



THE INFLUENCE OF IN-MIGRANT PASTORALISTS ON LAND USE CHANGE IN RUFJI DISTRICT, TANZANIA

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ABSTRACT

This study was conducted to determine land use change as a consequence of pastoralists' arrival in Rufiji district. It involved a total of 200 households whereby each was represented by one member. Data collection methods involved: household survey, interviews, focus group discussions and documentary review. Binary logistic regression was applied to establish factors influencing land use changes. The study established that land use had been changing from time to time after the arrival of pastoralists. Before their arrival, land uses were dominated by crop production and human settlement. After their arrival, the land uses became dominated by crop production, human settlement and livestock keeping, implying that livestock keeping is a new land use practice. Three factors had significant influence on land use change (number of livestock owned by pastoralists ($p \leq 0.01$), number of years pastoralists lived in the area ($p \leq 0.05$) and the local people's involvement in livestock keeping ($p \leq 0.05$). It is concluded that the pastoralists and their associated activities have led to the land use changes in the area. The land use and conditions change feature through water sources destruction as well as spread of forest fires and vegetation clearance. It is recommended that efforts should be made to minimize adverse effects over the land by making sure those areas for agriculture and pastoral activities are defined and necessary services should be provided in the areas. The district authorities should develop sustainable land use plans for each village.

Key words: *pastoralists, agro-pastoralists, land use change, Tanzania.*

1. INTRODUCTION

Tanzania is endowed with abundant natural resources including land with an area of about 942 600 square kilometres and a population of about 44 928 923 millions of people in 2012 (URT, 2013). Land is the most important natural resource in which all activities are based and is a platform for all human activities. Therefore, whatever is done in any sector of economy has an impact on land (Fredy *et al.*, 2014). Growth in the livestock population has raised the demand for grazing land (including that under cultivation) and has also made serious soil problems in some areas (URT, 1997). Land use is the term used

to describe human uses of the land, or immediate actions of modifying or converting land cover. It includes such categories as human settlements, protected areas and agriculture (Sherbin, 2002). It refers to what people do on the land surface, that is, the manner in which human beings employ the land and its resources (Geist and Lambin, 2002). According to Veldkamp and Fresco (1996), land use change is determined by special and temporal interaction between biophysical factors (e.g. soil, climate, vegetation and topography) and anthropogenic factors (e.g. population size and density, technology levels, economic conditions, the applied land use strategy, and social attitude and values).

Land use change is among the drivers of environmental change influencing the basic land resources including the soil (Maitima *et al.*, 2010). With the recent advances in satellite remote sensing, software and computer technology, land use and land cover studies have progressed significantly in the last two decades (Giri, 2012) and across the continents. There are continual changes in land use in many parts of Tanzania. They occur in response to various situations like adverse climatic conditions, changes in population, land pressure and changes in socio-economic conditions that favour or discourage certain changes (Ngailo *et al.*, 2001 and Msoffe *et al.*, 2011). It is also influenced by increasing human activities which have increased the demand for agricultural land, forest, pasture, urban and industrial, building, grazing animals and for cultivation of both food and cash crops (Fredy *et al.*, 2014 and Nzunda *et al.*, 2013). Nevertheless, cultural differences have important impacts on direct drivers to land use change (Nelson *et al.*, 2006).

Walsh (2012), Ngailo (2011) and Ngailo *et al.* (2001) showed that land use and land condition changes related to pastoralists have a role in the evolution of farming systems in Tanzania. Ellis (2013) and Devisscher (2010) described the role of demographic and socio-economic processes in altering the environment and that land use and condition change are normal human behaviour of modifying the world.

According to Mwilawa (2003), Rufiji district started receiving pastoralists and agro-pastoralists from different places in Tanzania in the beginning of the 2000s. In March 2006, the government of Tanzania, through the Office of the Vice President, issued a statement declaring the eviction of pastoralists, agro-pastoralists and small scale holding communities from Usangu Basin in Mbarali district and Kilosa and Kilombero districts (Mvulla and Kawawa, 2006). This aimed at conserving the Usangu-Ihefu Wetland as pastoralists were named as the critical causes of environmental degradation in the areas.

