Natural Resources Conservation and Livestock Interface

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Abstract

Natural resources conservation and livestock interface is conspicuous in areas adjacent to protected areas where interactions among wildlife, human and livestock commonly occur inside and around protected areas. The interactions commonly result in conflicts mainly the Human- Wildlife Conflict (HWC) and between Livestock and Wildlife with both negative and positive consequences that exist between them. The conflicts are stemmed on competition for limited natural resources when human, livestock and wildlife share the environment. Economic processes influence agricultural and wildlife-based enterprises as sources of income for communities while ecological processes influence the relative efficiencies of livestock and wildlife species in utilizing available natural resources. It has been observed that when livestock and wildlife share the same area, wildlife tend to disappear when livestock production is so specialized where irrigated and fertilized improved pastures, feed supplementation and fenced paddocks are put in place to support livestock production while wildlife left to exist naturally. This consequently result in Human-Wildlife Conflict as both livestock kept by human and wildlife tend to trespass the boundaries that separate them. The negative impacts associated with conflicts between Human and Wildlife compels the governments, wildlife managers, scientists

and local communities to find solutions. Principally there are two main approaches in managing human wildlife conflicts that include prevention and mitigation. In addition, there is a new socio-economic approach in alleviating conflict which is based on changing attitudes of communities to wildlife conservation through education and ensuring that affected communities and individuals are active participants in, and enjoy tangible benefits from wildlife conservation. Analysis of the situation of natural resources conservation and livestock interface in Tanzania indicate that continuous livestock grazing system shows signs of rangeland deterioration in communal grazing lands adjacent to protected areas. It was envisaged that the situation might entangle livestock keepers in a vicious cycle of poverty due to losses of livestock under deteriorated rangelands.

Keywords**:** *wildlife conservation, protected areas, livestock interface, grazing lands*

Introduction

Livestock production in many developing countries and Tanzania in particular is based on natural resources availability. This poses a challenge on finding the balance between increased livestock population and the conservation of natural resources for sustainable production. Natural resources conservation and livestock interface is conspicuous in areas adjacent to protected areas. Natural resources conservation in protected areas

intends to keep the land as ‘pristine’ nature or ‘in wilderness. This practice views ‘nature’ as separate form of land use out of agricultural-based communities, livestock, and related livelihood activities (Fletcher, 2010). This tendency leads to conflicts among different natural resources users where the most common conflict is Human Wildlife Conflict (HWC). Human-wildlife conflicts are interactions between humans and wildlife where negative consequences, whether perceived or real, exist for one or both parties (Decker *et al*. 2002). Interactions among wildlife, human and livestock commonly occur inside and around protected areas where wildlife population density is higher and animals often stray into adjacent cultivated fields or grazing areas. Human Wildlife Conflict is exacerbated by human population growth, land use changes, habitat loss for specific species, land degradation and fragmentation, restrictions to access nature reserves, increasing livestock and wildlife population as a result of various factors that support either livestock or wildlife population growth. The extreme side of conflicts lead to extinction of species due to injuries, deaths caused by human retaliatory shooting, poison or capture of wildlife

(Ogada *et al.*, 2003*)*. Such human-induced mortality affects not only the population viability of some of the most endangered species, but also has broader environmental impacts on ecosystem equilibrium and natural resources conservation. Human-wildlife conflicts undermine human welfare, health and safety, and have economic and social costs. Encounters among human, wildlife and livestock result in exposure to zoonotic diseases, physical injury or even death caused by large predators and financial implications for individuals and society in the form of medical treatments to cure and cost associated to prevention of disease infections. Economic losses resulted from destruction and damage to property and infrastructures as well as livestock depredation is increasingly reported in areas adjacent to protected areas. Negative social impacts include missed school and work, additional labour costs, loss of sleep, fear, restriction of travel or loss of pets have also reported (Hoare, 1992). The negative impacts associated with conflicts between Human and wildlife compels the governments, wildlife managers, scientists and local communities to find solutions. This paper therefore enlightens a discussion on natural

resources conservation and livestock interface by toggling on the following questions:

i. Are natural resources conservation and livestock production in rangelands compatible?
ii. Can we sustain livestock production while conserving natural resources in rangelands?
iii. What are possible solutions to conflicts pertaining natural resource conservation and livestock production?

