Panorama of agro-pastoralism in western Serengeti: A review and synthesis

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Abstract

Agro-pastoral production system in western Serengeti is subsistence oriented livelihoods directed towards attaining self-sufficiency in food and livestock production and supporting growing human population. Production strategies involves the extensive use of land cultivating for food and cash crops production, and fallowing land. Households form the basic units of production, which utilize land, family labour, livestock keeping and any capital at their disposal to meet their production goals. Livestock, especially cattle have great symbolic value regarded as a bank on hoves, and a basis for various traditional transactions that makes households strive to increase livestock capital. Analysis of crops production and livestock population trends reveal that agro-pastoral system expand due to increase in prices of livestock products. Paucity of land to absorb the growing human and livestock population caused the political and administrative machinery to develop and implement village land use plans to ensure proper land utilization. However, introduction of land use plans alone is not a panacea to land use problems in villages. It was envisaged that land use plan should be accompanied by introduction of sustainable crops and livestock production systems by improving productivity of land in terms of pasture and crops to support the current human and livestock population in the Western Serengeti. The future direction of agro-pastoralism in Western Serengeti under these circumstances is not well understood. This entails a need for a multidisciplinary study of impact of agro-pastoralism on livelihood of people in Western Serengeti.

Key words: *land use, food security, western Serengeti*

Introduction

Western Serengeti is situated in agro-ecological zones 1/5 and 1/4 (FINNIDA/GRT 1981) and encompasses Serengeti, Bunda, Magu and Bariadi districts. These zones are low potential agricultural areas marginally suitable for arable agriculture. Average annual rainfall ranges between 500-1200 mm, declining towards the Park boundary and increasing towards Lake Victoria (Campbell and Hofer 1995). The area is highly diverse in terms of ethnicity with more than 20 ethnic groups living in the area, the major ethnic groups including Ikoma, Sukuma, Kurya, Ikizu, Natta, Isenye, Zanaki, Zizaki, Ngoreme, Taturu and Jita. The main ethnic groups in Western Serengeti are agro-pastoralists and studies indicate that it is among the most densely populated areas in the Greater Serengeti ecosystem with population growth rates exceeding those to the north, east and south of the National Park (Kideghesho 2010).

Agro-pastoralism relates to a practice of growing crops and keeping livestock as a livelihood strategy (Kerven et al 2011). It is a production system that relies on environmental factors including rainfall and natural resources such as land and natural pastures. Agro-pastoralism emerged as pastoralism systems experienced chronic pressure to alter their land use as a consequence of multiple forces. This include government policy oreiented against the nomadic lifestyle of pastoralism, farming, wildlife conservation; immigration, population growth; encroachment of agriculture; a governmental bias against pastoralists and extreme environmental circumstances, particularly droughts and floods (Olson 2006). The government policies create positive and negative impacts on agro-pastoral production system depending on the interpretation by the state machinery on one hand and agro-pastoralists on the other hand. The general assumption, which normally is adapted by the government technocrats in developing policies, is that the state functions as the motor of development and serves as the central means by which to fulfil social aspirations and bring about positive change in all communities in the country. This perception put emphasis on proper land use plans to accommodate resource needs of different communities. However, agro-pastoralists' perception on resource-use is characterized by diversification strategies to spread risk and flexible mechanisms that allows movement of animals in certain periods. Livestock possession is a central traditional element of agro-pastoral culture. Without livestock, aperson will not have social status, power and cannot support a family. Animals form an integral part of social life, economic and ideological values that guarantee the survival of individuals and the continuity of agro-pastoral system. Livestock is to a large extent seen as a a bank on hooves in many pastoral communities.

Food security

Food is a basic need necessary for supporting the survival of human populations in any society. Human population dynamics in the area determines food demand and security over resources required for food production within ecosystem. Evaluation of population census reports indicates a rapidly growing human population in Western Serengeti from 1960s until the 2010s where the population growth leveled off (Figure 1).

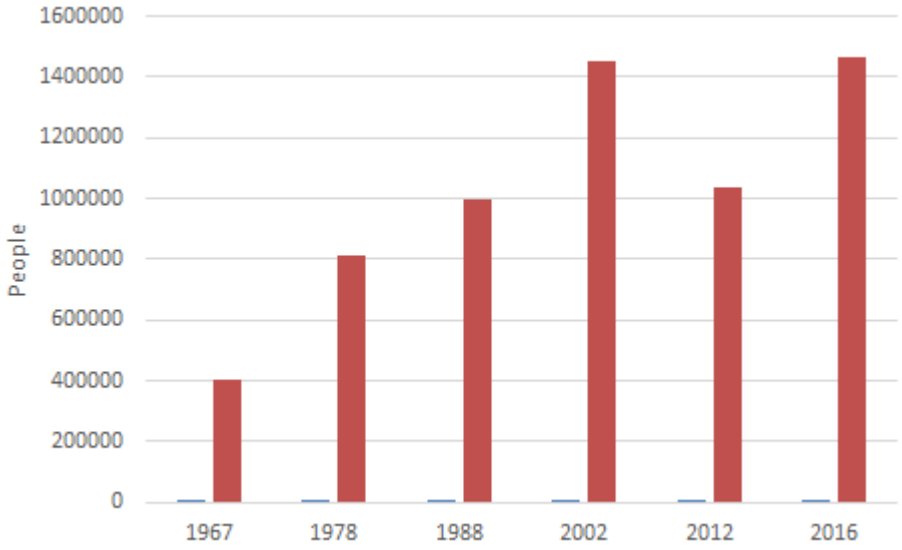

Figure 1. Human population in western Serengeti
Source: *Authors' computation from National Bureau of Statistics reports*