The land use and land conditions changes since the pastoralists and agro-pastoralists arrival in the Rufiji district have not well been studied. This was the motivation towards this study which was conducted in Rufiji district. This paper examined the influence of pastoralists on land use change in the study area. Specifically, it describes the pastoralists and their livestock registration status; assessed land allocation, identified changing nature of land use, distribution, condition; explains factors influencing land use changes, and finally describes peoples' perception on the changing nature of the land use conditions in the study area. The paper is guided by the Malthus' Population Theory (1798). The theory considers both migration and population increase consequences, and migration is regarded as one of the factors for population increase. The theory postulates the dangers population growth exerts over the resources.

2. METHODOLOGY

2.1 Study Area

The study was conducted in Rufiji district, one of the six districts of the Coast region in Tanzania. The district land size is 1,334,000 ha of which 47% constitutes Selous Game Reserve; 36% is general land

where settlements and agricultural activities are permitted; 12% is protected forest and 5% consists of rivers, swamps, lakes and the Indian Ocean (Mkindi and Meena, 2005).

2.2 Research Design

A cross-sectional research design was employed. It was preferred to a longitudinal study design because of limited resources such as finance and time available to pursue the study. In a cross-sectional study respondents are interviewed at a single point in time (Mann, 2003) which saves money and time. However, in a longitudinal study, researchers conduct several observations of the same subjects over a period of time, sometimes lasting many years (Institute for Work and Health, 2009). Cross-sectional design was also preferred as it supported both quantitative and qualitative analyses techniques. Another merit of a cross-sectional study design is that it allowed the study to compare many different variables at the same time. It was possible, for example, to look at number of pastoralists and livestock received number of years pastoralists have spent in the study area as well as newly introduced economic activities in relation to land use changes in the study area.

2.3 Sampling and Sample Size

The district was picked purposefully among other districts of the region because it started experiencing the influx of pastoralists in the 2000s compared to other districts. This was also fuelled by the arrival of the Usangu and Kilombero evicted pastoralists in 2006 were directed to move to the district (Mvulla and Kawawa, 2006). Five villages were involved out of 20 villages which received pastoralists. The k^{th} factor formula was applied to pick the villages whereby 20 villages which received pastoralists were subjected to the formula. The sampling fraction was used to get the first village in a list, whereas other villages were selected by choosing every other k^{th} village. The respondents for the study included village members aged 30 years and above in 2014 and who had been living in the village since or before 2000, on the basis that they had experienced the situation under investigation. Basing on Bailey's (1994) arguments that a sample of 30 respondents is the bare minimum for statistical analysis regardless of the population size, the study thus, involved a total sample of 200 local communities' households' representatives for the survey.

2.4 Data Sources and Collection Techniques

Sources of primary data were: key informants, household heads and community members. Secondary information was collected from village reports and relevant research reports. The secondary data collected included: number of registered pastoralists, registered number and types of received livestock as well as the number of pastoralists allocated for each village. The methods of data collection included: key informant interviews, household survey, focus group discussions (FGD) and documentary review. The tools used for data collection were interview guides, questionnaire, and checklists. The household survey on land use change was sought to capture information regarding people's understanding and identification of land use changes as well as interrelated drivers and effects.

2.5 Data Analysis

Analysis of qualitative data was done through the content analysis which involved quotation of statements, interpretation, identifying variations and similarities of the related arguments. Binary logistic regression was used to test factors influencing land use changes. The dependent variable (Y) attempted to explain whether there were land use changes or otherwise. No land use change was assigned a value of 0 and presence of land use change was assigned a value of 1. The model was presented as follows:

$$\text{Logit}(\pi) = \log(\pi/1-\pi) = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \dots + b_kX_k \dots \dots \dots (1)$$

(Agresti, 2002; Powers and Xie, 2000), Where:

Logit (π) = \ln (odds (event)), that is the natural log of the odds of an event occurring, in this research

