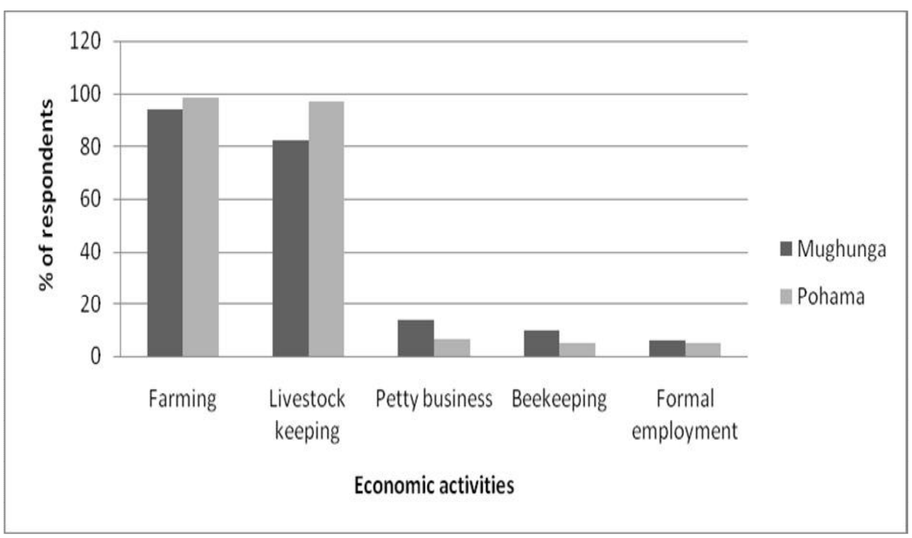

Fig. 3. Respondents' major economic activities

3.4 Major Crops Grown in Study Villages

As pointed out earlier, both food and cash crops were reported to be grown in the study villages. The food crops includes; maize by 74% in Mughunga and 59% in Pohama, sorghum by 90% in Mughunga and 67.2% in Pohama as well as bulrush millet by 12% in Mughunga and 24.6% in Pohama, while the cash crops includes sunflower by 84% in Mughunga and 91.8% in Pohama, green grain none in Mughunga and 1.6% in Pohama, groundnuts by 4% in Mughunga and none in Pohama as well as finger millet by 20% in Mughunga and none in Pohama (Table 2). However, it should be noted that, despite the distinction between food crops and cash crops, all food crops could sometimes during the year be sold where a household is in urgent need of cash. Findings from this study further revealed that production of crops like maize, sorghum and sunflower has relatively declined since 1990s to date. The major reason for this trend were pointed out to be decline in soil fertility caused by increased land degradation and reduced agricultural land due to the introduction of conservation initiatives such as CBFM in 1990s. These findings conform to the views of villagers reported during focus groups that, there is more than 200 acres of land that have been taken away to form part of Mgori forest. This has happened soon after the adoption of CBFM. As a result, area of land previously used for agriculture purposes was vastly reduced.

3.5 Major Sources of Income in Study Villages

The major sources of income in the study area include crop production by 68% in Mughunga and 67.2% in Pohama, livestock production by 22% in Mughunga and 16.4% in Pohama, small business by 6% in Mughunga and 14.8% in Pohama as well as beekeeping by 4% in Mughunga and 1.6% in Pohama (Fig. 4). Other activities also contributing to community income though pursued at a small scale including, selling of local brews, firewood and traditional medicine, charcoal and timber production, carpentry, masonry and people employed under formal sector. It was further revealed that because most of these activities supplement income of local communities, there is higher competition over land uses among various stakeholders who depend entirely on the availability of land for undertaking their activities. Stakeholders under this phenomenon include livestock keepers, crop producers, conservationists and many others who have interest upon agricultural land and forest resources. Similar observations have been reported by Tanzania National Strategy for Growth and Reduction of Poverty [27] mentioned annual crop farming as the principal and dominant source of livelihood in most rural areas of Tanzania.

3.6 Types of Soil in Study Villages

Changes occurring to agricultural land can partly be influenced by types of soil found within the study area. This conception prompted the researcher to find out various types of soil found within the area and the results reveal three types of soil common in both villages. First sandy soil by 82% in Mughunga and 63.9% in Pohama, followed by black soil by 10% in Mughunga and 23% in Pohama and finally is reddish brown by 8% in Mughunga and 13.1% in Pohama. Since soil type has direct influence on agricultural land use, a good number of respondents claimed on poor soil fertility caused by the persistent of sandy soil in the study area. This evidence is equal to those reported by URT [28] which showed that, land in Singida Region is not particularly well-suited for agriculture, as it is sandy therefore not very fertile.