This suggests an increasing demand for food to support this growing population. Increase in population consequently caused an impact on the Serengeti ecosystem due to increased demand of land to grow crops. Several studies have demonstrated the role of human demography in dictating the magnitudes of ecological pressures in the Serengeti ecosystem (Campbell and Hofer 1995; Loibooki et al 2002; Songorwa 2004; Kideghesho et al 2005).

Food crops production in western Serengeti is basically small scale holdings using traditional low efficient methods of the ethnic groups residing in this area. Increase in food production to meet population growth requirement in western Serengeti is mainly based on expansion of cultivated land. This is shown by the similarity of food crops production trend (Figure 2) and the trend of land cultivated for food crops production shown in figure 3.

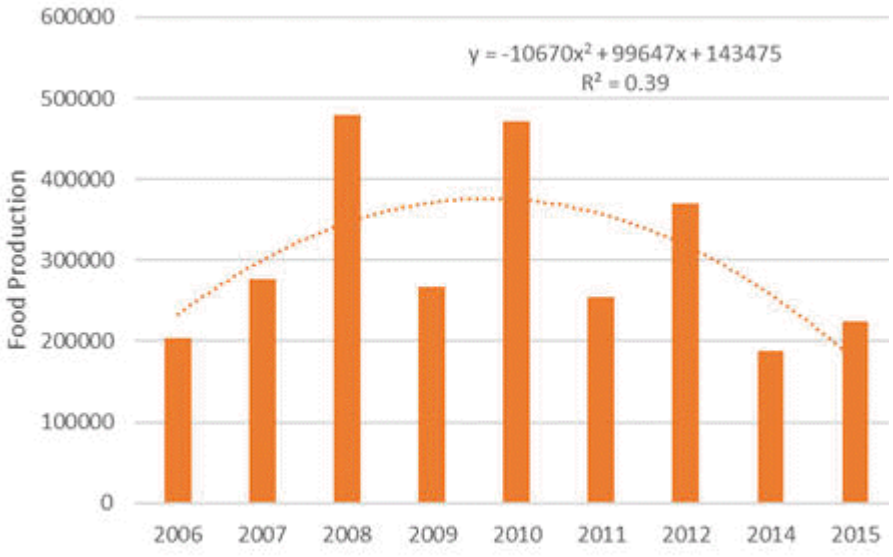

Figure 2. Food crops production in western Serengeti
Source: *Authors' computation from Agriculture census reports and Ministry of Agriculture and Food Security statistics unit*

Expansion of land for food crops production in western Serengeti decreased after 2008 due to increase in human population within limited land and crop raiding caused by wildlife.

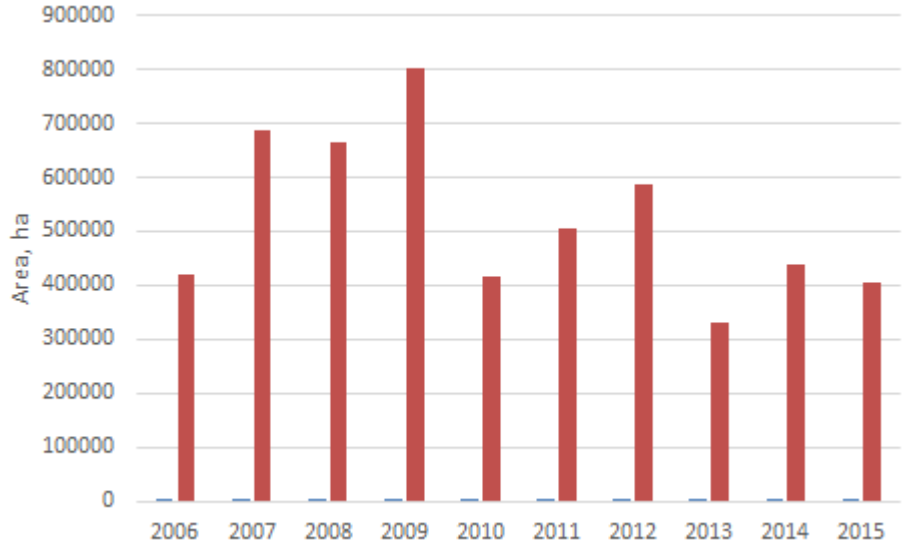

Figure 3. Land cultivated for food crops production in western Serengeti
Source: *Authors' computation from Agriculture census reports and Ministry of Agriculture and Food Security statistics unit*

Field observation and discussion with farmers indicated that high incidences of crop raiding by elephants caused many farmers to abolish cultivation in areas adjacent to protected areas. This situation poses food insecurity threat in western Serengeti. Results shown in figure 4 indicate decrease in food availability per person per year after reaching a peak in 2008.