π = prob (event), that is the probability that land use changes will occur

$1-\pi$ = prob (no event), that is the probability that the land use changes will not occur

b_0 = constant of the equation

b_1 to b_k = coefficients of the independent variables (predictors)

k = number of independent variables

x_1 to x_6 : Independent variables for land use changes entered in the model

x_1 : Number of pastoralists received

x_2 : Number of livestock owned by pastoralists

x_3 : Population size of the area

x_4 : Number of years spent by in-migrant pastoralists

x_5 : Number of economic activities introduced in the area

x_6 : Natives' involvement in livestock keeping

3. FINDINGS AND DISCUSSION

3.1 Pastoralists' Livestock Number and Land Allocation

The Tanzania land policy emphasizes transparency on land administration (URT, 1997). This is contrary to the pastoralists' arrival processes in Rufiji district. The findings showed that their arrival involved cheating as some were not registered and others registered less the number of livestock than they actually owned. This resulted in the villages ending up without correct records of the number of people and livestock received. For example, it was narrated in an FGD: "*.....At Muyuyu village in the beginning of 2005, six pastoralists were registered with 7000 cattle, but in few months later the number rose to about 50 pastoralists, but the number of livestock was not recorded*" (FGD-Muyuyu village).

The results support the findings by Barbour and Prothero (1962) who described that Africa is a unique region from which it is difficult to draw important empirical evidence about people's migration. This is perhaps due to improper record keeping in the continent. The results from this study imply that more herds and population of livestock have actually been moved to Rufiji district and therefore the village land use plans and the carrying capacity are likely to have been jeopardized. It was further reported that other pastoralists came in without being registered as they came under the umbrella of the few registered colleagues.

For example, it was discussed that: "*...in-migrant pastoralists were avoiding the wrath of residents by splitting up their livestock herds. Any excess was divided among elder sons as a way of showing that an individual was in possession of a small number of cattle...*" (FGD-Muhoro village). This statement implies that there is a larger number of livestock received in the study area than what has been officially recorded and registered. The increasing number of livestock moved in the district has affected the village land use plans, especially on crop production.

The five villages in total received 14 840 cattle, 1014 goats, 211 sheep and 75 donkeys from 38 registered pastoralists. However, it was reported by one of the key informants that in reality on average each pastoralists' family owned between 3000 and 5000 cattle. This implies challenges on the village land carrying capacity to accommodate livestock. As required in the Village Land Act (URT, 1999) and the Rural Farm Lands Act (URT, 2002) on land allocation, all villages were required to allocate the lands. The total land size allocated by the four villages was 17 888 hectares (Table 1). The findings show that all the villages in the study area complied with the national land policy (1997) and the village land act (1999)

which requires the villages to allocate and plan for sustainable land use plans at the village level in order to minimise land use conflicts and enhance sustainable village land use plans.

Table 1: Pastoralists and number of livestock and village allocated land size

Village	Number of pastoralists	Cattle	Goats	Sheep	Donkey	Total land size (Hectares)
Nyamwage	8	920	132	57	16	3 106
Muhoro	10	3 700	160	26	27	2185
Kiwanga	5	1 120	292	37	12	2 500
Muyuyu	6	7 000	100	49	9	5 073
Chumbi A	9	2 100	330	42	11	250
Total	38	14 840	1014	211	75	17 888

3.2 Land Use Changes, Distribution, Possession and Acquisition

The results in Table 2 show that majority of the respondents (84.5%) acknowledged the existence of land use changes in the study area; while 15.5% reported that they had never observed any sign of land use changes. These findings generally indicate that, the coming of pastoralists in the study area has caused changes in the land use. This may be in the form of expansion of previously existing land uses or introduction of new land use practices in the land. The evidence provided for the land use changes include: establishment of new settlement areas, establishment of new farming lands, drying of the wetlands, and destruction of vegetation cover, burning of forests and observed signs of soil erosion.

Table 2: Responses distribution on occurrences of land use change (n=200)

Land use change occurrence	Percent response distribution by villages (%)					Total
	Nyamwage	Muhoro	Kiwanga	Muyuyu	Chumbi A	
No	4.5	4.0	3.5	2.0	1.5	15.5
Yes	15.5	16.0	16.5	18.0	18.5	84.5

Moreover, respondents were required to mention whether pastoralists and other in-migrants (investors influenced by the coming of pastoralists) had acquired land apart from the land areas allocated to them. All the respondents reported that the in-migrant pastoralists had also acquired land in the farm lands. This means that pastoralists have dispossessed some local people's part of their formerly owned land hence the size of land among the local people has reduced.