Natural Resource Conservation and Livestock Compatibility

Natural resources are materials that occur in nature and are essential or useful to humans; such natural resources include land, water, air, land, forests, fish and wildlife, and minerals. Conservation is the system of natural resource management founded in the late nineteenth century by "scientific managers" like conservationist Gifford Pinchot and President Theodore Roosevelt (United States Institute of Peace, 2007). These early conservationists believed that natural resources could only be properly managed through public ownership. Unlike preservation which is concerned

with existence, conservation advocates on “efficiency” and “wise use” of natural resources to avoid degradation and ensure sustainable supply of natural resources.

Livestock are domesticated animals raised in an agricultural setting to produce labour or commodities such as meat, milk, leather, wool, fur and skin. Principally, livestock evolved from the domestication of wild species, which has been done through elimination of “wildness” over centuries. The practice of wilderness elimination developed a culture of livestock husbandry that protects livestock from adverse natural conditions making livestock production dependent on human actions and decisions.This implies that human influences the way livestock make an impact on natural resources and the consequent discrepancies between livestock and wildlife production systems.

In this paper wildlife will be taken as an example of natural resource which is conserved in interaction with livestock production. Competition for natural resources occurs when livestock and wildlife share the environment and

competition operates through two sets of processes within the social–ecological systems called rangelands (du Toit *et al*. 2017). The authors consider that economic processes influence agricultural and wildlife-based enterprises as sources of income for producer communities while ecological processes influence the relative efficiencies of livestock and wildlife species in utilizing the feed and water resources that occur in their shared range. At the global scale, economic processes generally result in agricultural returns to outcompete wildlife returns due to intensification of agriculture (Hobbs et al. 2008). Figure 1 adopted from du Toit *et al*. (2017) indicates that the livestock and wildlife interface begins with a fully intact wildlife community (Point A) as it occurs in National Parks and Game Reserves when livestock are excluded.

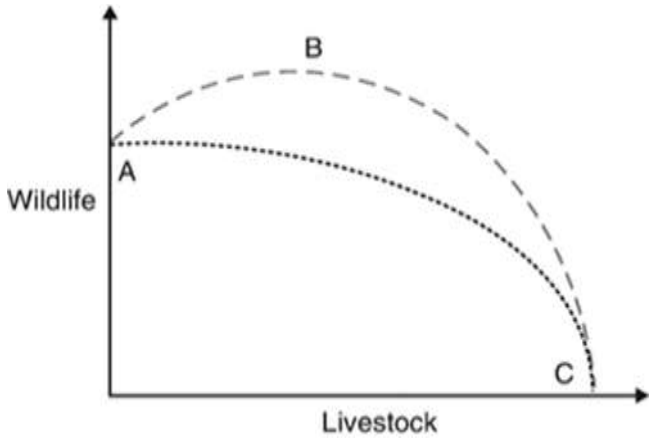

Figure 1. Relationship between wildlife and livestock production
Source: du Toit et al. (2017)

But when livestock and wildlife share the same range, wildlife tend to disappear when livestock production is so specialized (Point C) where irrigated and fertilized improved pastures, feed supplementation and fenced paddocks are put in place to support livestock production while wildlife left to exist naturally. On the other hand, extensive livestock production characterized with continuous grazing based on exploitation of natural resources without replenishment become suicide to livestock production itself. It has been demonstrated by

Kavana *et al*. (2017) that such practice in livestock and wildlife interface result in depletion of feed resource base in livestock grazing land as compared to wildlife grazing in protected areas as shown in Figure 1.