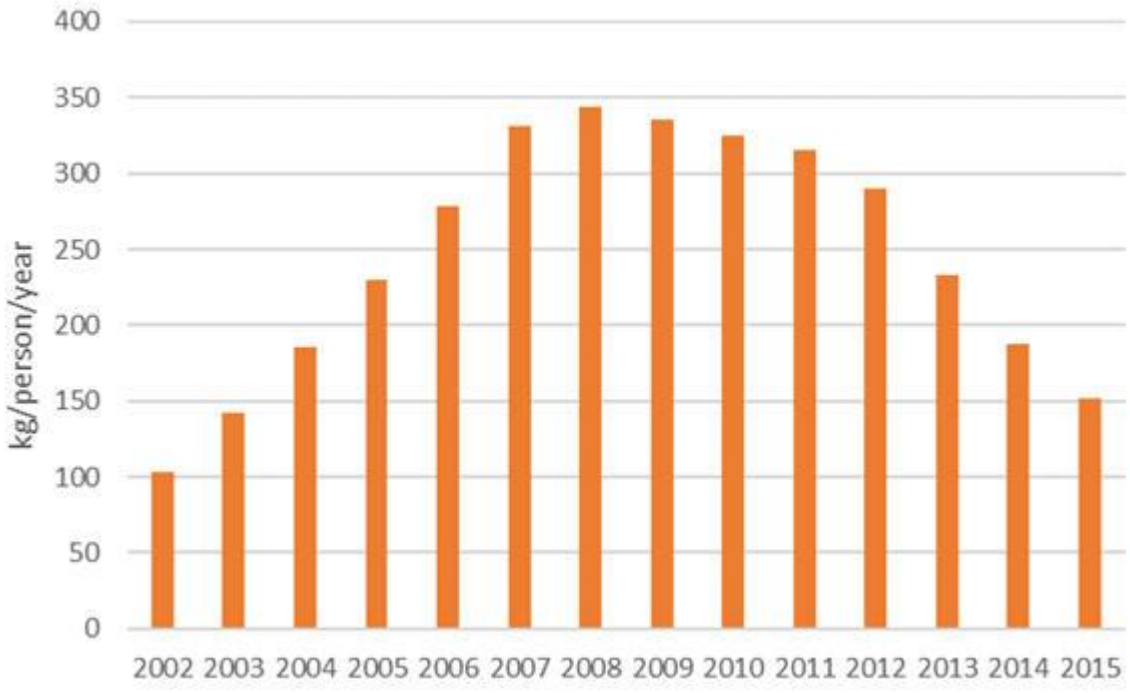

Figure 4. Food availability in western Serengeti
Source: *Authors' computation from National Bureau of Statistics census reports*

According to Frongillo and Nanama (2012), household food insecurity occurs when food is not available, cannot be accessed with certainty in socially acceptable ways, or is not physiologically utilized completely. Food security in Tanzania is normally measured in terms of amounts of grains harvested, bought, and received freely per capita per year. Generally, households with less than 200 kg per capita per year are considered to be food insecure (Kayunze 2008). This implies that western Serengeti experienced periods of food insecurity between 2002 to 2004 and from 2014 to 2016. Food insecurity is not only expressed in terms of food crops alone as also animal protein is necessary for a normal balanced function of the human body.

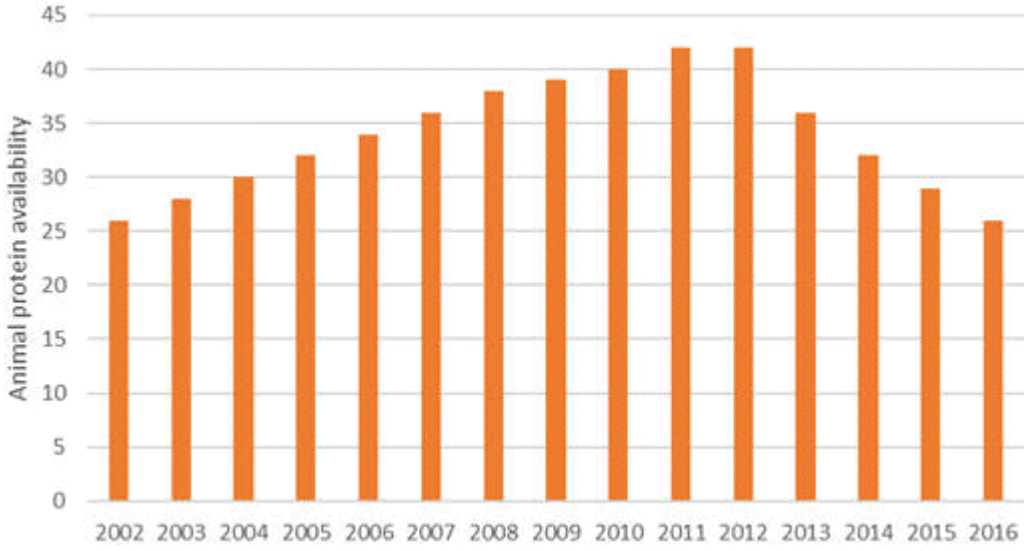

Figure 5. Potential daily supply of animal protein in western Serengeti
Source: *Authors' computation from Human population and livestock census, livestock offtake rate of 10%, dressing percentage of 52% for cattle and 50% for goats and sheep*