Furthermore, it was stated that land uses were few before the arrival of the pastoralists in many villages. This was due to the nature of socio-economic activities carried out by the local people. The findings in Table 3 also showed that at village level, especially in the study villages, major and dominant land use types were: agriculture which included crop cultivation (both food and cash crops), human settlement, forest land and burial sites. The arrival of pastoralists introduced livestock grazing. This was not initially an activity carried out in the district; however after the pastoralists' arrival livestock keeping became among the dominant land uses, ranking the third (24%) after human settlements (27%) and agriculture (33%).

Table 3: Ranking land use distribution before and after pastoralists arrival (n=200)

Before arrivals	Percent	Ranking	After arrivals	Percent	Ranking
Agriculture	36.5	1	Agriculture	33.6	1
Human settlement	33.5	2	Human settlement	27.3	2
Forestry land	15.5	3	Livestock grazing	24.0	3
Burial sites	14.5	4	Forestry land	8.1	4
			Burial sites	7.0	5

The findings in Table 3 show that livestock grazing ranked the third land use, swapping with burial land sites and forest land. Livestock grazing has also expanded the land use types from four main land use types to five. Findings by Lubowski *et al.* (2006) showed that the conversion of farm land and forests into grazing land reduced the amount of land for food production. It also results in soil erosion, and other types of soil degradation associated with pastoralists' activities as well as deforestation which reduce the quality of land resources. This happened just because the local people are also engaged in livestock keeping and leading to extended grazing land and human settlements, especially into demarcated farm land as a result of increase of both human and livestock population.

3.3 Factors Influencing Land Use Changes

The major constraints contributing to changes in land use and livelihood diversification in many parts of the world include high level of illiteracy, poor agricultural technology and knowledge of proper farming technologies, economic factors such as increasing levels of poverty due to unemployment, social and health factors that interfere with the people's productive capacity, decreased per capita and availability of arable land due to overpopulation and soil degradation due to overuse and lack of fallow periods (Laurance *et al.*, 2014). Using binary logistic regression, the paper determined pastoralists related factors responsible for influencing land use changes. The model contained six independent variables (Table 4).

The overall model fit containing all the predictors was statistically significant ($p = 0.000$), indicating that the model was able to predict respondents who agreed about the land use change and those who did not agree on the land use change. The Nagelkerke R^2 was 47.10395, indicating that the independent variables entered in the model explained 47.1% of variance in the dependent variable and Cox and Snell R^2 was 39.5%. The value of the Hosmer and Lemeshow Chi-square (6, $n = 200$, 56.6%), obtained was 5.272, but it was not significant ($p = 0.728$), implying that the model's estimates fitted the data at an acceptable level (Garson, 2008) because a finding of non-significance means that the model adequately fits the data (Agresti and Finlay, 2009).

Table 4: Pastoralists influences on land use changes

Variables entered in the model	β	Std. Error	Wald	df	Sig.	Exp (B)
Number of pastoralists received	-0.117	0.138	0.714	1	0.398	0.890
Number of livestock owned by pastoralists	-0.098	0.036	7.448**	1	0.006	0.907
Population size	-0.079	0.176	0.200	1	0.655	1.045
Years pastoralists lived in a village	-0.601	0.279	4.646*	1	0.031	0.548
Number of economic activities introduced	0.133	0.188	0.501	1	0.479	1.142
Local people's involvement in livestock keeping	0.004	0.003	1.487*	1	0.043	0.924

Valid cases = 200, Goodness-of-fit: Pearson's Chi-Square = 5.272 (p = 0.728); Cox and Snell Pseudo R-Square = 39.5, Nagelkerke Pseudo R-Square = 47.1%

Note: * and ** represent statistically significant levels at $p \leq 0.05$ and $p \leq 0.01$ respectively

The findings in Table 4 show that number of livestock had significant influence at $p \leq 0.01$. This implies that the number of livestock which were received had big negative impact on the land allocation for the grazing activities to take place and hence there were possibilities of transforming some parts of land for this purpose. There were some effects which resulted from the livestock keeping activities environmentally and economically, but this was not a concern for this paper. The findings are similar to those of Mwamfupe (2015) as reported in a study done in Rufiji, Kilosa, Kilombero and Kiteto districts. The author asserted that the major complaint was that livestock keepers have contributed to the degradation of rice fields and consequently leading to reduced productivity of the land.

