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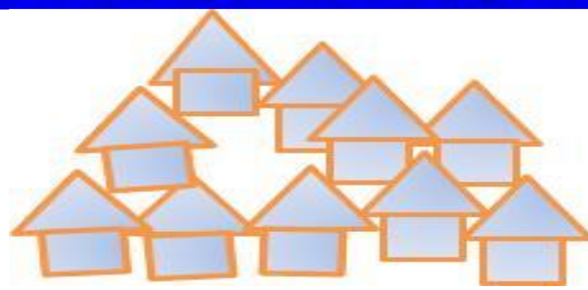

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The Effect of Land Tenure on Land Management in Magu and Misungwi Districts

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Land is a crucial resource for the social, political, and economic sustainability of rural farm households in developing countries because it supports food production, ecosystem services, and income generation. This study investigated the effect of land tenure on land management in Magu and Misungwi districts. Household survey questionnaire, key informant interviews and focus group discussions were used to gather data, which were analyzed using descriptive statistics and Multinomial logit model. The study revealed that land tenure has significantly negative contribution to the adoption of manure and crop rotation. This study recommended that government and policy makers should advice financial institutions to recognize Customary Right of Occupancy (CCRO) to promote credit accessibility, which enables land markets expansion, particularly in rural areas.

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1.0. Introduction

Land is a crucial resource for social, political, and economic sustainability of rural farm households in developing countries because it supports food production, ecosystem services, and income generation. However, it contains 86.1 percent of the world's biomass and only 29.3 percent of the planet surface (Legesse & Thomas, 2018; Melesse, 2020). Rapid global changes like population growth, climate change, and the increased demand for food and raw materials are putting pressure on land resources (Senda & Gachene, 2020), and it is estimated that 75 percent of the earth surface has been directly impacted by human activity (Author, 2021).

African region is rapidly urbanizing globally, with an annual urban population growth rate of 3.6 percent between 2005 and 2015. The availability and accessibility of farm land among smallholder farmers are significantly impacted by the conversion of agricultural lands into urban development. The vulnerability of these farmers could get worse as a result of subsequent income losses (Totina & Roncoli, 2021). Food security and poverty crises have affected farming households worldwide, including East Africa (Kristjanson & Gassner, 2012). In addition, between 720 and 811 million people worldwide, primarily in Sub-Saharan Africa, Asia, and Latin America, experienced hunger in 2020 due to the COVID-19 pandemic (FAO, 2021; Rashid, 2021). Tanzania, like other Sub-Saharan African countries was experiencing growth mainly in building (12.9 percent), transport and storage (11.8 percent), and information and technology sectors (9.1 percent) and rate of poverty has barely decreased from 28.2 percent in 2012 to 26.4 percent in 2018 (Rashid, 2021).

Reliance on rain-fed agriculture, nutrient mining, and low inputs all contributed to the collapse of agriculture in Africa, particularly Sub-Saharan Africa, leaving many families without enough food (Kimaro & Mareale, 2013; Teshome & Ritsema, 2016; Lal & Mwaseba, 2015). Sustainable Land Management (SLM) strives to maximize social and economic benefits from the land while preserving or improving the ecological support functions of the land resources. However, due to insufficient investments in sustainable land management (SLM), soil erosion is one of the key underlying causes of food insecurity in Tanzania. Therefore, sustainable land management (SLM) investments are crucial for food security improvement (Nyanga & Tenge, 2016). Sustainable land management can be achieved with land rights thereby addressing gender disparities, and conflicts (Lawry & Hall, 2014).

When access to land, land rights, and tenure security are assured, farmers are more likely to invest in long-term improvements to their farms without worrying about being seized (Nara & Zevenbergen, 2020; Lawry & Hall, 2014). The current study examined the effect of land tenure on land management in the study area.

2.0. Literature review

2.1 Theoretical review

The study was guided by two theories, namely Lancastrian consumer theory by Kelvin Lancaster (Lancaster, 1966) and the Evolutionary theory of property rights by Harold Demsetz (Demsetz, 1967). The Lancaster theory assumes that commodity characteristics determine the utility they offer. As a result, people draw utility from commodity characteristics rather than commodity itself. The theory was supported by Batten (1987) who included consumer and producer preference groups. Nevertheless, Trajtenberg (1990) used the theory to explain product invention. The theory is useful for the current study because land tenure can influence its management. The farmer is willing to put more resources to conserve and improve the quality of land if the ownership takes considerable time duration. Farmers grow different crops both perennial and annual. But, if land ownership period is very short, there will be little concern on the improvement of land quality. With utility maximization, consumer choice comes in place because resources are scarce. People choose the alternative that gives the maximum utility. For land management choice, the utility does not come from land but rather agricultural outputs that come from land. As a result, such an indirect utility (Legesse & Thomas, 2018) is what makes farmers choose how to manage their land.

According to the evolutionary theory of property rights, land scarce forces the state to implement a land titling policy. This intends to formally establish private property rights in order to lessen disputes and foster efficiency, economic progress, and political stability (Demsetz, 1967). This theory supports the current study in the fact that land ownership reduces disputes and fosters efficiency.

2.2 Empirical review

Many studies have been conducted outside Africa on land management. Du & Xie (2019) used Tobit model to investigate the quantitative impacts of informal and formal agricultural credit on farmland abandonment. The finding shows that, access to agricultural credit reduces farmland abandonment and by comparing formal agricultural credit (provided by institutions), informal agricultural credit (provided by family and friends) is more significant in reducing farmland abandonment. Songa & Huyen (2020) used two stage least square (2SLS) or instrumental variable (IV)-Probit model to investigate the factors affecting SLM adoption among farmers in Na Ri district. The estimated 2SLS regression indicated that there is a set of factors affecting SLM adoption, namely, relative risk aversion, farming experience, farm size, knowledge of SLM, membership in farmers' organization, number of labors, and slope of farm land.