Joseph and Ajayi (2002) recommended that a minimum nutrient requirement to be consumed per day per capita for crude protein must at least include 40% (i.e., 26 g) animal protein. Hence, western Serengeti experienced inadequate animal protein production in 2002 and 2016 (Figure 5). The decreasing ruminant livestock population trend shown in figure 6 might exacerbate food insecurity problem in western Serengeti further in the future.

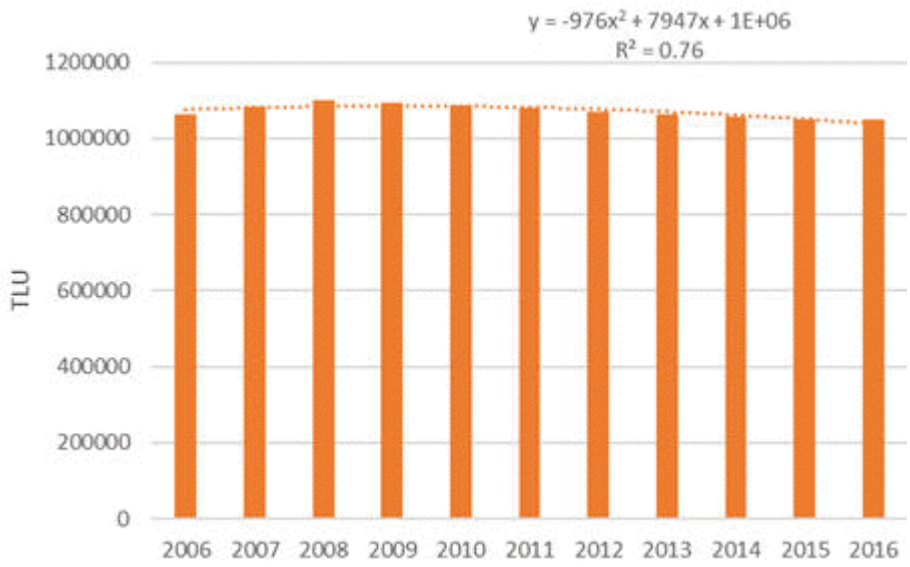

Figure 6. Aggregate ruminant livestock units in western Serengeti
Source: *Authors' computation from Tanzania National Bureau of Statistics census reports, District councils annual reports, Jahnke (1982) and Management of Animal Genetic Resources, Ministry of Agriculture, Livestock and Fisheries of Tanzania*

The decrease in aggregate livestock units observed is attributed to a decline in number of cattle and sheep that are mainly grazers as compared to goats (Figure 7).

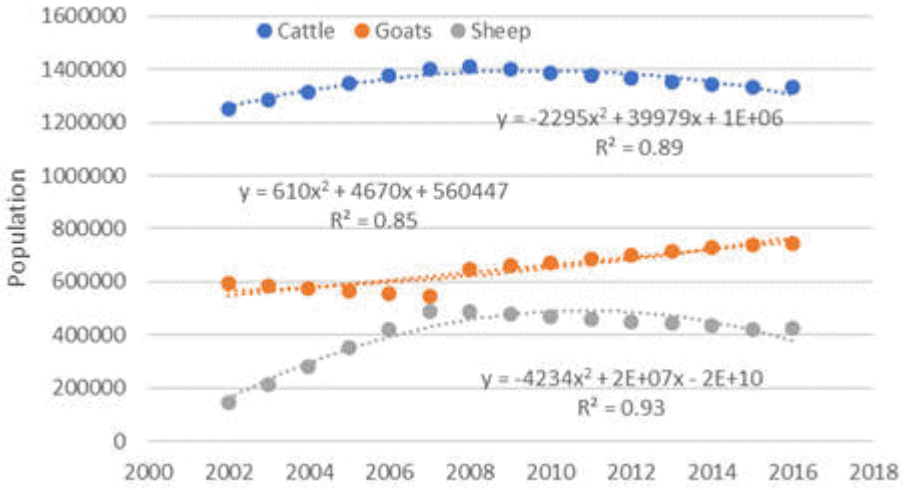

Figure 7. Ruminant livestock population in western Serengeti
Source: *Authors' computation from District Councils Annual Reports and National Bureau of Statistics Agriculture census reports*

The slight decrease in number of cattle and sheep might be caused by unfavourable condition for cattle and sheep (grazers) such as unavailability of pasture to support grazers in village lands. Unfavourable condition on village lands might have compelled livestock keepers to shift cattle and sheep to other grazing areas. However, a detailed study on changes in agro-pastoralism activities in western Serengeti is needed to justify this argument. Detailed study

might establish a base for developing sustainable agro-pastoral production model to ensure food security in western Serengeti for supporting human population.