Furthermore, the findings have shown that the number of years pastoralists had lived in a village had significant negative influence at $p \leq 0.05$. The results imply that years pastoralist stay in certain areas signify increasing amount of land needed for various socio-economic activities which may influence also local people's farm lands. Mbilinyi *et al.* (2013) postulated the impact of livestock on farms as small scale farmers are also affected. In the study areas *Maasai* pastoralists and other agro-pastoralists are blamed to graze their livestock on the farm lands. As they keep on staying in the village, more land is converted into various uses including crop cultivation as well as grazing activities and collection of forests products from the forest lands. In addition to that, the local people's involvement in livestock keeping was also found to have significant negative influence on land use changes at $p \leq 0.05$. It was mentioned that there were few local people who had started to engage in livestock keeping. This resulted in increasing number of people engaging in livestock keeping including the in-migrant pastoralists themselves hence increased demand for land for that purpose.

Moreover, the number of economic activities and local people's involvement in livestock keeping had positive coefficients with β values 0.133 and 0.004 respectively, implying that any increase in magnitude of these variables would result in higher possibilities of land use changes. On the other hand, the number of pastoralists received, number of livestock owned, population size in the area and years pastoralists had lived in a village had negative coefficients (β values) -0.117, -0.098, -0.079 and -0.601 respectively implying that the variables influenced land use changes negatively. These findings are in line with what was described by Bello and Arowosegbe (2014) who also attributed the mentioned factors to land use changes.

One Interviewee said: “.....the expansion of grazing land in the area causes many socio-economic impacts to the side of the crop producers.....” (Interview-Kiwanga village). According to them, the major socio-economic impacts of land use change are loss destruction of agricultural land which results in loss of income gained from farm and sometimes leading to food shortages.

In general, the growing population and increasing in socio-economic needs in the area creates pressure on land use change. This pressure results in destruction of agricultural and extension of grazing land. It was further revealed by participants during the FGD that the current land use change around the study area has been linked to various environmental problems such as habitat destruction, soil degradation, water pollution, loss and destruction of wildlife habitat. Same results were also reported by Laurance *et al.* (2014) who pointed out that the land use change can also have direct significant effects on ecosystem structure and on tree cover.

One of the FGD participants explained that: “...we were used to hunting wild animals in the nearest forests, but the coming of these pastoralists has made the animals we were hunting to be rarely found as they burn forests, they graze in the forests...we cannot find the animals for easy hunting....” (FGD-Muhoro village).

Wald coefficient is a measure of the distinctive contribution of each independent variable in the perspective of the other independent variables and holding constant other independent variables. Wald coefficients corresponding with individual independent variables assist to realize the relative importance of each independent variable with an indication that the bigger the Wald coefficient of an independent variable the higher the contribution of the variable to the occurrence of the dependent variable (Agresti, 2002; Garson, 2008). In this case the number of livestock owned by pastoralists. Basing on the results (Table 4), pastoralists' number of livestock owned, with Wald statistic of 7.448 had the biggest influence on land use changes compared to other variables. This concurs with what was found by Boundeth *et al.* (2012) about land use change and its determinant factors whereby numbers of livestock owned influenced land use changes as more land was demanded for pastures. Information obtained from the key informants confirmed that the increasing number of pastoralists together with their livestock results to the disturbance of the local environment which in turn affects the valuable and traditional land uses, and hence affecting habitat of many wild life species.

The odds ratio (Exp (B) for a given independent variable represents the factor by which the odds in this change for a one-unit change in the independent variable. Odds ratios less than 1 indicate decreases in the odds; odds ratios more than 1.0 indicate increases in the odds; an odds ratio equal to 1.0 indicates that the independent variable has no effect on the dependent variable. Results from the study revealed that the odds ratios (EXP (B)) for number of economic activities were 1.142. This means that number of economic activities perception increased (because B was positive) the odds of land use change by a factor 1.142. Therefore, the respondents who were aware of land use change were 1.142 times more likely to report that number of economic activities had influence on land use change than any other factors mentioned in Table 4.