Furthermore, different studies have been conducted in Africa on land management. Legesse & Thomas (2018) used probit model to evaluate the probability that a farmer may invest in reforestation intervention given with land tenure/property rights, age, sex, education, family size, farm credit, farmers' attitude towards reforestation intervention, training, participation in community-based institutions, extension services and off-farm income. Among others, property rights to land may be one of the major factors that affect farmers' decision to invest in land management. Therefore, the study found out that land security is one of the most significant factors that affect farmers' decision to practice reforestation intervention. Etongo & Djenontin (2018) employed multivariate probit models and a correlation coefficient to examine the factors influencing the adoption of land management practice in southern Burkina Faso. The findings show that household labor force, education of household head, land tenure security, livestock holding, and membership in farmers' groups influence the adoption of land management. Kansanga & Bezner (2020) adopted logistic regression to examine the determinants of the concurrent adoption of short-term and long-term SLM practices. The findings indicate that significant predictors include plot size, farmer-to-farmer information sharing, the existence of a chronically ill individual in the households, the amount of active household labour, affluence, and women's autonomy. Ndagijimana & Asseldonk (2018) employed descriptive statistics and multinomial logistic regression to describe determinants of smallholder farmers' adoption of short-term and long-term sustainable land management practices. The findings indicate that higher investments in SLM are significantly and favourably associated with soil erosion on the farm, access to financing, education level, the household head's involvement in farming, and household head age.

Moreover, few studies have been conducted in Tanzania on the effect of land tenure on land management. Rashid (2021) used descriptive statistics, correlation analysis, and conditional mixed process to examined the nexus between land tenure security, credit access and rice productivity in Tanzania. The correlation analysis shows a positive association between land tenure security, credit access and rice productivity. Education and family size positively affects land tenure security while land survey and district location negatively affect land tenure security. Land tenure security significantly and positively affects access to credit by farmers in the study area. Mwijage & Ridder (2011) investigated on how land tenure changes affect subsistence farming, specifically how they affect the farming system's production in the Bukoba district. According to the report, tenure reforms, such as those that enable individual ownership over formerly communal properties, have destabilised customary tenure and land use practises.

2.3 Research Gap

From the review of empirical literature conducted in Tanzania, Rashid (2021) has not explained the influence of land tenure on land management. The study just explained the influence of land tenure on rice productivity. It is well known that higher rice productivity can only result from proper land management practices. Even though, this has not explicitly explained in the study. This marks an important place for the current study's contribution to the knowledge body among land management literature in Tanzania from the context point of view.

Nevertheless, the approach used in Rashid's (2021) study is different from multinomial logit suggested by the current study. As a result, from the methodological point of view, the current study offers an opportunity to expand knowledge in the existing literature.

The study by Mwijage & Ridder (2011) lacks the explanatory power of land management influence of land tenure for the current period. A ten year time lag is enough to guarantee substantial changes. Therefore, from time lag point of view, there is a need to conduct another study.

From the geographical point of view, Bukoba has a different climatic condition compared to the current study area of Magu and Misungwi districts. Even the food crops grown in the two areas are different. The former grows mostly banana, while the later areas are famous in maize and rice cultivation. With climate difference, even land is differently valued by farmers. Therefore, it is important to have another study which uncovers land management practices in other geographical settings. This study makes a significant place in the body of literatures concerning sustainable land management influence of land tenure.

3.0. Research Methodology

3.1 The study area: Magu and Misungwi districts

The study was conducted in Magu and Misungwi districts, Magu district lies between 2.58996° and 2° 35' 24" south latitude, and 33.44453° and 33° 26' 40" East longitude covering an area of 252 km2. The mean annual temperature in the Magu district is 28.5°C, with a mean annual maximum and minimum monthly temperature of 25 °C and 32 °C, respectively. The minimum annual rainfall in Magu district was 700 mm and maximum were 1000mm. The rainfall pattern is bimodal, with two major (summer) rainy season that extends from March to May, and then from September to December. The agricultural system is characterized by subsistence rainfed crop farming with sales of surplus (maize, cassava sweet potatoes, sorghum, sunflower, peanuts, legumes) free roaming livestock keeping in rangelands (cattle, goat, and sheep; chickens are kept in the villages), and woodlands used for fuel and beekeeping.