3.7 Average Farm Size of Respondents

Farm size is the total area (acres) cultivated by each respondent. The result showed that most of the respondents (76%) in Mughunga and 44.3% in Pohama cultivated more than 6 acres with the mean size of 2.47 acres. Also result showed a quite sizeable proportion of the respondents by 16% in Mughunga and 42.6% in Pohama cultivated farm land between 3 to 5 acres and the rest 8% in Mughunga and 13.1% in Pohama cultivated 1 to 2 acres (Table 3). The chi-square test indicated a highly significant ($p<0.01$) difference in farm size between villages, with computed Chi-square value being 11.75, at 2 degree of freedom and 0.003 significance probability levels. Despite that the study results suggest that majority of the respondents in both villages have larger farm sizes. However it was noted that the exact proportional of land area under cultivation is relatively very low, this is due to low income by majority of people in the study area. As a result, diversification into non-farm activities is currently taking place at an alarming rate. Another major limitation hinder effective utilization of land in the study area is heavy reliance on hand hoe as a main cultivating tool.

3.8 Land Ownership in Study Villages

Understanding the ownership of land is essential for development and the assessment of various land resources values in the world. This fact impelled the researcher to ask respondents whether had owned and farmed any plot of land during the last 12 month. Responses in both villages showed that, about 100% of respondents in Mughunga and 96.7% in Pohama owned and farmed a plot of land during the last 12 months while none of respondents in Mughunga and 3.3% in Pohama had not (Fig. 5). It was however further noticed that, for respondents who owned land none of them have title deeds while those who do not own any plot of land mainly are government employees or village officers and have been in the village for less than a year after having being transferred from neighboring districts and regions. Similar results were pointed out by Tripathi [29] that, about 80% of Tanzanian land is classified as "village land" and less than 10% of the populations have formal certificates of ownership for the land they farm, making them vulnerable when investors begin sniffing around.

Table 2. Major crops grown in study villages (%)

Crops	Mughunga		Pohama	
	Frequency	Percentages	Frequency	Percentages
Maize	37	74	36	59
Sorghum	45	90	41	67.2
Groundnuts	2	4	0	0
Sunflower	42	84	56	91.8
Bulrush millet	6	12	15	24.6
Green grain	0	0	1	1.6
Finger millet	10	20	0	0

Note. These are multiple response results–percentages and totals are based on respondents

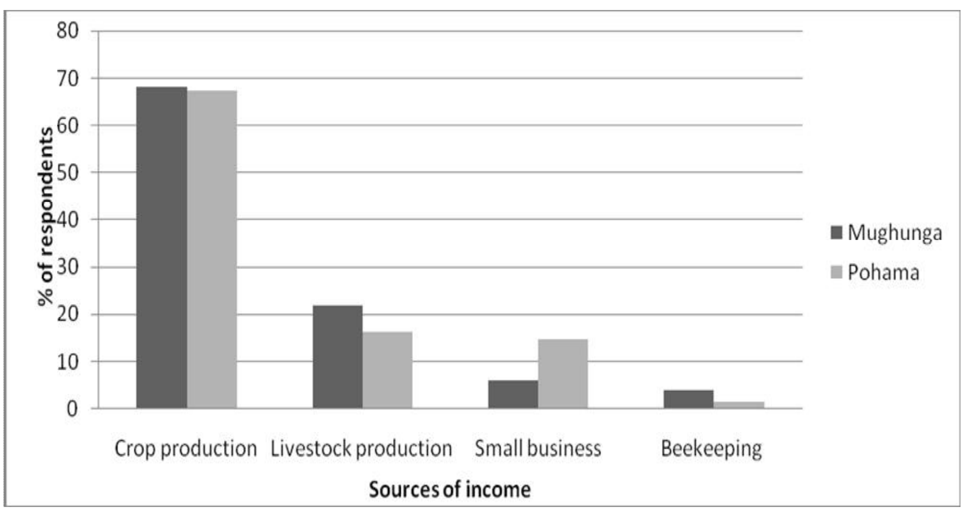

Fig. 4. Major sources of income

Table 3. Average farm size of the respondents per villages (%)

