

Livestock Population and Role of Land Use Planning on Sustainable Grazing Land Management: Case of Tanganyika District, Katavi Region

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Abstract

The aim of the study was to assess the trend of livestock population and contribution of land use planning process towards development and implementation of sustainable grazing land management, reconciling land use with environmental concerns and resolve potential conflicts between sectoral interests and potential uses as well as increasing land tenure security and clarify customary land tenure of grazing lands (communal lands) as per requirement of national policies and laws. The study employed Land Degradation Surveillance Framework (LDSF) as tools to realize the study aims. Results from the livestock data in the district show that there is an increasing number of livestock, and in particular cattle increased from about 39600 in the year 2006/2007 to about 316651 recorded in the year 2016/2017 in the Tanganyika district. This signifies that the district experienced almost 700% increase in cattle from 2006 to 2017. In the year 2018, Lwega village located within the Mwese ward contributed 20950 cattle (55%) out of the 37834 in the Mwese ward. Land use planning process was carried out in the Lwega village as pilot

village to enable setting aside areas for various uses including grazing land and issuance of Certificate of Customary Right of Occupancy (CCRO) in grazing land and other communal lands. The process enabled setting aside grazing land of total area of 12,955 ha (which is 26% of the whole village land) for the village with a total of 12,736 Livestock (with a total of 11,359 cows) by 2020 and which is expected to have a total of 15,193 Livestock (with a total of 13,313 cows) by 2030 based on the number of livestock found within new village boundary which was resurveyed in 2020. The requirement of grazing land was 20,579 ha which would have been sufficient for the planning period of 10 years i.e. from 2020 to 2030. This has a deficit of 7,625 ha and therefore this calls for a further study which will provide recommendations for interventions to improve rangeland quality and advise on restoration techniques of the currently degraded rangeland including enrichment planting and identify species of interest taking into account their palatability, intake, digestibility, and nutrient content for future reseeding programs or other measures including destocking.

Keywords: *Land use planning, Grazing land management, CCRO, Land Degradation Surveillance Framework (LDSF)*

Introduction

Competition for land is increasing as demand for multiple land uses and ecosystem services rises (Mertternicht, 2017) and is accelerating land degradation across the globe (Lambin and Meyfroidt, 2011). Studies have indicated that approximately 10-20% of drylands and around 24% of arable lands have been degraded (Aquino et al., 2008; MEA, 2005). As a consequence, grazing and agricultural lands have been the most vulnerable

ecosystems to land degradation (Bogunovic et al., 2019). Productivity in grazing lands have been affected and degraded due to a combination of myriad factors mostly due to anthropogenic activities, over-grazing, climate variability and gaps in feed supply (Sanz et al., 2017). According to Conant (2012), about 7.5% of the world's grasslands have been degraded due to overgrazing and grazing lands are the most degraded land use type in the world (Papanastasis, 2009).

In Tanzania as in many other areas in Africa and across the globe, land degradation jeopardizes people's livelihood and threatens sustainability of many ecosystems and the services they provide (Silangwa, 2016). As degradation is mostly related to human activities and the extent to which they use the land including overgrazing, sustainable management of land, circumventing land degradation requires adoption of sustainable land management (SLM) technologies including determination of grazing land management techniques (Sanz et al., 2017) for sustainable environments. Sustainable grazing management requires among other things, determination of the carrying capacity of maximum livestock or wildlife population that a habitat or ecosystem can carry on a sustainable basis, and manages the timing and severity of grazing to ensure that the carrying capacity is not exceeded. To be able to do this, land use planning needs to be applied to ensure that competing needs of the land are balanced for sustainable ecosystems (Chapin III et al., 2009; MEA, 2005).

Land use planning (LUP) can be of use with regard to finding a balance among competing and sometimes contradictory uses because it is the systematic assessment of land and water potential, alternatives for land use and economic and social

conditions in order to select and adopt the best land use options (Merttternicht, 2017). Its purpose is to select and put into practice land uses that will best meet the needs of the people while safeguarding resources for the future (FAO, 2006). In rural villages in Tanzania as in other areas around Africa, access to land is usually regulated through social groups like a village or clan. In Tanzania, the Village Land Act and the Land Use Planning Act established the legal framework for LUP at the village level. Attainment of sustainable development goals in Tanzania such as poverty reduction, gender equality, and climate action are compromised when conflicts over land resources arise. Worsening stresses brought on by floods, droughts, and population growth further reduces the resilience of communities and households.