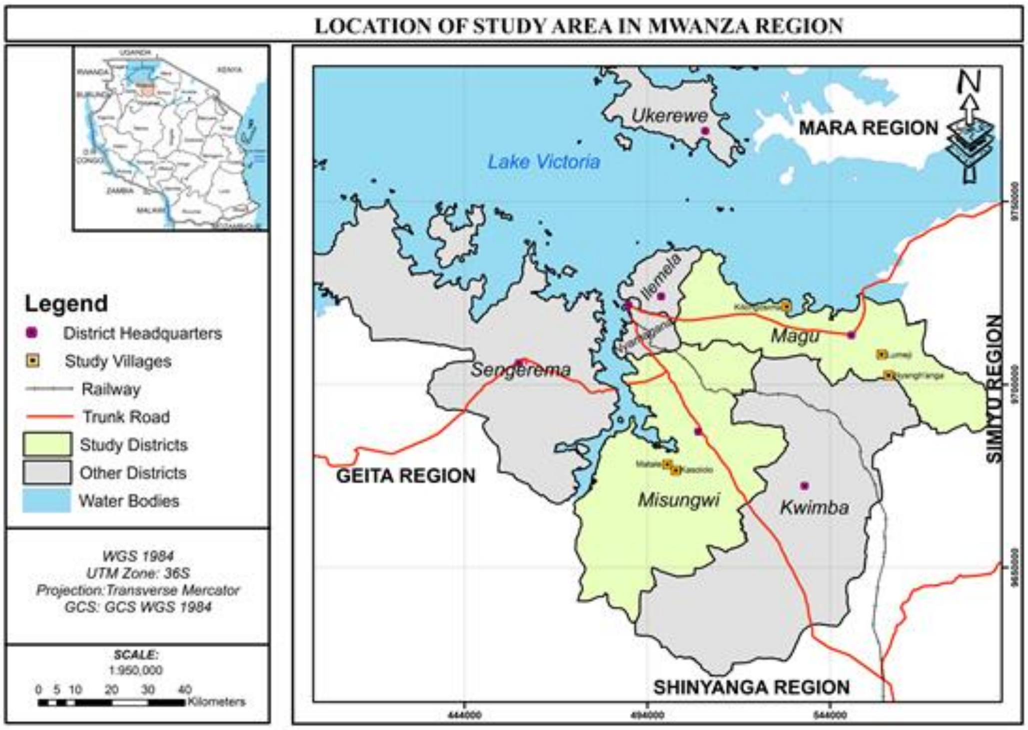

Figure 1: Study area
Source: Field data

Misungwi District lies between 2° 51' 0" south latitude, and 33° 4' 59" East longitude covering an area of 2,553 km2. The mean annual temperature in the Misungwi district is 27.1°C and 26.7°C, with a mean annual maximum and minimum monthly temperature of 13.3 °C and 11.6 °C, respectively. The minimum annual rainfall in Misungwi district was 600 mm and maximum was 1200mm. The rainfall pattern is unimodal, with one major (summer) rainy season that extends from November to April. The agricultural system is characterized by subsistence rainfed crop farming with sales of surplus (maize, cassava, sweet potatoes, millet, paddy, cotton, legumes) free roaming livestock keeping (cattle, goat, sheep, and chickens).

3.2 Data source and Data collection techniques

Cross-sectional primary data was employed in this research. The study employed simple random sampling and purposive sampling to select households for the survey. Five villages namely Lumeji, Kitongosima, and Nyang'hanga in Magu District; Matale and Kasololo in Misungwi District were purposively selected due to land use plans, soil erosion issues, and large number of households that own land certificates for their plots. Household heads were randomly selected from the target population.

The target households were 2660 households, of which 1619 households were from Magu District and 1041 households were from Misungwi District. The unit of analysis were household heads, so due to large population, this study decided to use the Cochran formula for unknown population to determine the optimum sample size given the desired precision level of ±0.05 with confidence level 95%, we considered 50% of the households have land tenure and adopt land management therefore, expected fraction of the attribute present in the population was 0.5 and the value of z was 1.96. Thus, the sample size obtained in combination from all districts was 267 households; then, we divided the sample size equally from each village, and we got at least 53 household heads in each village. According to the calculation, Magu district would have 161 samples and Misungwi district 106 samples. This was because Magu had three villages and Misungwi had two villages.

Household questionnaires, key informant interviews, and focus groups were used to gather data for this study. Questionnaires were administered to 267 households; interviews were used to gather data from two district executive directors and two heads of land departments; and 74 households were selected to participate in a focus group discussion. The village leaders assisted in selecting participants for the focus group discussions (FGDs) and household survey.

In addition, this research used a convergent parallel research strategy, in which researchers simultaneously collected quantitative and qualitative data. We gave equal weight to each approach, analysed the two components separately, and jointly interpreted the findings. The data obtained from both approaches were analyzed with the support of a computer program known as STATA version 14. Nevertheless, descriptive statistics in quantitative data were presented using tables and graphs to form the basis of the discussion.

3.3 Validity of Instrument

Through a questionnaire and an interview, we observed how the respondents' data were accurate. The study used content validity to test if the tools presented the content that needed to be measured in the study. The researcher distributed instruments to the people who had sound knowledge of research tools for them to make some corrections for improvements. Additionally, the researcher sought for the opinions of experts in the field of study, especially lecturers from economics departments and supervisors, to check the relevance of the contents before being admitted to the respondents in the study.

3.4 Reliability of Instrument

In this study, the researcher visited the study area and distributed questionnaires to the eighteen (18) district representative from different departments know as PLUM team and 40 villagers (8 in each village) who have general idea of land use plan, and was not included in the household survey. The researcher repeatedly distributed the same research instrument to them and then compared two observations of the researchers of the same occurrences to confirm if their measures are equivalent (Kothari, 2019). Therefore, the measuring instruments were reliable because there was consistency in the results.

3.5 Ethical Consideration

In this study, the researcher requested research clearance in writing from the Vice-Chancellor from St Augustine University of Tanzania for Data Collection. Then the letter obtained from SAUT was presented to Misungwi and Magu District councils for their permission concerning data collection. After that, a consent letter was produced for participants to ensure they were well informed. The researcher ensured that all the information collected during the research period was handled confidentially and solely for academic purposes.

3.6 Model Specification

Identifying the effect of land tenure on land management practices, including one land management, two land management or more than two land management practices on farm plots is possible with a Multinomial Logit (MNL) model adopted from (Miheretu, 2017; Aberaa and Budds, 2020). Hence, this model is applied in this study to investigate the effect of land tenure on land management guided by random utility theory and the Lancastrian theory of consumer choice. After exercising rational decision-making, household heads identified one or more land management practices that provide them with the most utility. The choice of a household to implement land management or not is influenced by an unobservable utility index I*i, which is dependent on explanatory variables. We express this index as: -

$$I^*_i = BX + \mu_i \quad (1)$$

Where i = ith individual, μ = error term and X is a vector of explanatory variables influencing the perceived of the land management practice.

Assume that Yi = 1 (a person adopts land management) if $I^*_I \geq 0$

Yi = 0 (when a person does not adopt land Management $I^*_I \leq 0$

That is, if a index of the person utility exceeds the threshold level I^*_I, he or she will adopt land management, and if it is less than that household heads will not adopt land management.

According to Green (2012) the Multinomial Logit (MNL) variant of the multiple-choice problem is given by: -

$$Prob\ (Yi = j) = \frac{exp\beta'_j X^i_j}{\sum_{j=1}^{j} exp\beta'_j X^i_j}, \quad j = 0,1, 2.........j \quad (2)$$

if Yi is a random variable that represents the decision made.