Farm size	Mughunga		Pohama	
	Frequency	Percentages	Frequency	Percentages
1-2 acres	4	8	8	13.1
3-5 acres	8	16	26	42.6
More than 6 acres	38	76	27	44.3
Total	50	100	61	100

3.9 Patterns of Landuse/Cover Changes Over 30 Year (1990-2010)

Investigating patterns in land use is important because it enables to fathom causal factors influential to changes in the economic value of agricultural land as well as their livelihoods implications. This pattern of land use cover change has been adopted as described by [30] on his study undertaken to assess implications of landuse/cover changes over three decades in Mgori forest. According to this study, land use cover has changed significantly despite the implementation of Community Based Forest Conservation (CBFM) initiatives in the area. For example the area under woodland in 1990 covered 29,905 ha and by 2010 this area covered only 9,399 ha of land indicating degradation and conversion to other land uses (Table 4). With the observed changes in woodland area the ability of Mgori to sequential carbon might have been reduced on the expense of deforestation and degradation of miombo woodlands in the area. This study further showed that there has been a significant increase in Bushland area (by 23%) and this may indicate that once woodlands are degraded through deforestation and degradation bushland emerges. Similar results have been reported for woodlands in Tabora region [16]. The observed changes have implications on community livelihoods and ecosystems by affecting a balance between ecosystem service provision by communities demands as described within the context of ecological gradients [31].

In general, woodland decreased by 53.8% over the last 30 years indicating that this may compromises with REDD+ initiatives if that tendency will be allowed to continue. Since most of woodlands appear to have been converted to bush land or thickets there are opportunities for reversing the situation once REDD+ is in place and this will not comprise much with agricultural land since a change to agricultural land is not significant. Improving productivity of agricultural land will balance the food demand to allow other benefits from REDD+ as the population grows. Other landuse have remained almost the same and one should not expect much change under REDD+. However, prediction of future land use changes considering all other changes such as population and economic growth in the area.

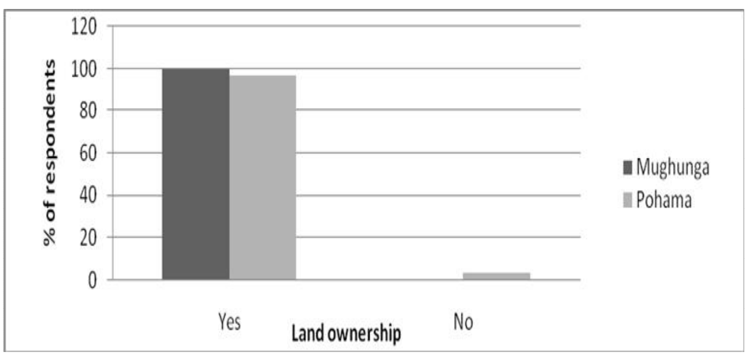

Fig. 5. Land ownership by respondents

Table 4. Land use/cover changes between 1990 and 2010 at Mgori forest

Years	1990		2010		2010
Vegetation type	**Area (ha)**	**%**	**Area (ha)**	**%**	**% change**
Bushland	6305	17.1	13642	40.0	+23.0
Cultivated Land	909	2.5	2678	7.3	+4.8
Grassland	0	0.00000	1207	3.3	+3.3
Rock Outcrops	89	0.2	0	0	0.0
Settlement	0	0.00000	45	0.12	+0.12
Swamp	351	0.95	1059	2.87	+1.92
Thicket	0	0.00000	8873	24.04	+24.0
Woodland	29249	79.3	9399	25.5	-53.8
Total area	36903	100	36903	100	

Source: Majule et al. 2012 [30]

3.10 Changes on Agricultural Land in Study Villages

Changes remarkably in agricultural land have been influenced by a number of factors. One major contributing factor is the rapid population growth. Empirical studies from densely-populated regions around the world have revealed that, either an increase in the population's demand for resources or a decrease in the environment's ability to supply resources is a major source of such disturbances. This former clarification was revealed by most of villagers during focus groups where majority of participants mentioned high increase of human and livestock population, settlement expansion, adoption of forest conservation initiatives, increased demands for agricultural and grazing land as well as land needed for implementation of village development activities are factors, amongst others, contributing to current pressure noticed in agricultural land. On the other hand, it was further observed that, each time the growth per unit area in numbers of animal and human population in the district has contributed to decreased size of the average farm size for both cropping and grazing. Also there has been a change in biodiversity, some of the cropping systems have become extinct whereas others have emerged. The negative aspect of such changes has been reduced soil fertility due to mammoth land degradation as well as reduction of species diversity due to species over exploitation.