Economic importance of agro-pastoralism in western Serengeti

The contribution of agro-pastoralism to the economy of people in western Serengeti and the nation is largely invisible.A direct result of the contribution of agro-pastoralism to the people of western Serengeti and national economy is however, the fact that the people do not rely on imported meat and staple food, but rely entirely on local production. Existing trade in agro-pastoral areas in western Serengeti and Tanzania in general is difficult to document. Records are scattered, and it is in general poorly documented because informal trade dominates formal trade in many areas. From the scattered, often anecdotal information that does exist, it is clear that, the value and the potential of agro-pastoralism in the economy of western Serengeti is significant. Figure 8 indicate that returns from meat produced in western Serengeti is increasing thereby generating billions of money to traders.

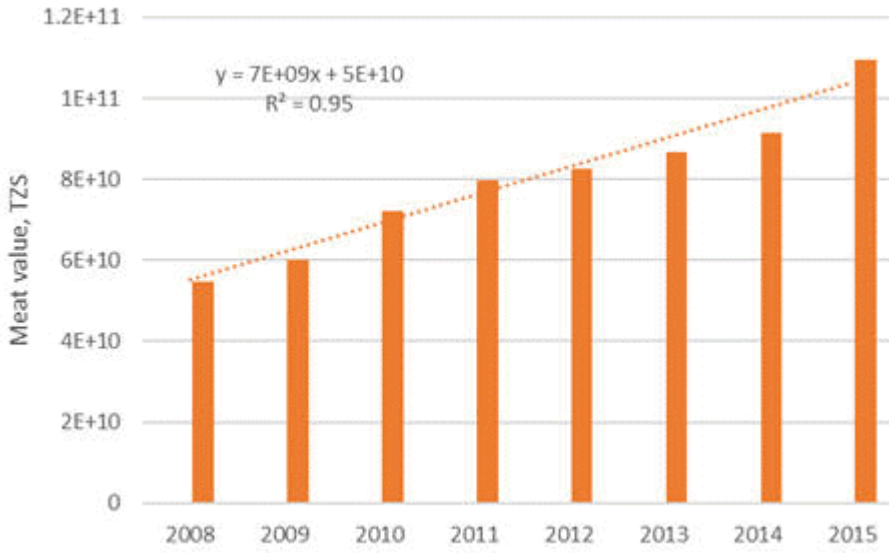

Figure 8. Value of meat produced in western Serengeti
Source: *Authors' computation from Tanzania data abstracts of National Bureau of Statistics, District*
Councils Annual Reports and East African Community Facts and Figures Report of 2016

The value of meat produced increased despite of a slight decline in numbers of cattle and sheep as demonstrated in figure 7. This could be attributed to steady yearly increase in price of meat that makes livestock production a lucrative business. This makes people in western Serengeti continue focusing on livestock keeping as one of the sources of income for households but the increase in livestock population is limited by availability of feed resources within village lands. On the other hand, the value generated by maize production in western Serengeti (Figure 9) decreased steadily due to decrease in production while production of maize in other places within the country increased that stabilized maize price.

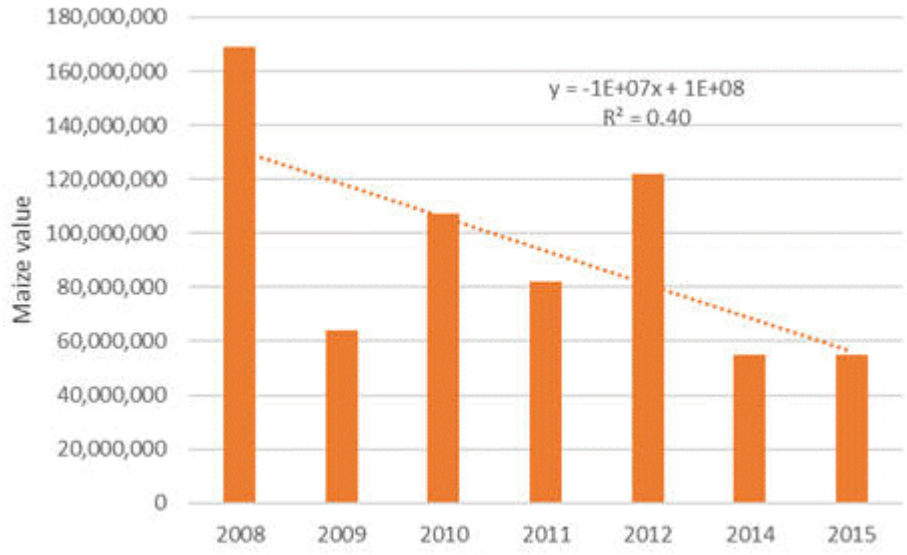

Figure 9. Value of maize (TZS) produced in western Serengeti
Source: *Authors' computation from Tanzania data abstracts of National Bureau of Statistics*

The decline in value of maize production together with crop raiding by wild animals in western Serengeti contributes to abandoning of maize farming as source of cash income and instead shifting the focus to producing mainly for subsistence.