A decision maker with the features given by X_{ij} will receive a set of chances for j + 1 land management practice. By assuming that β0 = 0, the equation can be made normal. As a result, the probability can be calculated as follows: -

$$Prob\ (Yi = j) = \frac{exp\beta'_j X^i_j}{1 + \sum_{j=1}^{j} exp\beta'_j X^i_j}, \quad j = 0,1, 2.........j \quad (3)$$

$$Prob\ (Yi = 0) = \frac{1}{\sum_{j=1}^{j} exp\beta'_j X^i_j}, \quad j = 0,1, 2.........j \quad (4)$$

The following log-odds ratio results from normalising on any other probabilities: -

$$In[\frac{\rho ij}{\rho ik}] = X'_i(\beta_j - \beta_k) \quad (5)$$

The output of the coefficients from a multinomial logitic regression cannot accurately depict the change in the propensity of farmers to invest in land management. As a result, the marginal effects of the hypothesized explanatory variables on the likelihood that landowners decide to invest in land management were estimated. The marginal effects for continuous explanatory variables were computed by multiplying the coefficient estimate β by the standard probability density function while holding other explanatory factors constant (Green, 2012). Finally, the probabilities of the outcome (1 if yes and 0 otherwise) were compared to examine the marginal effects of dummy explanatory factors as follows: -

$$mi = \frac{\delta Pi}{\delta xj} = P_j[\beta_j - \sum_{k=0}^{j} P_k\beta_k] = P_j[\beta_j - \beta] \quad (6)$$

3.7 Variable Definition

The study measured the following variables LM_i = Land Management (dummy variable which takes the value of 1 for those who adopt land management and 0 otherwise), LT = Land Tenure Security (dummy taking the value 0 for those who have land security and 0 otherwise), AC = credit availability (Number of household heads who have access to credits), ADP = Adoption (dummy variable which takes the value 1 for those who adopt land management and 0 otherwise), CR = Conflict Resolution (Number of conflicts resolved), and age, gender, education level, family size, farm size, plot slope, experience in soil management, land use planning, and contact with the extension officer are socio-economic and demographic characteristics.

4.0. Results and Discussion

4.1 Land management practices adopted by farmers in Misungwi and Magu districts

Household heads in the study area were aware of the decline in soil fertility of their plots due to land degradation, overgrazing, and soil erosion. Hence, they adopted soil management practices such as combination of chemical fertilizer, animal manure and crop rotation; application of manure, soil bunds and crop rotation; combination of manure, terracing and crop rotation; combination of tree planting, manure and crop rotation; combination of manure and crop rotation; combination of crop rotation and terracing; application of manure only; application of terracing only; combination of tree planting and manure; combination of soil bunds and crop rotation; and application of crop rotation only so as to restore soil fertility and to improve the productivity of their land.

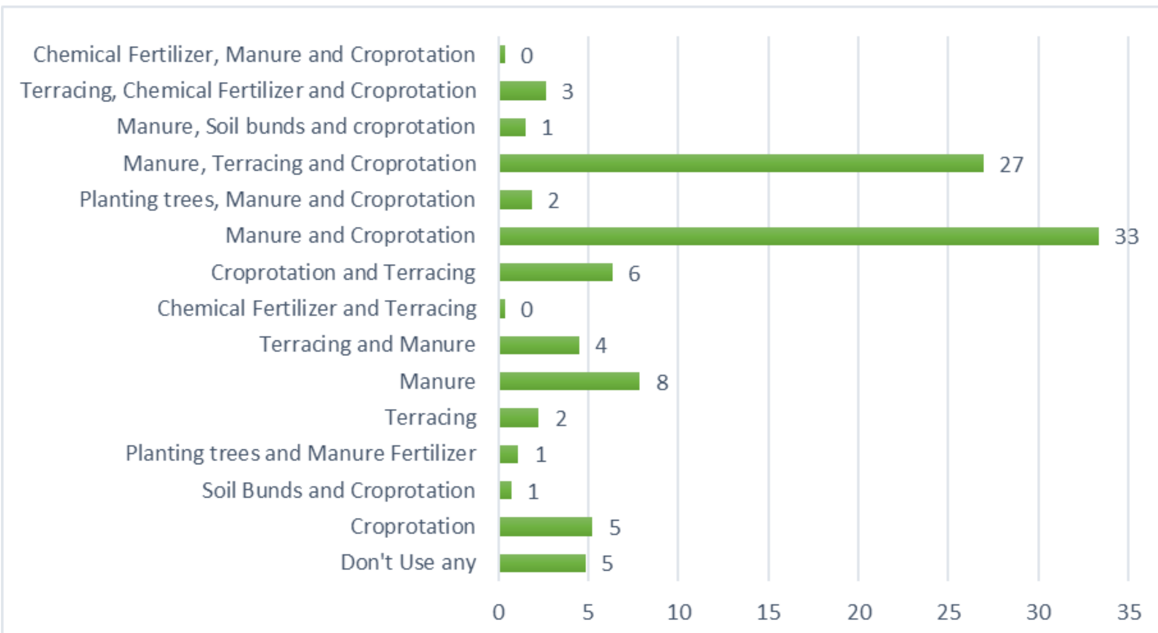

Figure 2: Land management practices

Source: Field data

The figure above shows that the combination of manure and crop rotation was one of the land management practices applied mostly by household heads (33 percent) due to its being less expensive and easy to get. This is because about 30 percent of the household heads in the study area were involved in farming and livestock keeping, which makes it simple for farmers to implement manure. Followed by application of manure, terracing, and crop rotation (27 percent) due to the nature of their farm in the study area and in addition as reported from focus group discussion large livestock keepers graze their animals in the fields, causing soil erosion. That is why farmers decided to engage in a combination of manure, terracing, and crop rotation to restore soil fertility and reduce soil erosion. Application of chemical fertilizers and those in combination with chemical fertilizers was minimal due to high cost, so household heads could not afford to buy them. Hence, they relied on animal manure. Moreover, crop rotation was also one of the practices applied mostly in the study area, in which there was rotation of crops from one season to another for crops like cotton, maize, sunflowers, millet and legumes, to reduce the existence of Striga for their local language called *kidua or sondo,* which can reduce crop production. Otherwise, 5 percent do not use any land management practices.