3.11 Trends in the Productivity of Agricultural Land in Study Villages

Productivity from agricultural can be affected by a number of factors, some of them include; poor soil fertility of the area, minimal application of agricultural inputs, inappropriate use of land management practices, as well as unreliable weather conditions. In this regard, a number of respondents were asked to provide their views on the trends in productivity of agricultural land in the study area. Majority 84% and 85.2% of respondents in Mughunga and Pohama respectively argued that agricultural productivity has enormously declined. On the other hand, 10% in Mughunga and 14.8% in Pohama said the productivity from agricultural has increased. The rest 6% in Mughunga and none in Pohama marked no change in agricultural land productivity in the study area (Fig. 6). These results are similar to those reported earlier by findings from in depth interviews and focus groups showing yield per hectare of agricultural land has declined sharply in the area, therefore poses serious consequences to livelihood of many people.

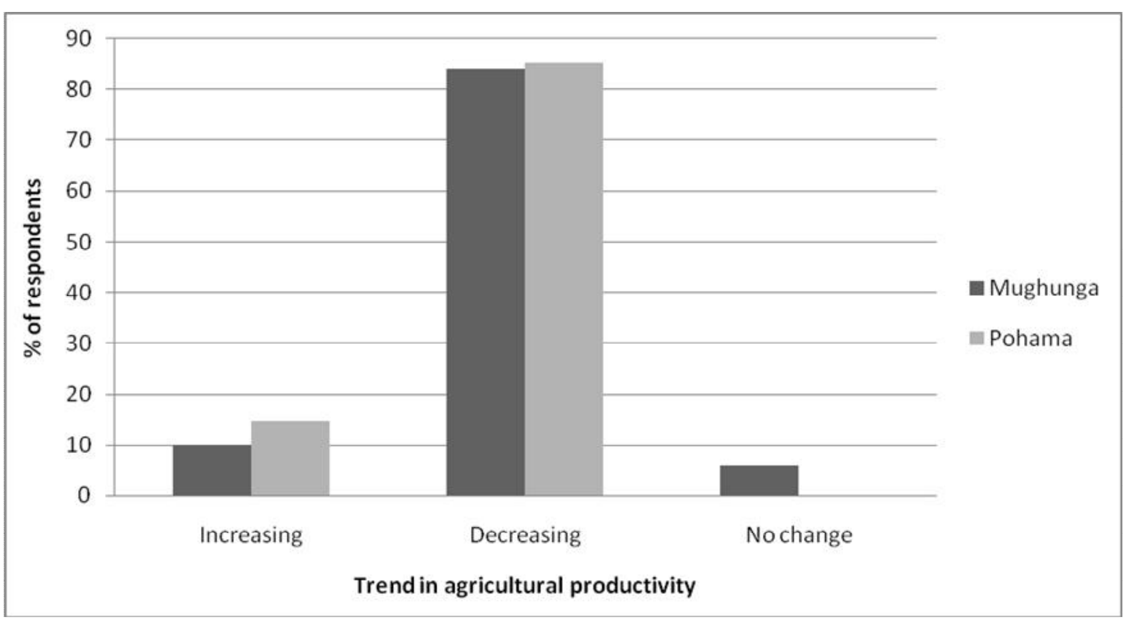

Fig. 6. Trend in agricultural land productivity

3.12 Economic Value of Agriculture Land in the Study Area

The needs to quantify the economic value of agricultural land stem from the fact that, appropriate land use decisions require better understanding of the value of agricultural land as well as the cost arising from agricultural land degradation. As indicated in Table 5, only major crops were considered in assessing the economic value of agricultural land in the study area. The crops in question include; maize, sorghum, bulrush millet and sunflower. Tables 6 shows the value of outputs from the cultivated land in the study area measured in Tanzania shillings of about 85,129,132 per year per approximately 9666 acres of cultivated land. These cropland values come from a range of both subsistence and cash crops, with some crops such as sorghum and sunflower being important for the village economy and the region as a whole. These results reveals increased agricultural activities in the study area, partly contributed by high population growth, as well as rising demands for agricultural land due to restrictions resulting from various conservation initiatives.