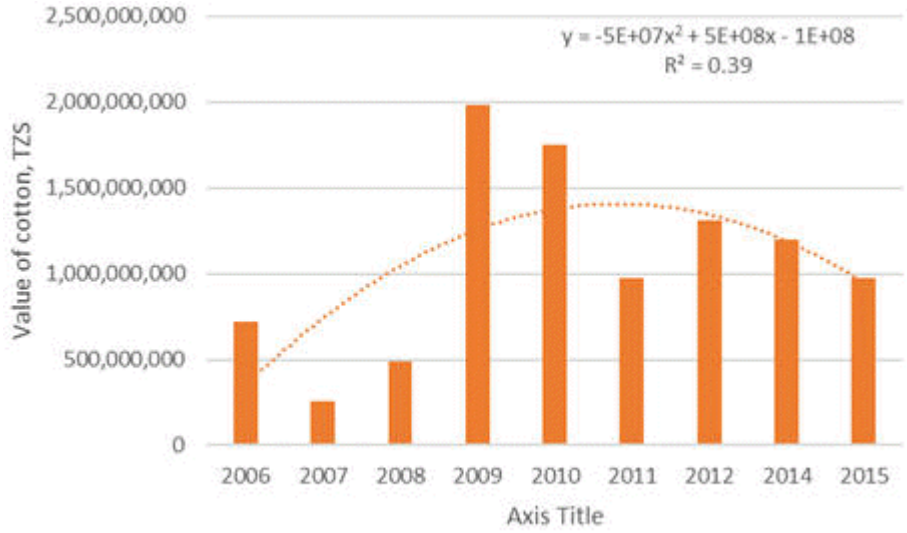

Figure 10. Value (TZS) of cotton produced in western Serengeti
Source: *Authors' computation from Tanzania data abstracts of National Bureau of Statistics*

The value of cotton produced as a cash crop (Figure 10) decreased steadily from 2012 probably due to a decrease in the price of cotton combined with crop raiding problems in western Serengeti. However, the overall value of agro-pastoralism activities that include monetary values of crops and livestock produced in western Serengeti (Figure 11) indicates a steady increase mainly due to the contribution made by income generated from livestock business.

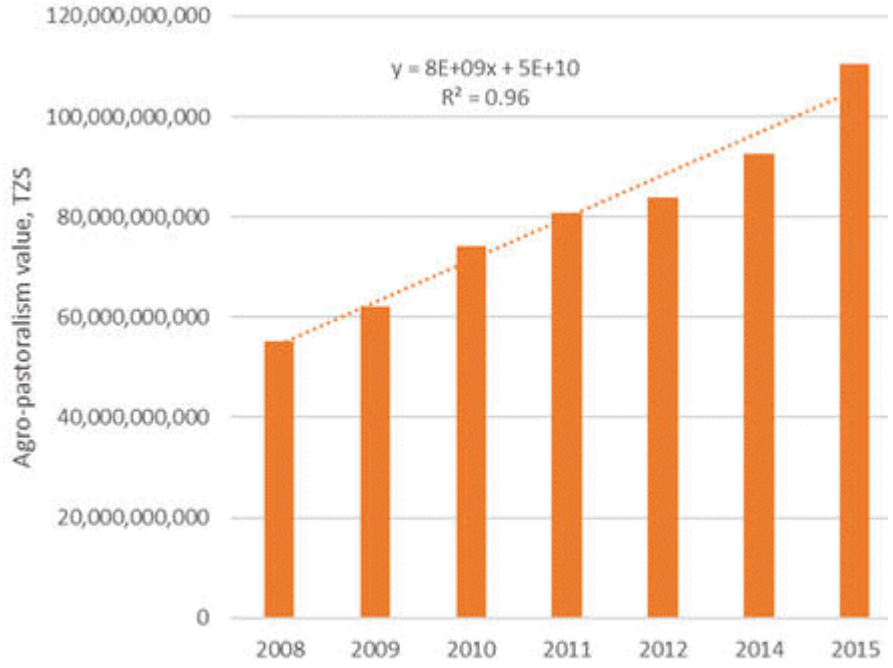

Figure 11. Overall value of agro-pastoralism in western Serengeti
Source: *Authors' computation from Tanzania data abstracts of National Bureau of Statistics, District*
Councils Annual Reports and East African Community Facts and Figures Report of 2016

This indicates that livestock keeping is an important economic activitity for agro-pastoral communities in western Serengeti. Sustainable livestock and crops production in western Serengeti is nessessary to prevent agro-pastoral communities in western Serengeti from falling into poverty due to declining trends shown in terms of livestock numbers and crops production.

Land Use

Land available for crops and livestock production in western Serengeti is estimated to 1,203,798 ha. Results in figure 12 indicate decrease in land cultivated for crop production from 2010 to 2016. This situation has increased the area of fallow land that is normally used for livestock grazing.