Furthermore, the analysis of the above figure revealed that, approximately 15 percent of household heads used only one land management practice on their farm, such as manure fertilizer, terracing, and crop rotation. Similarly, approximately 45 percent of the plots used two land management practices simultaneously that is terracing and manure (TEMA), manure and crop rotation (MACRO), and about 33 percent of the household heads used more than two land management practices simultaneously on their farm, namely tree planting, manure, and crop rotation (PLAMACRO), Manure, terracing, and crop rotation (MATECRO) and terracing, chemical fertilizer, and crop rotation (CHETECRO). Therefore, the main land management practices adopted in the study area by the farmers to increase production were terracing and crop rotation, manure only, TEMA, MACRO, PLAMACRO, and MATECRO.

4.2 Correlation between Outcome Variables

Correlation is very important in this study because it measured the relationship between variables, with the help of correlation, it is possible to have a correct idea concerning land management and land tenure, and, it is possible to understand the behaviour of one variable to another.

Table 1: Correlation between Outcome Variables

	Terracing	TEMA	Manure	MACRO	PLAMACRO	MATECRO	Farmer training	Extension Off.	Access to credits	Conflict Resolution
Terracing	1									
TEMA	-0.032	1								
Manure	-0.0443	-0.063	1							
MACRO	-0.1108	-0.007	-0.214	1						
PLAMACRO	-0.0249	-0.036	-0.048	-0.12	1					
MATECRO	-0.0939	-0.134	-0.181	-0.452	-0.102	1				
Farmer training	-0.0921	0.0311	-0.084	-0.019	0.164	0.1894	1			
Extension officers	-0.0869	0.0014	0.0583	0.037	0.0147	0.1301	0.5322	1		
Access credits	-0.0093	-0.013	-0.018	-0.045	-0.010	-0.038	0.1124	0.1070	1	
Conflict resolution	-0.0376	0.1276	-0.211	-0.055	-0.056	0.1874	0.0356	-0.0725	0.0668	1
Land security	-0.065	0.0885	-0.181	-0.092	-0.039	0.1603	0.1009	-0.0190	0.0558	0.804

Source: Field data

The result from table above indicates that there was a positive relationship between dependent variables and independent variables because those who perceived land tenure security and conflict free could have the possibility to contact extension officer and have knowledge about soil management and then had a loan accessibility, which had the possibility to apply the combination of manure, terracing, and crop rotation (MATECRO) and PLAMACRO. Otherwise, those who perceive land tenure security and conflict-free had the option of reducing the use of manure only and MACRO, and replacing it with either PLAMACRO or MATECRO.

4.3 The effect of land tenure on land management

The effect of secured land tenure on land management was discussed using the multinomial logit (MNL) model in the next section based on the following four specific objectives. The estimated MNL model coefficients, marginal effect and their significance levels were presented in Table 2 and 3.

Table 2: MNL Results

Variables	Terracing and Crop rotation		MATECRO		PLAMACRO		MACRO		Manure Only		TEMA	
	Coef	P-value	Coef.	p-value	Coef.	P-value	Coef.	P-value	Coef.	P-value	Coef.	P-value
Const.	-12.28	.05	-2.555	.021	-11.40	.044	.8403	.672	-1.266	.518	-.091	.969
Age	1.363	.17	.323	.021	-.162	.652	-.142	.252	-.538	.09	.254	.405
Gender	-.495	.67	-.065	.857	.190	.856	.623	.063	-.613	.299	-.771	.282
Educ.	1.877	.17	-1.220	.005	2.883	.010	.5518	.116	-1.016	.214	-1.741	.127
HH size	.394	.56	.065	.930	1.864	.209	.046	.833	.223	.556	-.434	.384
FarmSize	-1.335	.05	.065	.243	.159	.260	.042	.452	-.335	.093	.099	.254
Slope	1.307	.11	.583	.002	.566	.341	-1.191	.000	.006	.986	.132	.746
Land use	-1.685	.87	-.063	.847	-2.455	.032	.106	.726	1.389	.060	-1.117	.102
Land Security.	-.6962	.72	-.002	.996	1.044	.492	-1.116	.027	.793	.793	-1.858	.473
Soil exp.	0	0	.468	.231	2.999	.017	.189	.639	-.944	.224	.121	.882
Agro.Ext	0	0	.332	.408	-.904	.428	.126	.756	1.119	.08	-.167	.85
Conflict Resolutio	-.12	.95	.786	.15	-2.347	.175	.786	.123	-1.889	.06	2.618	.31
District	-.913	.53	.406	.267	-2.122	.110	-.667	.062	-2.234	.003	-.487	.517

Terracing only; MATECRO: Manure, Terracing and Crop rotation; PLAMACRO: Planting trees, Manure and Crop rotation; MACRO: Manure and Crop rotation; Manure Only and TEMA: Terracing and Manure. No. of obs = 267; LR $Chi^2(12)$ = 25.37[0.0132]; Pseudo R2 = 0.3919
Source: Field data

The log likelihood estimation of -19.6848 and the chi-squared value of 25.37 showed that the likelihood ratio statistics are highly significant ($p < 0.05$) suggesting the model is good-fit and has a strong explanatory power. The pseudo R2 was 0.3919 indicating the explanatory variable explained about 39.2 percent of the variation in choice of land management practices. This means that the empirical MNL is highly significant in explaining the choice of land management practices by farmers.

4.3.1 The Effect of Credit Access on Land Management

The MNL logit result showed that credit access data is constant and does not vary from one respondent to another, so it was not included in the logit model, but the correlation analysis anticipated a significant and positive correlation between farmer experience on soil management and loan availability. Hence, it was possible for those who perceived land tenure with access to credits and had experience in soil management to adopt long-term investment that was a combination of planting trees around the farm, manure, and crop rotation that were associated with farmer experience in soil management.