One of the key informants said that “...the current land use change in the study area results into fragmentation of land and water sources pollution and destruction in the area...local people have been engaging in various economic activities they have never experienced before; others have concentrated more on crop production than they have been doing before....” (Interview-Nyamwage village). This quotation implies that the coming of pastoralists had positive effects on the land uses which have also impacted other socio-economic systems of the local people.

3.4 Native' Perceptions on the Current Land Use Condition

Responses from the study demonstrate that land conditions (physical appearance of settlement lands, wetlands, grasslands, forest lands and agricultural lands) have been altered as compared to the period before the arrival of pastoralists. Tilman *et al.* (2011) demonstrated that expansion of cultivation in many parts of the world has changed land to more agro-ecosystems and clearance of natural vegetation. The findings in Table 5 show that settlement land had increased (expanded) as reported by the majority (57%) of the respondents. The increasing number of pastoralists in the area was reported to be one of the factors to such change. They influence establishment of new settlements in places which were not in use and which were not allocated for the newcomers. This is in line with what is stipulated by Schneider *et al.* (2011) on the impacts of populations increase on environmental conditions. These results imply that land use and land conditions were happening as a result of population increase in the study area.

Table 5: Perceptions of land use change after pastoralists arrival (n=200)

Land use type	Percent distribution of responses (%)			
	Expanded	Decreased	Unchanged	Invaded
Settlement land	57.0	8.0	17.0	18.0
Agricultural land	41.0	12.0	14.5	32.5
Wetland	5.0	42.5	5.5	49.0
Grassland	2.5	52.5	4.0	41.0
Forest land	4.0	40.5	6.0	49.5

The findings in Table 5 further indicate that a large number of the respondents (41%) indicated that agricultural lands had extended, while 32.5% contended that the lands had been invaded. Croplands have been converted into pastures as well as settlement lands. One of the influencing factors for the changes was the increasing number of livestock in the study areas. The findings are similar with those by Havlik *et al.* (2012) who also found the impacts of livestock keeping on the land use changes and its effects on crops. Moreover, it was reported that the agro-pastoralists had influenced extension of cultivated lands as they increased establishment of new farms in areas formerly not used for crop farming.

A study by Armstrong *et al.* (2010) has established detrimental effects of livestock grazing on water quality in streams and lakes. In the study area the arrival of pastoralists unquestionably has brought changes in the wetland features. Many (49%) of the respondents declared that the wetlands had been invaded, and 42.5% observed that wetlands were getting reduced in quality like being destroyed and polluted (Table 5). The influencing factors included: number of livestock and the increasing number of pastoralists and agro-pastoralists; these had increased demand for water for various uses and led to effects over water quality in the grazing areas. Other effects include destruction of water sources such as rivers, ponds, wells and water channels. These observations are in line with findings by Ciparis *et al.* (2012) who described the effects of watershed densities of animal feeding operations on nutrient concentrations and estrogenic activity in agricultural streams. The observed indicators of reduced water quality and destruction of water sources include: water pollution, disappearance of some water sources and stream bank erosion. It was reported that *Lule* and *Wambanda* areas (sources of water for household use) at Muhoro village were drying and were by then waterless.

Furthermore, more than a half (52.5%) of the respondents in the study areas testified that grasslands had declined in size (Table 5). The reasons given were: establishment of new settlements, crop production and

livestock grazing as a result of livestock grazing activities. Likewise, Kioko *et al.* (2012) described that continuous grazing within an area may lead to loss of vegetation, with long-term implications for the health of the grassland conditions. This study observed the signs of declining grass lands including, bare lands and gullies as a result of absence of vegetation cover to protect water runoff in some areas. It was also found that it is necessary to have controlled grazing activities (identify special places for livestock grazing) to maintain the grasslands in good conditions to supply ample feed for the livestock.