3.13 Livelihood Opportunities Resulting from Valued Agricultural Land

During focus group discussion, respondents mentioned a number of livelihood opportunities resulting from valuation of agricultural land in the study area. These include; first, increased value of agriculture land by understanding productivity of crops with high value in the study area and therefore increase their production. On the other hand, helps to understand crops with lower economic value and hence develop mechanism for improving their productivity. Second; increased efficiency use of agriculture land, this will promote sustainable land use practices in the study area and therefore increase agriculture production while at the same time reduce the problem of agricultural land degradation in the study area. Third, ensures proper investment in agriculture land that promotes sustainability of agricultural land. All these will create the followings livelihoods opportunities; ensure food security in the study area, land allocation for different uses and hence reduces land use conflicts, reduced land degradation therefore increase crop productivity, increased community income through increased production of high valued crops, reduce poverty and vulnerability caused by problems of famine and drought as people will have enough food reserve.

Table 5. Production and price values for different crops per villages in tshs (year 2013)

Crop	Mughunga		Pohama	
	Total production per households per year (kg)	**Average price per kg of the crop**	**Total production per households per year (kg)**	**Average price per kg of the crop**
Maize	10,000	746	15,726	767
Sorghum	9,790	819	19,320	837
Sunflower	37,660	484	37,840	506
Bulrush millet	2,610	830	2,230	842
Total	60,060	2,879	75,116	2,952

Note: computed values for different crops are based on acres

Table 6. Computed economic value of agricultural land for different crops in tshs (year 2013)

Crop type	Mughunga	Pohama
	Annual production crop values (A_1)	**Annual production crop values(A_2)**
Maize	7,460,000	12,061,842
Sorghum	8,018,010	16,170,840
Sunflower	18,227,440	19,147,040
Bulrush millet	2,166,300	1,877,660
Sub-total	35,871,750	49,257,382
Economic value of agricultural land (A_1+A_2)		85,129,132

Note: computed values for different crops are based on acres

3.14 Implications of Changing Agricultural Land Value to Community Livelihoods

Majority of communities living in villages surrounding Mgori forest depend their livelihoods on agriculture. In this case a significant change in the value of agricultural land will have a significant impact to livelihood of people in the study area. Based on focus group discussion, major implications were notable to be decline in agricultural productivity, increased pressure on land resources, increased deterioration of forest resources, increased periods of food shortage, death of livestock, out-migration to search for agricultural land as well as increase cost of living. Population increase was the major contributing factors to such situation; others include low income, soil erosion, climate variability, limited access to agricultural inputs, overgrazing, no land fallowing as well as shortage of land.

3.15 Awareness and Livelihoods Implications of REDD+ among Mgori Forest Dependent Communities

Respondents were asked if they are aware of REDD+ project. The results from the household survey revealed that, 58% and 39.3% of respondents in Mughunga and Pohama villages respectively are aware of REDD+. Those who are not aware of REDD+ were 42% in Mughunga and 60.7% in Pohama (Fig. 7). The results of this study revealed that REDD+ has yet to be well known and understood by most of villagers in the study area. Even those who are aware were not much familiar as to what REDD+ is exactly about. This confirms the results by Blomely et al. as cited by Kimaryo [32] that, knowledge and understanding of REDD+ at community level remains very limited. The reasons behind low level of understanding of REDD+ could be attributed to the remoteness of Mgori which hinder them to be reached by pro REDD+ elites. Of those who heard about REDD+, they revealed that their major sources of information about REDD+ initiative were MJUMITA who conducted seminars to their village and researchers from various academic institutions. The understanding of REDD+ was diverse including; financing incentives to forest dependent communities, addressing adverse impacts of climatic change as well as forest conservation.

In addition, the researcher observed two contentious arguments among villagers as what REDD+ would really mean to their livelihood. Some of them see REDD+ as an opportunity such as increased communities income as well as ensure conservation of forest resources, while others see REDD+ as a challenge aimed at increasing life hardship through limiting agricultural expansion. This is because former conservation initiatives with the same intention as that of REDD+ such as CBFM have vastly resulted into many livelihoods challenges among the majority of people within the villages including limiting access to forest products, reduced land for agricultural and or limit agricultural expansion. All these mentioned challenges greatly affect villages' economy at one hand and livelihood at the other. As such, despite huge benefits expected, REDD+ project brought fear and resistance among communities in the study area and as well in other rural areas of Tanzania particularly those depending on agricultural and forest resources to earn their livelihoods.