Table 3: Marginal Effect

	Marginal effect					
	TERRACING	MATECRO	PLAMACRO	MACRO	MANURE	TEMA
Age	0.0016867	0.05918	-0.00032	-0.03062	-0.01036	0.00588
Gender	-0.0006709	-0.01207	0.00036	0.12786	-0.02033	-0.02106
Education level	0.0023232	-0.22308	0.00577	0.11926	-0.02976	-0.04038
Family size	0.0004879	-0.00407	0.00373	0.00998	0.00653	-0.01007
Farm size	-0.0016521	0.01195	0.00031	0.00902	-0.00979	0.00229
Plot slope	0.0016521	0.10669	0.00113	-0.25756	0.00017	-0.00305
Land use planning	-0.0002735	-0.01155	-0.00491	0.02294	0.04068	-0.02591
Land Security	-0.0009007	-0.00049	0.00209	-0.24156	0.00595	-0.05247
Conflict resolution	-0.0001492	0.14589	-0.00525	0.17072	-0.05753	0.08472
Training on soil management	0	0.09033	0.01688	0.04159	-0.02316	0.00372
Contact with extension expert	0	0.06323	-0.00149	0.02754	0.04452	-0.00372

Source: Field data

4.3.2 The Impact of Land Tenure on the Adoption of Land Management Practices

Farmers in the study area were asked their opinion on how their land management techniques significantly impacted soil erosion and soil fertility loss. They were questioned about their land management practices for reducing soil erosion, increasing soil fertility, and increasing the productivity of underdeveloped fields. MNL results indicated that the choice of land management practice depends on land tenure and other institutional and socio-economic factors.

Terracing

The application of terracing in the study area was negatively and significantly determined by farm size ($p<0.05$) (see table above). An increase in farm size would reduce the chance of implementing terracing practices by about 0.2 percent ceteris paribus. This was because household heads with small farm sizes had a higher probability of applying terracing than those with large farm sizes, probably due to a lack of credit and skills for most household heads. In addition, focus group discussion revealed that in this study area, land was not used as collateral for borrowing money unless you invested in land before the loan process or you had another source of income that could be used as a guarantee to access credits. The findings contrast with Kansanga & Bezner (2020), Songa & Huyen (2020) and Oduniyi (2021).

Combination of Application of Manure, Terracing and Crop rotation (MATECRO)

The application of combination of manure, terracing and crop rotation in the study area was positively significantly influenced by age ($p < 0.05$) and plot slope ($p<0.05$) while the education level of the household head had a negative and significant impact ($p<0.05$) (see table 3 above). Increase in plot slope would increase the chance of applying a combination of animal Manure, Terracing, and crop rotation practices by about 11 percent than those with flat slope because the rate of soil erosion increases as the slope of farm increases, especially during rainy season. In addition, according to focus group discussion and key interviews revealed that, the study area is concentrated on livestock keeping with no permanent area for grazing because the area designated for grazing during land use planning is still owned by households. Other areas are concentrated on water, which cannot be grazed. Instead, livestock keepers graze on farm land, which later reduces soil fertility due to soil erosion. That is why adoption of a combination of manure, terracing, and crop rotation on plot slope is important to restore soil fertility and reduce the high rate of soil erosion.

An increase in one-year age will raise the probability of application of a combination of animal manure, terracing, and crop rotation practices by about 6 percent while the probability of investing in animal manure, terracing, and crop rotation will decrease by 2 percent when the level of education of the household head increases, other factors remaining constant. This might be because education was not an important factor in helping them acquire sufficient information, skills, and knowledge about the benefits of adopting a combination of animal manure, terracing, and crop rotation. The findings contend with those of Oduniyi (2021), and Kirui (2017).

Combination of planting trees, animal manure and crop rotation (PLAMACRO)

The education level ($p<0.05$) and training of household heads in soil management ($p<0.05$) were positively and significantly associated with adopting a combination of planting trees, applying animal manure, and crop rotation practice in the study area, while land use planning has a negative impact ($p<0.05$) (see table 3 above). An increase of training of household head would increase the probability of applying combined planting tree, animal manure application, and crop rotation methods by about 2 percent than those who do not get training and the probability of investing in combination of planting tree, animal manure, and crop rotation increases by 0.5 percent as level of education of the farmer increases, held another factor constant. This might be due to the reason that education helps the farmer to acquire new skills and knowledge of the benefit of adopting long-term investment rather than short-term. The findings are in line with those by Kansanga & Bezner (2020), Songa & Huyen (2020), Kirui (2017) and Oduniyi (2021) who said education and farming experience had positive impact on land management. Otherwise, if the areas designated for different uses during land use plans are not well implemented, then the adoption of combined tree planting, animal manure, and crop rotation will be reduced by 0.4 percent compared to those who implement land use plans. This might be because all areas designated for various uses in the study area were not well implemented, so it could not allow the long-term investment of land management.

Combined Manure and crop rotation (MACRO)
Gender positively influenced the adoption of crop rotation and animal manure adoption in the study area ($p<0.1$), while plot slope ($p<0.01$) and secure land tenure ($p<0.05$) had negative signs (see table 3 above). The results showed that those who perceive land tenure security would decrease the probability of application of a combination of manure and crop rotation practices by about 24 percent compared to those who do not have land security. This might be due to the reason that land tenure security is positively associated with farming experience on soil management, which can probably encourage those with land tenure to shift to other land management practices. When farm slope increases by 1 unit, probability of adopting combination of manure and crop rotation decreases by 26 percent. This might be due to the reason that household heads may shift to other land management practices like terracing or planting trees, which could be able to prevent soil erosion. Similarly, adoption of a combination of manure and crop rotation was positively higher in Misungwi district than in Magu district. This could be explained by the availability of animals which encourages farmers to adopt that land management. The findings contrast with Kirui (2017), Issahaku (2019), and Oduniyi (2021) who reported positive significant between security of land tenure and land management; but agree with Kansanga & Bezner (2020) who reported that gender had a positive impact on land management.