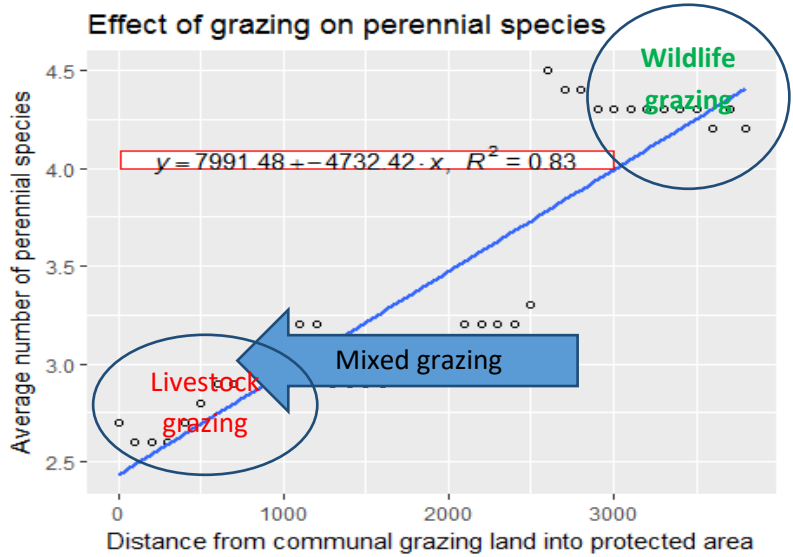

Figure 1. Effect of livestock and wildlife grazing on perennial herbaceous plants
Source: Kavana *et al*. (2017)

The interactions between livestock production and the environment are complex. Understanding the physical mechanisms, with which livestock improve or degrade the natural resource base, is of paramount importance;

however, human actions and decisions, which make livestock behave the way they do, are much more important to be considered in development of natural resources conservation in livestock and wildlife interface

Can we sustain livestock production while conserving natural resources in rangelands?

The growing concern nowdays is whether the current situation that takes place in natural resource conservation and livestock interface conform to healthy rangeland? Will continuous grazing in communal grazing lands adjacent to protected lands of Tanzania suitable for sustainable livestock production under existing environment and wildlife policies? It should be recalled that, the bases of environmental policy is conservation of natural resources and water catchment areas. The national environmental policy has shown a concern on unsustainable livestock keeping/pastoralism and agricultural activities, among other factors, have exacerbated land degradation and the degradation of water catchments areas and the erosion of the otherwise rich biodiversity of Tanzania. This portrays doubt of environmental policy on existing livestock

production system in the country and considers livestock keeping/pastoralism as a threat to natural resources conservation. This perception can only hold the truth if no effort will be taken to reverse the current livestock keeping practices that is happening in natural resources conservation and livestock interface. For example, western Serengeti low herbaceous plant cover has been reported as compared to conservation areas due to impact of agro-pastoral activities on availability of herbaceous plants (Figure 2).

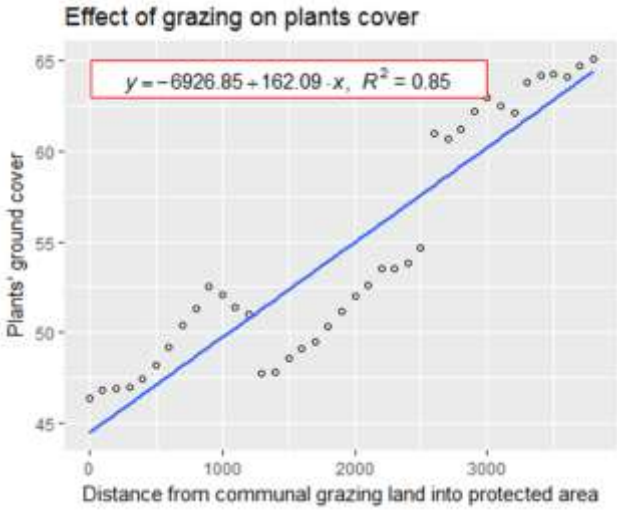

Figure 2. Effect of livestock and wildlife grazing on herbaceous plant cover
Source: Kavana *et al*. (2017)

In addition to inappropriate agricultural activities outside conservation areas, land use types has noted to affect natural resources conservation as most of the communal grazing lands are subjected to soil erosion (plate 1) that may lead to poor soil condition and consequently low productivity of land.

Plate1. Communal grazing land in Mwantimba village (left) adjacent to Serengeti National Park (right)
Source: Photos taken by Kavana 2017

Studies conducted on communal grazing land in South Dakota (USA) by Savory (1988) indicated that many native rangelands experienced shifts in plant species composition due to persistent heavy grazing that left little ability for desirable perennial plants to reproduce (either by seed or vegetatively) that resulted in a loss of favoured plant species. Similarly, Kavana *et al*. (2017) observed low average number of perennial herbaceous plant species in communal grazing lands that are subjected to continuous grazing as compared to protected areas that are subjected to low grazing pressure as shown in Figure 3.