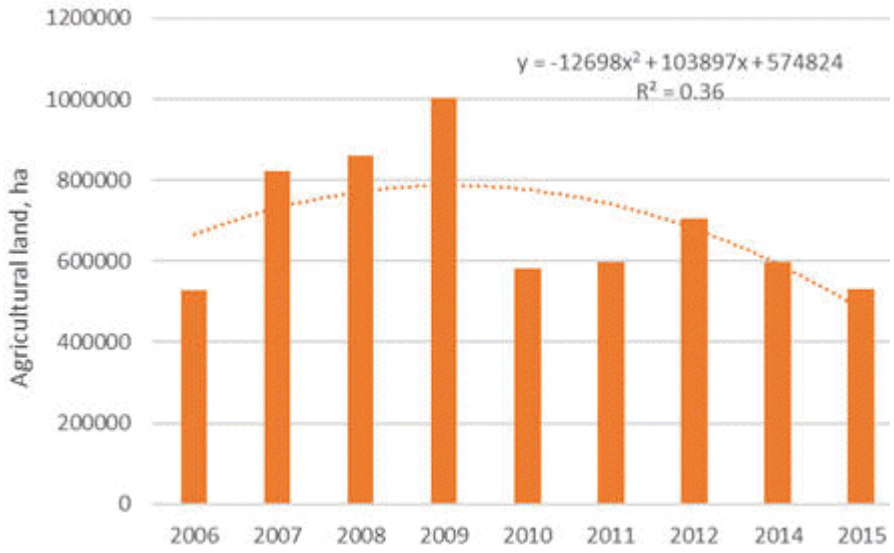

Figure 12. Land cultivated for crop production in western Serengeti
Source: *Authors' computation from Agriculture census reports and Ministry of Agriculture and Food Security statistics unit*

Although decrease in cultivated land provided fallow land reflected in increased grazing land per animal unit as shown in figure 13, the individual pald parcles available are very small (0.40 – 0.62 ha/TLU/year) compared to the national average of 3.4 ha/TLU/year (NBS, 2016).

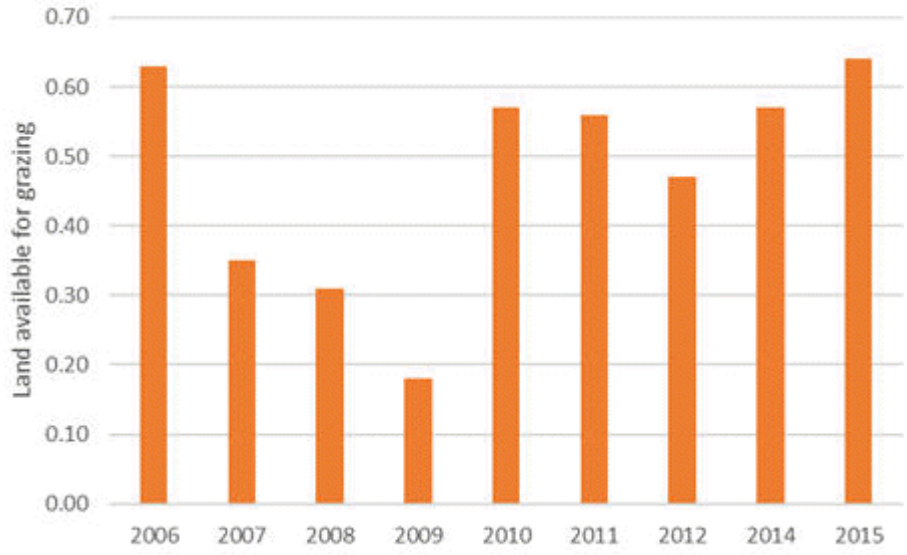

Figure 13. Land availability for livestock grazing in western Serenge
Source: *Authors' computation from Agriculture census reports and Ministry of Agriculture and Food Security statistics unit*

This indicates that grazing land available in western Serengeti may be insufficient to support the current population of livestock without detrimental effects to the land itself. This entails a need for detailed study on effect of livestock grazing on vegetation and soil properties in western Serengeti. In an endeavour to ensure proper land utilization in western Serengeti, the Government introduced land use plans in some villages. However, in practice there is limited implementation of land use plans in villages probably due to poor involvement of stakeholders

and lack of necessary expertise at the planning stage. Result presented in Figure 14 reveal that >50% of village lands were allocated for crop production while <10% of village lands were allocated for grazing livestock.