Livestock rearing is one form of agricultural activities which includes cattle, sheep, goats, pigs, and poultry. Livestock keeping system practiced in villages of Tanganyika district in Tanzania is mainly agro-pastoral production system. Production strategies in this system involves the extensive use of land for grazing, cultivating for food and cash crops production, and fallowing land the situation leading to tree clearing. The predominant grazing pattern, stocking density, carrying capacity, livestock marketing infrastructure and other important information for development of grazing land management plan in the landscape is lacking. Furthermore, the Tanganyika district is experiencing dramatic human population growth and influx of livestock. Katavi Region, in particular Tanganyika and Mpanda districts is one of the areas highly affected by immigration and influx of livestock from other areas in the country. Major factors favouring migration into the Tanganyika district include, soil fertility which favours

agricultural activities, and the fact that this is an area which is considered pristine attracting migration of pastoralists and their livestock flocks (Silangwa, 2016) which are detrimental to sustainability of land resources in the area. Unlike other areas in Tanzania like in the Ngorongoro where over 80% of the population consists of Maasai who are pastoralists, and earn their livelihoods out of pastoralism (Manzano et al., 2018), the Sukuma who mainly practice agropastoralism are the largest group of people immigrating into the Katavi region and have had significant impacts on the environment. Agropastoralism which is the integration of crop production and livestock rearing has long been considered as one of the most important driving forces of land degradation as it affects directly through overgrazing and cultivation, and indirectly generating land cover change to create new pasture land (Bajocco et al., 2012). The immigration of people and livestock have had impacts on the land use systems and have resulted in loss of vegetation cover and ultimately in land degradation. According to Salerno et al. (2017), the data drawn from interviews with government officials in 80 rural districts covering the majority of land area across Tanzania during that study, it was revealed that recent settlements were associated with forest clearing, overgrazing and landscape burning. A national-wide study conducted in Tanzania by Salerno et al. (2017), indicate that Internal or within-state migration of agropastoralists has environmental and social consequences that are often poorly understood.

Furthermore, there is a need for concerted efforts to address the influx of livestock and promoting SLM practices for crop production and livestock keeping. However, ensuring these efforts must go hand in hand with the designation of land for different

activities and uses. In addition, land tenure security is considered as the strongest factor in the prediction of land degradation (Vetter et al., 2006) and a key problem in pastoral land development (Senda et al., 2020). Land tenure security is likely to increase community's responsibility and how land is being used and managed. As livestock keeping is generally practiced in village land which is communally owned, and in most cases adjacent to general land, proper planning is required. Lack of plans for use and managing land can have unpleasant impacts on the general land. Furthermore, improved communal land governance in terms of enhancing security of tenure through land adjudication, registration and issuance of Certificates of Customary Right of Occupancy (CCRO) for grazing land (a communal land) is imperative.

Furthermore, land use planning process, apart from being pre-requisite in setting aside areas for grazing land and other land uses within village land in Tanzania, can be one of the steps towards getting key information and the only procedure for setting up conducive environment for development of Grazing Land Management Plan. Village LUP and management regulates the use of land resources; enables: the resolution of land conflicts which may arise over communal lands; the improvement of land tenure security, and land use; and the improvement of land husbandry measures, according to the priorities and capacities of stakeholders. Village land use planning (VLUP) in Tanzania has its basis in the Land Use Planning Act No. 6 of 2007 and the Village Land Act of 1999, both of which give village councils (VCs) the powers to plan, manage and administer the lands within their village. Sectoral legislation such as the Environmental Management Act of 2004 directs and obliges every village

community to practice the sustainable management of the resources within its village (NLUPC, 2020). The current study is relevant and aligned to a number of national development programmes and sectorial policies and strategies such as the National Land Policy (1995) that promotes land resource management among local community. The study is also supported by the National Livestock Policy (2006), Grazing Land and Animal Feed Resources Act, 2010 and Grazing Land and Animal Feed Resources (Safeguarding, Development and Sustainable Use of Grazing Land) Regulations of 2013 that promotes inventorisation, identification, protection, management and sustainable use of rangeland resources. The study also addresses the SDG number fifteen with the aim of protecting, restoration and promoting sustainable management and use rangeland resources, combating desertification, and reverse land degradation and halt biodiversity loss.

The aim of the study was to assess the contribution of land use planning process towards development and implementation of sustainable range/grazing land management, reconciling land use with environmental concerns and resolve potential conflicts between sectoral interests and potential uses as well as increasing land tenure security and clarify customary land tenure of grazing lands (communal lands) as per requirement of national policies and laws. Lwega village located in Tanganyika district has been used as a case study.

Materials and Method

Description of the study area

The study was conducted in Tanganyika district, Katavi Region. The districts lies between UTM Zone 36, UTM 9240000 through 9410000 Northing and 140000 through 320000 Easting. It lies between 1040 m and 1100m above mean sea level. It receives rainfall ranging from 1000-1300 mm per annum and the maximum temperature is 32° C in October and whereas minimum temperature is 13°C in July. The pilot study was conducted in Lwega village which is located in the Mwese ward, Mwese division (Figure. 1). Lwega village has land área of about 49,239 ha.