3.16 Expected Challenges of REDD+ Project Implementation to Agricultural Land

Respondents were asked to provide their views on what challenges will be caused by REDD+ project implementation to agricultural land. The results indicate that reduced land for agricultural is the major challenge anticipated to occur following the implementation of REDD+ project by 89.5% in Mughunga and 87.5% in Pohama. 5.3% in Mughunga and none in Pohama argued on decrease in agricultural productivity, 15.8% in Mughunga and 12.5% in Pohama argued on increase in wild animals with significant impacts on agricultural crops distortion, 47.4% in Mughunga and 93.8% in Pohama argued on loss of grazing land, 21% in Mughunga and 37.5% in Pohama argued on reduced forest products, none in Mughunga and 18.8 in Pohama pointed out on loss of land for settlement construction as well as none in Mughunga and 6.2% in Pohama said there will be no challenges rather than advantages (Table 7). In a similar way, a study conducted by Kimaryo [32] in the study area revealed similar results that most of villagers surrounding Mgori forest have experienced changes in land access and sizes after the introduction of various conservation initiatives such as the introduction of CBFM.

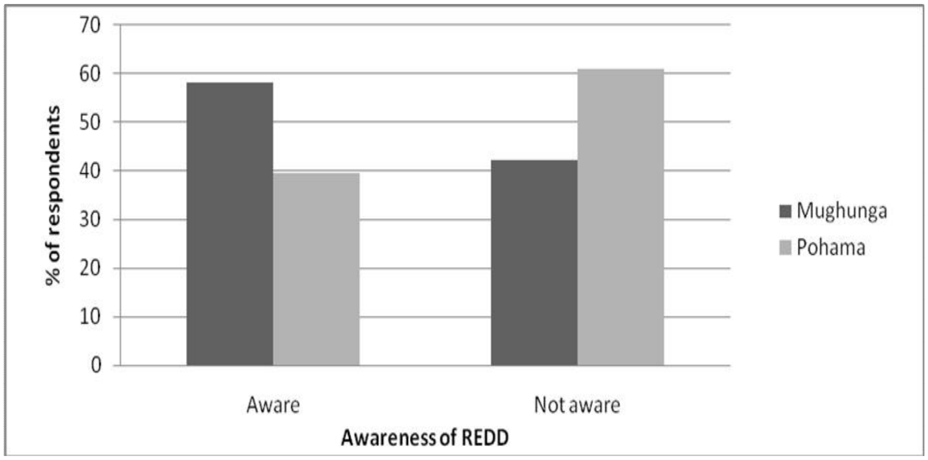

Fig. 7. Awareness of REDD to agricultural dependent communities

Table 7. Expected challenges of REDD project to agricultural land

Challenges	Mughunga		Pohama	
	Frequency	Percentages	Frequency	Percentages
Loss of agricultural land	17	89.5	14	87.5
Decrease agricultural production	1	5.3	0	0
Increase wild animals	3	15.8	2	12.5
Loss of grazing land	9	47.4	15	93.8
Reduced forest products	2	10.5	2	12.5
Loss of land for settlement construction	0	0	3	18.8
Limit access to charcoal	0	0	2	12.5
Limit access to firewood	2	10.5	2	12.5
No challenges, there are only advantages	0	0	1	2.9

Note: These are multiple response results–percentages and totals are based on respondents

This could be justified by first, zonation of Mgori forest which reduced access to forested land for crop cultivation, livestock grazing and settlement. Second, the remaining land which is not part of the forest is limited relative to demand.

4. CONCLUSION

Agricultural remains to be a key sector in term of supporting community livelihoods in both study villages, mainly undertaken by smallholders' farmers who do not apply improved farming practices. The economic value of agriculture land in both villages was revealed to be high, with sunflower contributes the highest, followed by sorghum, maize and bulrush millet. This research further revealed increased agricultural activities largely contributed by high population growth as well as increased degradation of other land resources. For sustainability of agricultural land in the study area, efforts need to be scaled up towards conservation of agricultural land, by communities, government as well as private entities.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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