Manure Only
Contact with agriculture experts ($P<0.1$) and land use plans ($p<0.1$) positively and significantly impacted the adoption of manure only in the study area, while age ($p<0.1$) and farm size ($p<0.1$) had a negative and significant impact (see table 3 above). increasing the probability of age of household head by one year reduced the possibility of adopting manure only practices by 1 percent. Similarly, if farm size increases by 1 unit would decrease the application of manure only by 0.9 percent. Additionally, if area allocated for grazing implemented by 1 unit would increase the adoption of manure by 4 percent. This might be because when area allocated for grazing is implemented by the construction of animal infrastructure and improved pasture, it would increase the availability of manure, hence encouraging farmers to adopt manure, whereas contact with an extension officer increased the probability of applying manure only by about 4 percent because household heads would have sufficient knowledge to apply manure in their field. The findings contend with those in Issahaku (2019), Aberaa and Budds (2020), and Oduniyi (2021).

4.3.3 The Value of Dispute Resolution in Land Management
Conflict resolution was negatively and significantly influenced by the application of manure practice only ($p<0.1$) (see table 3 above). An increase in conflict resolution (especially boundary conflict) by a unit makes the probability of household heads not investing in manure only by 0.05753, which is equivalent to 6 percent. This might be because conflict resolution is positively associated with the adoption of a combination of manure, terracing and crop rotation and land security and negatively with the adoption of manure only, so it could be possible to encourage the household head to adopt other practices that were a combination of manure, terracing, and crop rotation.

4.4 Test for ANOVA

Table 4: Analysis of Variance

ANOVA IN MAGU DISTRICT

	SS	df	Mean Square	F	Sig.
Between Groups	.045	1	.045		
Within Groups	22.398	158	.142	.321	.572
Total	22.444	159			

ANOVA IN MISUNGWI DISTRICT

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.648	1	.648	4.189	.043
Within Groups	16.231	105	.155		
Total	16.879	106			

Source: Researcher, 2022

Table 5:Turkey analysis

Land Management	Contrast	Std.Err	t	P>|t|
Land security No vs Yes	-0.0490773	0.0472901	-1.04	0.300
Land Security Yes vs No	0.0490773	0.0472901	1.04	0.300

Source: Field data

A one-way ANOVA was conducted to determine if land management practices differed between groups of those with land tenure and those who do not have land tenure in Magu and Misungwi District. The mean (±) and standard error were used to explain the data. Participants were divided into two groups based on their ownership of land; that is, those who have land tenure and those who do not have land tenure. The one-way ANOVA in Magu District F (1, 158) = 0.321, p = 0.572 showed that there was no statistically significant difference between the groups while in Misungwi District F (1, 105) = 4.189, p = 0.043 showed that there was a statistically significant difference between the groups.

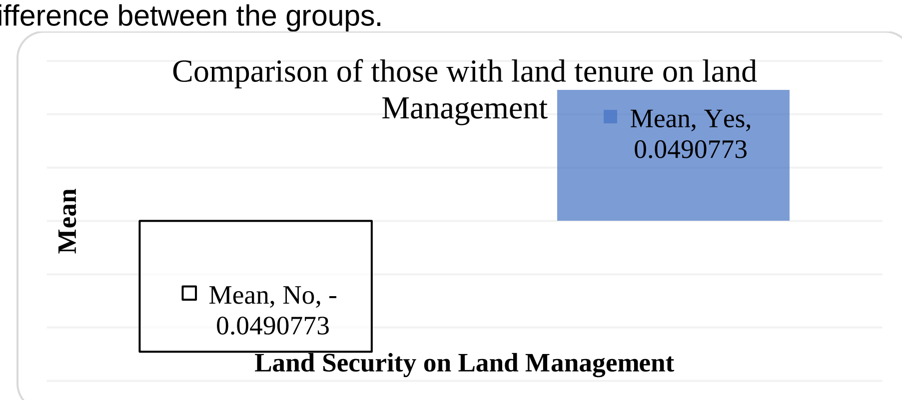

Figure 3: Comparison between Land Management and Land Tenure
Source: Field data

A Tukey posthoc test showed that land management was not statistically significant when comparing people with and without tenure security (-0.05± 0.05, p = 0.300). It was also not statistically significant when comparing people without and with tenure security (0.05± 0.05, p = 0.300). However, the mean of those who have land tenure is higher than that who do not have land tenure meaning that those who have tenure security are more numerous than those who do not. As a result, the contribution of land tenure to land management is positive even if it did not add to loan availability; instead, it only made their land more secure, planned, and conflict-free, which increased household income.

5.1 Conclusion

The study was influenced by the fact that previous studies could not explain the effect of land tenure on land management in Magu and Misungwi districts. The argument was based on the methodology used where there was no direct causal relationship between land tenure and land management. But rather land tenure and crop productivity. The current study managed to uncover the direct causal relationship between land tenure and land management. We managed to empirically show that land tenure in combination with other factors can influence sustainable land management practices. The study revealed that land tenure security is an important but not sufficient prerequisite for assisting household heads in obtaining credit access and investing in land management.

Another building block of the current study was the geographical different and time lag between the current study and previous studies. The current study has brought on surface the land management status in the districts of Magu and Misungwi. From the findings, financial constraint has been a stumbling block among smallholder farmers in the study area. Despite the positive associations between land tenure security, farming experience in soil management and conflict resolution, which would probably encourage the household heads to adopt either a combination of tree planting, manure, and crop rotation or a combination of manure, terracing and crop rotation but still crop production remained a problem in the study area. Otherwise, the findings show that the livelihood in the study area will be improved when household heads focus on the adoption of a combination of manure, terracing, and crop rotation because it has shown to contribute more to food availability than the adoption of manure only.