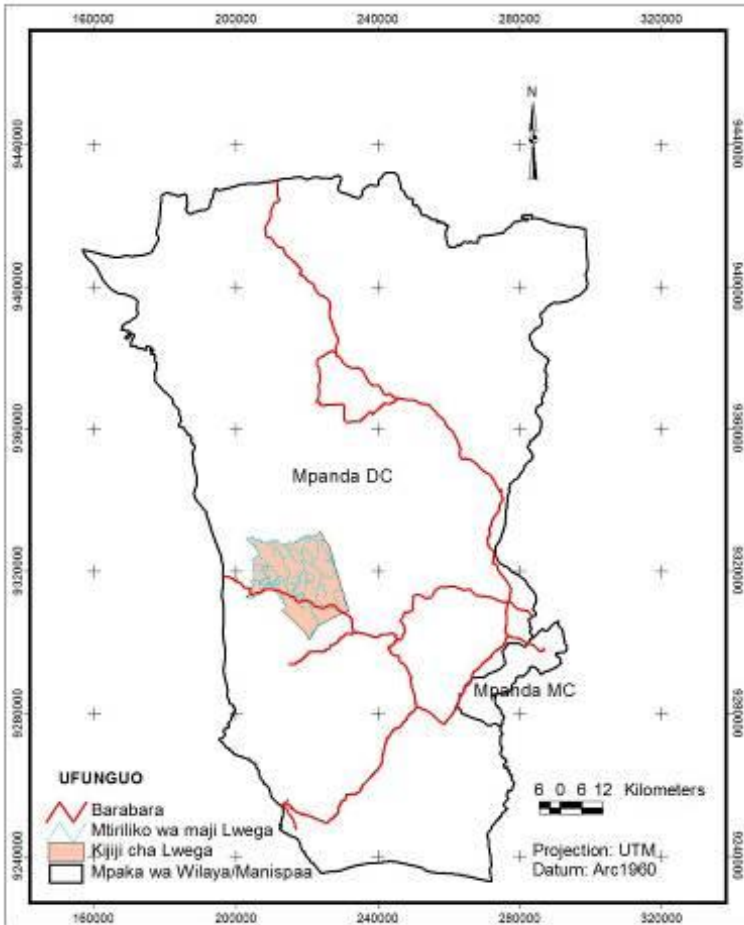


Figure 1: Location of Lwega village (*Kijiji cha Lwega*) in Tanganyika District (previously part of Mpanda DC)

Livestock data collection and analysis

The study used a combination of methods including collection of primary data population and livestock in the area and data collection through village meetings with leaders and communities, village game scouts and district officials, site surveys, geographical information (GIS) and remote sensing analysis as

well as statistical analysis. Livestock data were collected from the district livestock office. The data included number of livestock including cows, goats, sheep, pigs, donkeys, and chicken found in the different wards of the district. The data were aggregated to get sum for the district for the years starting with 2006/2007 financial year to 2017/2018 financial year.

Procedures used to prepare Lwega village land use plan

The process of village LUP was guided by “Guidelines for Participatory Village Land Use Planning, Administration and Management”, 3rd edition (“The PLUM Guidelines (3rd edition)”), a document which describes the six steps to be followed in the VLUP process (NLUPC, 2020): 1) preparations for village land use planning, 2) data collection and resource assessment for land use planning and management, 3) mapping of existing village land uses, 4) preparation of village land use plan and bylaws, 5) detailed village land use management planning, and 6) village land administration and tenure security.

Steps 1, 2, 3, 4 were fully implemented. Step 6 was implemented for communal lands including land set aside as grazing land. It is not a pre-condition to start Step 5 before implementing Step 6. Therefore, given available resources, step 5 was not implemented except for collection of data which can be used when implementing step 5 within an area set aside for grazing. Step 2 enabled among other things, the preparation of a Community Action Plan (CAP). The CAP is expected to become part of the village development plan and also became the basis for the detailed village land use planning and management activities in the succeeding steps of PLUM. The CAP is a road map for implementation of the Village Land Use Management Plan, which

should be displayed on the notice board of the Village Government Office for self-assessment. CAP included required activities to improve the prioritised natural resource management components, to be worked out in the following steps of PLUM. The developed CAP reflects priorities of different socio-economic groups in the village in a balanced way. Also, it presents short, medium and long term needs and land use matters of the village without contradicting with district, regional and national plans and policies.

Generally steps 1 to 4 provided a broad zoning of the village land into various land uses and the formulation of a CAP.

Step five which was not implemented is when Grazing Land Management Plan can be prepared. Important conditions to be met before starting step 5 are:

- Approved village land use plan is in place.
- Bio-physical surveys for different parameters are undertaken
- Land-use conflicts are resolved/minimised.
- Resource sector management planning and implementation guidelines and regulations are in place.
- Resource sector work plan and budgets for implementation in prioritized villages are in place.
- Management committees for communal land use are in place.