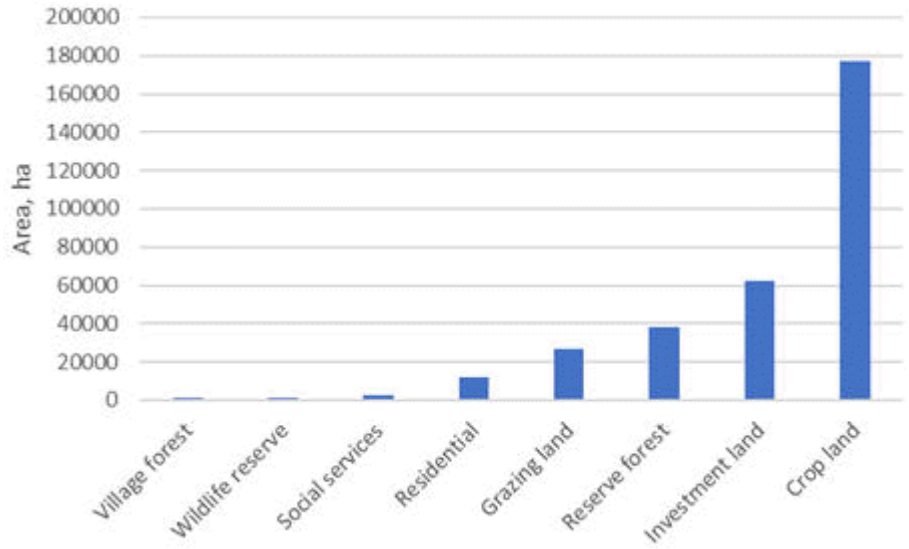

Figure 14. Land allocated for different uses in western Serengeti
Source: *Authors' computation from Tanzania's National Land Use Commission baseline data*

Based on the current livestock population of 1,049,363 TLU and a national average carrying capacity of 3.4 ha/TLU/year, grazing land required for livestock in western Serengeti is 3,567,834 ha (356.8 km^2). This is three times the size of land available (1,203,798 ha) for both crop and livestock production in western Serengeti. Certainly, the implementation of land use plans as currently shown in this study is not a panacea to proper land utilization. Introduction of land use plans in villages should be accompanied with introduction on development of sustainable agro-pastoralismby improving the productivity of land in terms of pasture and crops production to support the human and livestock population currently existing in western Serengeti.

Conclusion

- Human and livestock population in western Serengeti is high relative to land available for food crops and livestock production under prevalent traditional farming techniques.
- The determinants of the direction that agro-pastoralism is developing in western Serengeti is not clearly understood. A combined model including economic, social and ecological components could enable predictions about the future of agro-pastoralism in this area.
- The current development and implementation of land use plans will not be a panacea to solve land use problems in the area unless accompanied by introduction of sustainable crops and livestock farming strategies.

Implication

There is a need to study agro-pastoralism in detail through multidisciplinary approach so as to derive a scenario that depicts the situation existing in western Serengeti. Improvement of pasture productivity for livestock grazing and forage conservation techniques are required for sustainable livestock production in western Serengeti so as to maintain the current livestock population.

References

Campbell K and Hofer H 1995 People and wildlife: Spatial dynamics and zones of interaction. Pages 534-570 in A. Sinclair, and P. Arcese, editors. Serengeti II: Dynamics, Management and Conservation of an Ecosystem. The University of Chicago Press, Chicago.

FINNIDA/GRT 1981 Lake Zone Regional Physical Plan 1981-2000, Government of the Republic of Tanzania and FINNIDA, Dar es Salaam

Frongillo E A and Nanama S 2012 Advances in developing country food insecurity measurement, development and validation of an experience-based measure of household food insecurity within and across seasons in Northern Burkina Faso*;* Journal of Nutrition; 136: 1409 - 1419.

Jahnke H E 1982 *Livestock production systems and livestock development in tropical Africa.* Kiel, Germany, Wissenschaftsverlag Vauk.

Joseph J K and Ajayi S 2002 Agricultural Products and Man. History and Philosophy of Science: General Studies Approach: Akanji MA, Jolayemi ET (eds.). 118-141 pp.

Kayunze K A 2008 HIV/AIDs and food security in Rufiji District Tanzania. Thesis for award of PhD degree at Sokoine University Agriculture Morogoro, Tanzania. 258pp.

Kerven C, Steimann B Ashley L, Dear C and Rahim I 2011 "Pastoralism and Farming in Central Asia's Mountains: A Research Review." MSRC Background Paper No. 1. September 2011. http://www.ucentralasia.org/downloads/pastoralism and farming in central Asia Mountains. Accessed on 13th November, 2016.

Kideghesho J R 2010 'Serengeti shall not die': Transforming an Ambition into a Reality. Tropical Conservation Science Vol. 3 (3):228-248.

Kideghesho J R, Røskaft E, Kaltenborn B P and Mokiti T M C T 2005 SSerengeti shall not die': Can the ambition be sustained? Journal of Biodiversity Science and Management 3(1):150 -166

Loibooki M, Hofer H, Campbell K and East M 2002 Bush meat hunting by communities adjacent to the Serengeti National Park, Tanzania: the importance of livestock ownership and alternative sources of protein and income. Environmental Conservation, 29: 391–398.

National Bureau of Statistics, NBS 2016 Statistical Abstracts 2015. Ministry of Finance and Planning, Dar-es-Salaam. 169 pp

Olson J M 2006 Implications of trends in land use change for livestock systems evolution in East Africa: Lessons from the LUCID Project. Targeting and Innovations Discussion Paper No. 4. ILRI (International Livestock Research Institute), Nairobi, Kenya. 41 pp.

Songorwa A N 2004 Human population increase and wildlife conservation in Tanzania: Are the wildlife managers addressing the problems or treating the symptoms? African Journal of Environmental Assessment and Management 9:49-77.

Received 15 March 2017; Accepted 29 August 2017; Published 3 October 2017

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