We conclude that the study bridged the gap established early in the literature section. For the Tanzanian context, the study applied the multinomial logit which lacked in other studies. The analysis also managed to establish the causal relationship between land tenure and land management practices in the study area. Therefore, this study has established its place in the body of literature by bridging the time, geographical and methodological gaps identified in the literature review section.

5.2 Recommendation

We recommend that the government and policymakers should advice financial institutions to recognize customary rights of occupancy (CCROs) to promote credit accessibility, which enables land market expansion, particularly in rural areas. Additionally, farmers should be informed about the uses of certificates before receiving them, as it is apparent that many are unaware that certificates can be used as collateral to secure loans for farm inputs. Furthermore, land allocated for different uses like land for agriculture, livestock, settlement, and forest should be well implemented to encourage household heads to adopt long-term investment that is a combination of tree planting, animal manure and crop rotation (PLAMACRO) and terracing. The district council should also set strategies for all areas designated for different uses and still owned by individuals to be implemented as they agreed.

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Policy Brief

The effect of land tenure on sustainable land management in Magu and Misungwi districts

Executive Summary

The relative importance of agriculture for food security and income generation among smallholder farmers in Tanzania, proper land management cannot be over emphasized. This study investigated the effect of land tenure on land management in Magu and Misungwi districts. Using mixed research approach, analysis of multinomial logit model revealed the importance of land tenure and other factors on land management. From the findings, appropriate recommendations have been provided to community development stakeholders including policy makers and practitioners.

Introduction

Reliance on rain-fed agriculture, nutrient mining, and low inputs contribute to low crop yielding agriculture in Africa (Kimaro & Mareale, 2013; Teshome & Ritsema, 2016; Lal & Mwaseba, 2015). Sustainable Land Management (SLM) strives to maximize social and economic benefits from the land. Therefore, sustainable land management (SLM) investments are crucial for food security improvement (Nyanga & Tenge, 2016). Sustainable land management can be achieved with land rights thereby addressing gender disparities, and conflicts (Lawry & Hall, 2014). When access to land, land rights, and tenure security are assured, farmers invest in long-term improvements to their farms (Nara & Zevenbergen, 2020; Lawry & Hall, 2014). The current study examined the effect of land tenure on land management in the study area.

Research Overview

The study was guided by two theories, Lancastrian consumer theory (Lancaster, 1966) and the Evolutionary theory of property rights (Demsetz, 1967). Lancaster theory assumes that people draw utility from characteristics of the commodity rather than commodity itself. While the evolutionary theory of property rights points out that land titling policy implementation by states is a result of land scarcity (Demsetz, 1967). From empirical evidences, the study adopted mixed research approach. The data were collected from 267 respondents with 161 from Magu District and 106 from Misungwi District. The qualitative data were obtained from focused group discussion. Village leaders helped to obtain households participating in focused group discussion. Convergent parallel research strategy was used thereby simultaneously collecting quantitative and qualitative data with equal weight to each approach. The two components were analysed separately and findings were jointly interpreted.

Findings

Large number, about 33 percent applied manure and crop rotation as it is less expensive and easy to get because about 30 percent of household heads were involved in farming and livestock keeping. Manure application, terracing and crop rotation was practiced by 27 percent due to the nature of their farm in the study area. As reported from focus group discussion large livestock keepers graze their animals in the fields, causing soil erosion. That is why farmers decided to engage in a combination of manure, terracing, and crop rotation to restore soil fertility and reduce soil erosion. But 5 percent did not use any land management practices.

Approximately 15 percent of household heads used one land management practice on their farm. While, approximately 45 percent of the plots used two land management practices simultaneously, and about 33 percent of the household heads used more than two land management practices simultaneously.

The application of terracing was negatively and significantly determined by farm size ($p<0.05$) due to managerial constraints. Focus group discussion revealed that land was not used as collateral unless another source of income was used. The findings contrast with Kansanga & Bezner (2020), Songa & Huyen (2020) and Oduniyi (2021).

The application of combination of manure, terracing and crop rotation was positively and significantly influenced by age ($p < 0.05$) and plot slope ($p<0.05$) while education level had a negative and significant impact ($p<0.05$). Adoption of a combination of manure, terracing, and crop rotation restores soil fertility and reduces soil erosion.

The education level ($p<0.05$) and training of household heads in soil management ($p<0.05$) were positively and significantly associated with adopting a combination of planting trees, applying animal manure, and crop rotation practice in the study area, while land use planning has a negative impact ($p<0.05$). The findings are in line with Kansanga & Bezner (2020), Songa & Huyen (2020), Kirui (2017) and Oduniyi (2021).

Plot slope ($p<0.01$) and secure land tenure ($p<0.05$) had negative signs on land management. Similarly, adoption of a combination of manure and crop rotation was positively higher in Misungwi district than in Magu district. This could be explained by the availability of animals which encourages farmers to adopt that land management. The findings contrast with Kirui (2017), Issahaku (2019), and Oduniyi (2021) who reported positive and significant relationship between security of land tenure and land management.

Contact with agriculture experts ($P<0.1$) and land use plans ($p<0.1$) positively and significantly impacted the adoption of manure only in the study area, while age ($p<0.1$) and farm size ($p<0.1$) had a negative and significant impact. The findings contend with those in Issahaku (2019), Aberaa and Budds (2020), and Oduniyi (2021).

Policy recommendations

Focus group discussion revealed that land was not used as collateral unless another source of income was used. Financial institutions should allow farmers to use their land as collateral. Farmers will manage terracing in large sized farms if they have access to credit from financial institutions.

Aged farmers are less educated but own many assets including farm animals. While young farmers are more educated but do not own farm animals. Community based organizations should support young farmers with farm animals. This will increase crop productivity and household income thereby reducing poverty.

Agricultural extension officers should educate farmers on the importance trees and manure on soil nutrient protection. This can be done through training village leaders, use of social media, radio station and news papers.