Steps followed in setting aside Livestock Keeping Grazing Land Area

Grazing land are areas used or designated for livestock grazing, of which pasture can be improved. Also they need to be facilitated

with infrastructures such as cattle routes, charcoal dams, cattle dips, livestock markets etc. To calculate the area (acreage) required for livestock grazing in the hamlet/village, livestock data collected were converted into Livestock Units (LU). In this context, 1LU is an equivalent of one mature Tanzanian short horn zebu cattle, with live body weight of 250 kg. If daily dry matter intake is assumed to be 3% body weight, then it means forage requirement of 7.5 kg per day or 2737.5 kg per annum. In most Tanzania areas (savannah grasslands) this amount of forage (biomass) can be obtained from 2.5 hectares (4.5 acres) annually, which is a planning unit requirement for 1LU. However, this depends on variation of agro-ecological zones and breeds. 1LU is equivalent to 1 cattle, 2 donkeys, 4 goats, 4 sheep. The total number of livestock units in the hamlet/village is multiplied by the annual grazing unit requirement to get the total required grazing area in the hamlet/village.

For the current study, due to the fact that the annual forage requirement for 1LU was considered to be 1.5 ha due to ecological condition of the study area (for example 1000 – 1300 mm annual rainfall and the grazing land area being dominated by grassland and wooded grassland).

Allocating land for livestock keeping and grazing should considered the following:-

- a) Existence of livestock keeping and grazing areas,
- b) Present and future requirements for livestock keeping and grazing,
- c) Direction and extent of growth/reduction for livestock keeping and areas,
- d) Separating grazing areas from settlements and farms,

- e) Establishing and maintaining livestock infrastructure, cattle routes to water points, pasture and cattle holding grounds,
- f) Farming systems in the village,
- g) Livestock keeping systems in the village,
- h) Existing and projected livestock units kept in the hamlet/village to match with carrying capacity of allocated grazing land.
- i) Possible future improvement of pastures in grazing lands/ranches; and management of livestock keeping and grazing land as provided in Step 5.

The current conditions of the grazing land were also assessed in order to provide data which will be used during preparation of Grazing Land Management Plan (step 5). Implementation of step five will be done in future depending on availability of resources for facilitation with livestock sector following the procedures which will be adapted from the Grazing Land and Animal Feed Resources (Safeguarding, Development and Sustainable Use of Grazing Land) Regulations of 2013. Step 6 was implemented as detailed in NLUPC, (2020) which results in enhancing security of tenure through land adjudication, registration and issuance of Certificates of Customary Right of Occupancy (CCRO).

Procedures used to assess levels of land degradation in areas set aside as grazing land

Systematic site characterization was undertaken following the adaptation of the Land Degradation Sampling Framework (LDSF). LDSF is a spatially stratified, randomized sampling design framework built around a hierarchical field survey and sampling protocol using “Blocks” and “Clusters”. One (1) sampling “Block” measuring 100 km² (10 X 10 km) was

demarcated within grazing area. The block was further subdivided into 16 tiles (2.5 X2.5 km in size) in which two “Clusters” of 10 plots were randomly allocated in for detailed characterization. Each cluster contains randomly allocated 10 circular sampling plots that have an area of 1000 m² each. Each plot was then subdivided into four sub-plots; one (i.e. the “center subplot”) in the center of the plot and three others surrounding the “center subplot” and separated by an angle of about 120 degrees, as shown in Figure 2. Random allocation of plots was carried out using QGIS software. Once the coordinates of the plots were obtained, they were loaded on to a GPS unit and used to geolocate the plots on the field for measurements and observations. Field observations were made at the plot and subplot scales. Therefore, a total of 20 LDSF sites were randomly selected.

At the plot level, observations were carried out to record basic site characteristics such as landscape position, slope, existing soil and water conservation structures, and information concerning the vegetation structure and types, etc. These and several other indicators of land degradation at plot and sub-plot levels were identified and assessed visually and were systematically recorded in a standard field form.