Moreover, the findings in Table 5 show that 49.5% of the respondents reported that the forest lands had been invaded while 40.5% contended that the forest land was destroyed by decreasing in size. The influencing factors include the increasing number of livestock and presence of pastoralists which have increased the demand for land as caused by population increase (both human and livestock population). These led to the establishment of new settlements, new crop farms opened, expanding livestock grazing areas and increased forest fires when fire is used to clear vegetation for crop farming and to encourage regeneration of new pastures. Similar findings were also revealed by Nzunda *et al.* (2013) who observed that the increasing demand for lands for crop production and pastoral activities may pave a way for agricultural lands expansion, resulting in forests encroachment.

The major effects reported to have been observed include destruction of the vegetation cover and land degradation. The drivers associated with the arrival of pastoralists include population growth, expansion of farming land, extraction of fuel; wood and increased number of livestock population in the area. Ngailo *et al.* (2001) postulated that people require trees for building their homes and need pastures for feeding their animals. Ngalande (2002) and Nzunda *at al.* (2013) described that agricultural expansion is among the reported activities, which have significant effect on natural vegetation. The results of this study have shown changes in the conditions and uses of settlement lands, cultivated lands, wetlands, forest lands, and grasslands which are associated with the arrival of pastoralists. The implication is that the areas are vulnerable via reduced size and quality by being invaded for several activities like crop production, pastures, forest harvesting and human settlements establishment.

4. CONCLUSIONS AND RECOMMENDATIONS

This paper examined the influence of pastoralists on land use change. Specifically, it describes the pastoralists and their livestock registration status; it assesses land allocation; it identifies changing nature of land use, distribution, condition; it explains factors influencing land use changes, and finally it describes peoples' perception on the changing nature of the land use conditions in the study area. Accordingly, the paper was trying to respond to such research questions like what was the actual number of pastoralists and how many livestock were officially registered, what is the land use allocation status before and after the arrival of pastoralists in the study area, and finally what are the current land use conditions as a result of the pastoralists' arrival in the study area.

The arrival of pastoralists involved illegal procedures like cheating on reporting the number of livestock owned by the pastoralists who were deliberately organised by leaders and pastoralists themselves. This is an alert to the authorities as for any activity which is illegal there are possibilities to result in adverse effects as they get implemented. Pastoralists were continually migrating to the district daily. The migration drives land use and land features changes with some adverse effects. The changes have branded the areas with vegetation clearance, widespread of forest fires, and destruction of water sources.

Land uses have currently changed compared to the time before the arrival of pastoralists. In the past land uses were dominated by, but not limited to, agriculture and human settlement. After the pastoralists'

arrival, land uses are dominated by agriculture, human settlement and livestock keeping. Land use features have also been affected, and the most affected land uses are the grasslands.

The study calls upon the responsible authorities from village to the district levels to ensure that there is truth among them and take proper measures to make sure those unethical procedures are avoided in order to avoid harm to the communities. The study further calls upon community-based land use planning where all villages are involved in the planning of the advent of new comers like pastoralists and agro-pastoralists. It is also recommended that there is a need for the appropriate land use plans to be developed in order to ensure that land uses are properly established. This should involve identification of grazing areas and making sure that all necessary and required services such as cattle drinking sources of water are found around the allocated grazing lands.

Moreover, it is recommended that there is a need for recounting the pastoralists so that the district can recognize their actual population number. Not only should the recounting to be done to the human populations, but also the same be done to the herds of cattle owned. The recounting will enable the government at the district and village levels to have reliable land use and development planning at both levels in keeping with actual populations of humans and livestock.

The study found the necessity of the situation under investigation to be in a serious precaution because the situation needed attention as pastoralists were increasing and some natives were also undertaking pastoral activities which would lead to increased effects of livestock grazing in wetlands. This can be done by ensuring that cattle drink water from the appropriate sources of water available for example identified river streams for that purpose.

The study also calls upon the regional and national policy campaigns to protect the land and other related resources in the area to be established and implemented. This is due to the fact that the area is attractive to pastoralists to continue coming in the area to settle and practise grazing activities; hence there are possibilities of continuing land use effects. The study further calls upon the emphasis on increased formal and informal land conservation activities within the study area which involve both the groups (local people and in-migrant pastoralists) which may mitigate or even prevent land use change effects on the ecology of the area in the future. This means land use management should rely on associating traditional and establishing communal managed areas within the district.

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