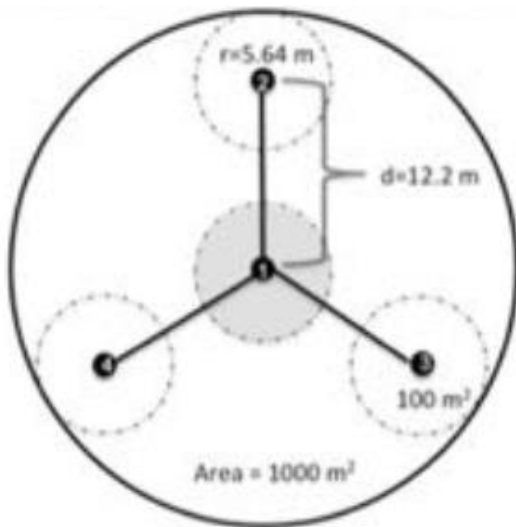


Figure 2: Location of 4-subplots within a plot

Results and Discussion

The extent of livestock increases in the Tanganyika District

Figure 3 shows the evolution of livestock in the Tanganyika District from 2006/2007 to 2016/2017. Results show that cattle were the most dominant livestock and increased from about 39600 in the year 2006/2007 to about 316651 recorded in the year 2016/2017. This signifies that the district experienced almost 700% increase in cattle from 2006 to 2017. The number of cattle decreased to 248851 in 2018. Although there are no known reasons for this sudden decline, anecdotal evidence shows that there might be underreporting on the part of the livestock keepers due to the fear of being charged. It can be observed that the surge of livestock started in the year 2013/2014 and steadily increased to reach its peak in 2016/2017. The same trend of increasing number can be observed in goats and sheep and coincides with the same ye

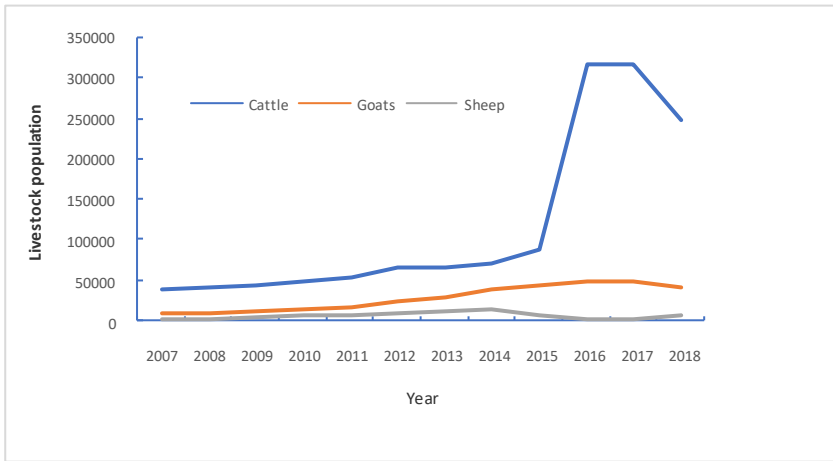


Figure 3. Livestock population in the Tanganyika District (2006-2018)
Source: Livestock Department – Tanganyika DC.

Results in Figure 4 show the distribution of cattle by wards in the 16 wards of Tanganyika district in the year 2017/2018. It can be observed that the largest number of cattle were found in the Tongwe ward (40862) with the Mwese ward being the second with the largest number of cattle (37834). Lwega village located within the Mwese ward contributed 20950 cattle (55%) out of the 37834. No single village in the entire district has larger number of cattle than Lwega village.

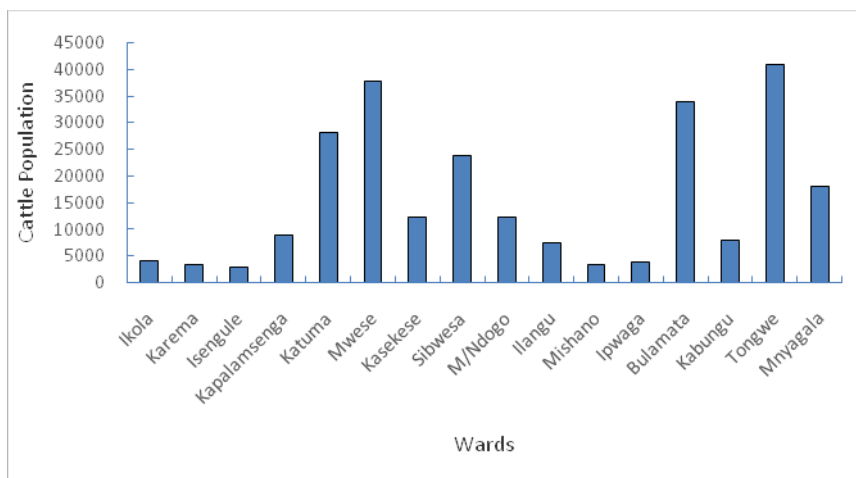


Figure 4. Cattle distribution in the wards of Tanganyika District (2017/2018) (Source: Livestock Identification and Traceability – Tanganyika District, 2018)

Land use and management plan and issuance of Certificates of Customary Rights of Occupancy (CCROs)

The land use planning process resulted into setting aside six land uses categories as shown in the Table 1 and Figure 5. This is a ten years land use plan for Lwega village (2020 – 2030).

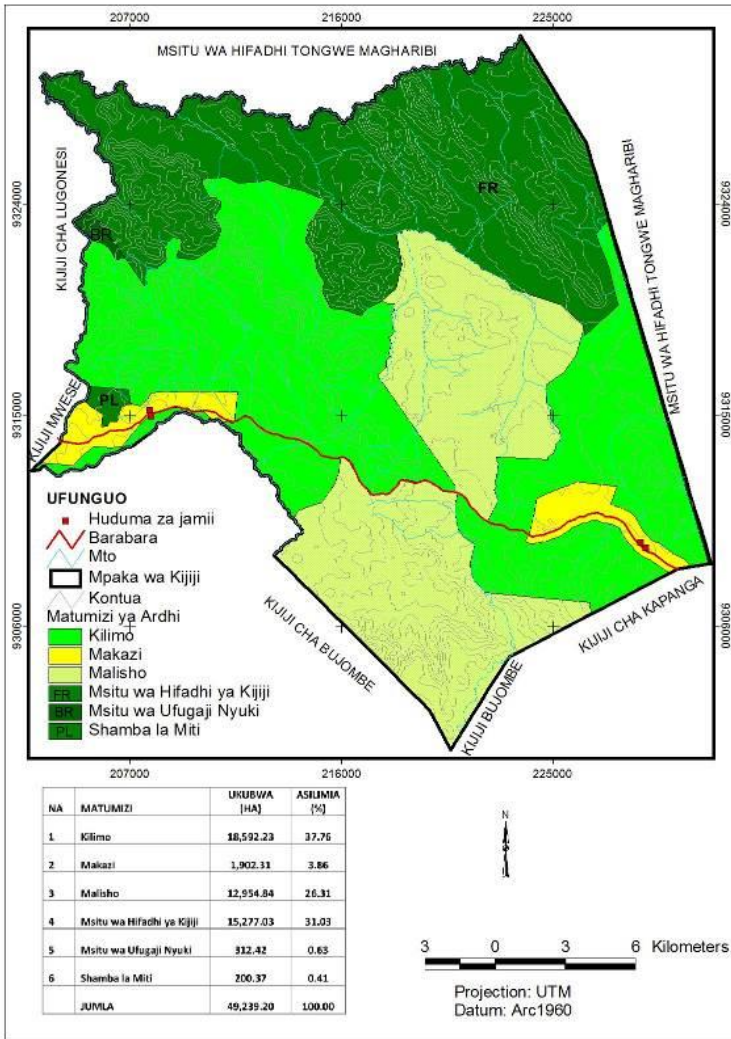


Figure 5: Land Use Plan for Lwega village 2020-2030

Table 1: Comparison of land requirements and areas set aside for each land use

S/N	Land Use	Land Area set aside (Ha)	Land area Required by 2030 (Ha)	Excess/ Deficit (Ha)
1.	Settlement	1,902.31	149.6	1,752.71 (excess)
2.	Village Forest Reserve (Kasumbaghulu)	15,277.03	9,847.84 14,771.76	– 505.27 (excess)
3.	Area for Cultivation	18,592.23	3,980 BKKB 1,792.32 KKKB	14,612.23 (excess)
4.	Bee Reserve	312.42	312.42	0
5.	Grazing land	12,954.84	20,578.5	7,624.5 (deficit)
6.	Forest Plantation	200.37	200.37	0

BKKB = Without following appropriate farming practices

KKKB = By following appropriate farming practices

The current land use planning process was carried out in one pilot village in Tanganyika district to enable setting aside areas for various uses including grazing land and hence issuance of CCROs in grazing land and other communal lands. The process enabled setting aside grazing land of total area of 12,955 ha (which is 26% of the whole village land) for the village with a total of 12,736 Livestock (with a total of 11,359 cows) by 2020 and which is expected to have a total of 15,193 Livestock (with a total of 13,313 cows) by 2030. The requirement of grazing land was 20,579 ha which would have been sufficient for the planning period of 10 years i.e from 2020 to 2030. This has a deficit of 7,625 ha and therefore this calls for a further study which will provide recommendations for interventions to improve rangeland

quality and advise on rangeland restoration techniques including enrichment planting and identify species of interest taking into account their palatability, intake, digestibility, and nutrient content for future reseeding programs or other measures including destocking.

Area set aside as grazing land was assessed to provides a biophysical baseline at landscape level, and a monitoring and evaluation framework for assessing processes of land degradation and the effectiveness of rehabilitation measures (recovery) overtime. The following were assessed:

Levels of degradation in area set aside for grazing

Impact of fire, grazing, agriculture and tree cutting on habitat

Habitats in more than 70% of sampled plots were severely impacted by fire, 90% severely impacted by grazing, 20% impacted by agriculture and tree cutting impacted about 30% of the habitats in the sampled plots (Figure 6). Assessment of impact on habitat was done using scale: 0 = none; 3 = Severe. The results show that the sampled plots are affected by overgrazing which might be one of the factors accelerating erosion in the area. Fire is also another factor impacting the habitat. Depending on severity, fire may change several forest floor and soil properties which affect the movement of water into or over the soil surface and the susceptibility of exposed soil to erosion processes.

Figure 4: Impact of fire on habitat

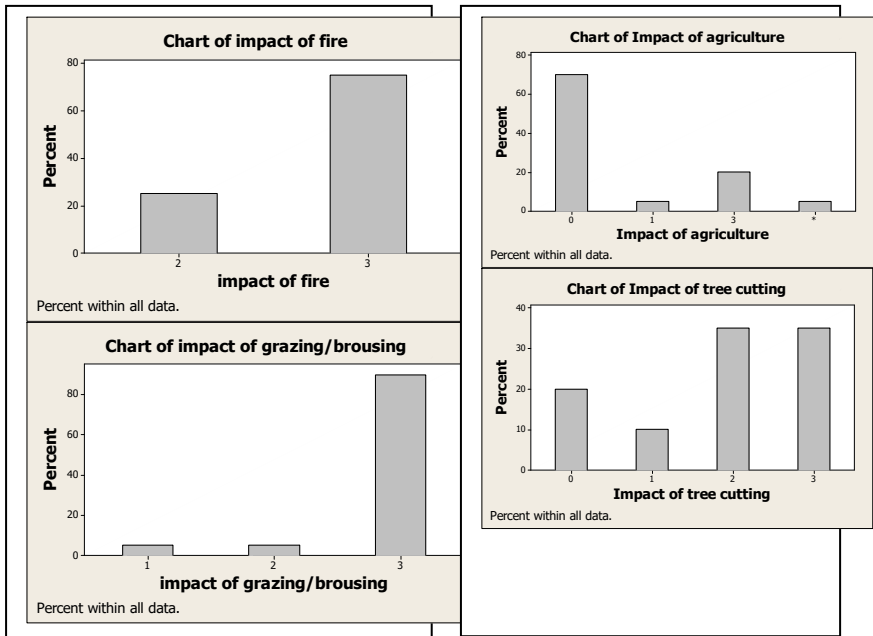


Figure 6: Impact of fire, grazing, agriculture and tree cutting on habitat

The most dominant vegetation class was Wooded Grassland (30%) followed by Woodland (20%) and Bushland (20%). Encroachment by cultivation was about 20% i.e Cropland 10% and Fallow 10% (Table 2).

Table 2: Summary of LDSF plotsa (%) by vegetation structure class

Vegetation structure Class	Number of LDSF Plots	LDSF Plots (%)
Grassland	1	5
Woodland	4	20
Wooded Grassland	6	30
Shrubland	1	5
Bushland	4	20
Fallow	2	10
Cropland	2	10
TOTAL	20	100

Results on the presence or absence of vegetation cover (trees, shrubs) and cultivated plots and bare land are presented in Figure 7.

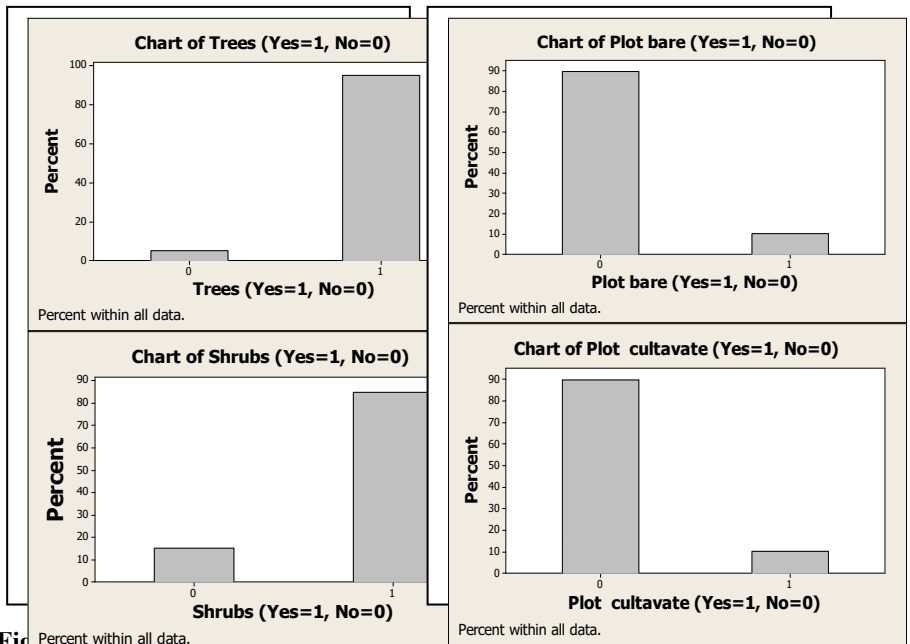


Fig 7. Percent within all data.

plots

Grazing land degradation due to soil erosion

In each sub-plot (1, 2, 3 and 4), signs of visible erosion are recorded and classified (as sheet, rill, or gully). Results showed that about 95% of all four LDSF sub-plots had sheet erosion (Figure 8). Sheet erosion was the most dominant form of soil loss having been observed in over 80% of the farms sampled. Agriculture (crop cultivation) was identified as the main activity with highest impact on the habitat. Sheet erosion is the uniform removal of soils in thin layers. Overgrazed and cultivated soils are most vulnerable to sheet erosion, and signs of sheet erosion include bare areas, water puddling on the surface as soon as rain falls, visible grass roots, exposed tree roots, and exposed subsoil or stony soils. Increased soil erosion is one of the main drivers of land degradation in East Africa's agricultural and pastoral landscapes (Wynants et al., 2019). One of the major threats to ecological processes in rangelands is the critical decline in productivity due to soil degradation as a result of intensified erosion processes and overgrazing (Heitschmidt et al.,[2004](#)). According to Bolo et al. (2019), anthropogenic rangeland degradation can manifest through agricultural activities and associated developmental practices, overstocking and overgrazing, as well as breakdown of social structures and government policies/by-laws. Authors further reports that numerous strategies to arrest and remedy rangeland degradation, such as rangeland re-vegetation, water harvesting, soil surface scarification, and livestock grazing management are available. The situation in the study area calls for immediate intervention including development of Rangeland Management Plan because human factors such as wildfires, agriculture, tree cutting and overgrazing are the ones which seem to have exerted a significant

contribution to the deterioration of rangelands through mismanagement.

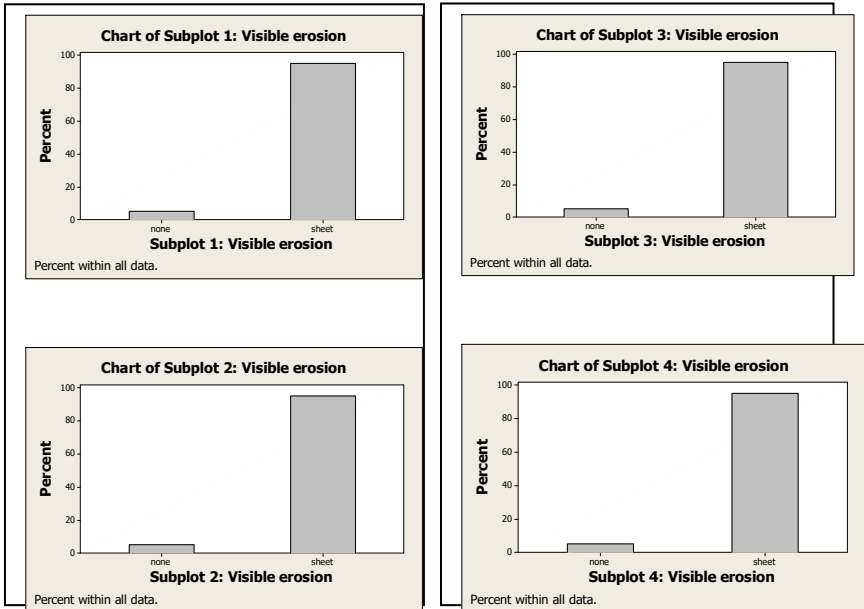


Figure 8: Visible sign of presence of erosion and its category for sub-plots 1,2,3 and 4

The results of the current study together with other information is expected to be an important input for development of a Grazing Land Management Plan in the context of existing village land use plan. This shows that responsible land-use planning, administration, and management is key to ensure sustainable management of rangeland for now and future generations.

Conclusion and Recommendation

The current study has revealed the importance of land use planning in grazing land planning and management in Tanzania. The area set aside for grazing land in the study village is inadequate and is degraded. This calls for immediate intervention

including preparation of Grazing Land Management Plan and immediate implementation of the Community Action Plan (CAP) in Lwega village as indicated in the land use plan document and similarly for other villages with land use plans in Tanganyika district is important and this will reduce land degradation within grazing lands in respective villages.

The current study revealed that Tanganyika district experienced almost 700% increase in cattle from 2006 to 2017. This is a dramatic increase which calls for immediate intervention to ensure sustainable land management and responsible land administration and management.

The results on Land degradation assessment which was done using the Land Degradation Surveillance Framework (LDSF) provides for practical and cost-effective ecosystem health surveillance. It provides a biophysical baseline at landscape level, and a monitoring and evaluation framework for assessing processes of land degradation and the effectiveness of rehabilitation measures (recovery) overtime within Lwega village grazing land. It will also be useful in preparation of Grazing Land Management Plan.

Issuance of a Certificate of Customary Right of Occupancy (CCROs) of grazing land areas to the Village Council is expected to be effective in strengthening community land rights on grazing land (communal lands) as provided for under the Village Land Act. This will also give a room for the implementation of the recently released guideline: *‘Mwongozo wa Upatikanaji, Uendelezaji na Usimamizi wa Maeneo ya Malisho’* of 2021.

The results of the current study together with other information is expected to be an important input for development of a Grazing Land Management Plan in the context of existing village land use plan. This shows that responsible land-use planning, administration, and management is key to ensure sustainable management of rangeland for now and future generations.

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