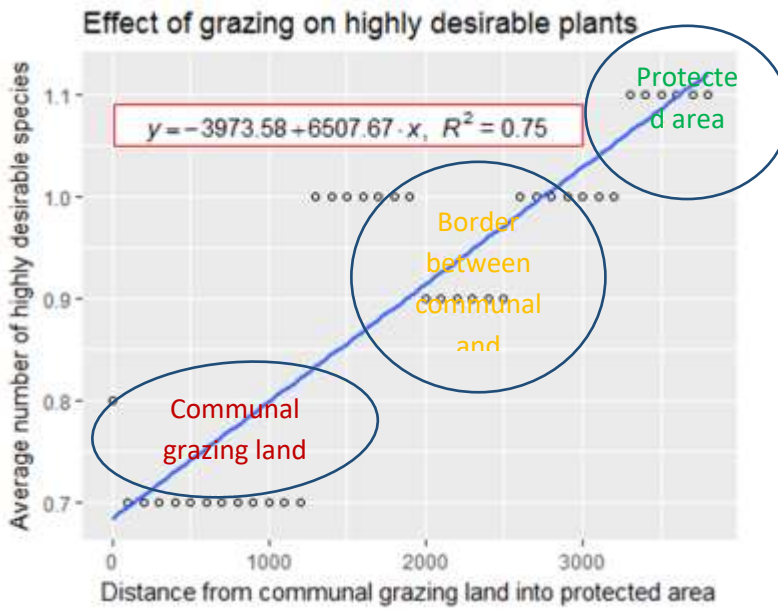

Figure 3. Effect of continuous livestock and wildlife grazing on highly desirable plants

Source: Kavana, *et al*. (2017)

Continuous grazing practiced in communal grazing lands has consequences on natural resource conservation and deterioration of rangeland condition. Deterioration of rangeland condition in communal grazing lands in villages that are adjacent to protected areas arouses a need for trespassing of livestock into protected areas that are still in

a good rangeland condition. But the existing policies and laws prohibit livestock grazing in protected areas. This put livestock keepers in jeopardy of losing their livestock due to insufficient feed resources in communal lands and failure to pay fines once their livestock caught in protected areas.

Alternative to continuous grazing in communal village lands is to develop grazing strategies that are appropriately organized and managed to provide blocks of undisturbed cover at times that allow for plant reproduction and energy storage for sustainable livestock grazing within village lands. Reseeding of desirable pasture species and grazing rotations can achieve short and long-term conservation objectives in village lands to ensure sustainability of livestock keeping in natural resource conservation and livestock interface within existing policies. Successful examples have been observed in .middle east countries where regeneration of vegetation in rangelands through resting (deferred grazing) and over seeding of locally adapted species or planting of adapted fodder and fuel wood shrubs were successful (Msellati, 1995). However,

water distribution is of paramount importance to ensure uniform distribution of grazing animals and efficient utilization of feed resources during the dry season. It was observed that that increased watering frequency regime increases the metabolic rate that increased the efficiency of utilization of scarce feed resources (King, 1983).

Solutions to natural resource conservation and livestock production incompatibility

Wild ungulates can only coexist with cattle in the few subsistence pastoral systems in which watering points are widely distributed and wildlife species are not intensively persecuted (Georgiadis *et al*. 2007). In fact there are about five different schools of thought with regard to natural resource conservation and livestock interface. These are based on (a) conservation ecologists, (b) social scientist researchers of pastoralism, (c) nature preservationists, (d) pastoral people's advocates and (e) pastoralists. The conservation ecologists and social scientist uses scientific methods in their endeavour to prove or disapprove past established concepts regarding natural resources conservation versus pastoralism. Biasness normally occurs

based on the roots of their professional training which is hinged on separation of the disciplines. Members of the conservation science community may ridicule idealizing the 'ecologically noble vicious' promoted by western countries influence; while at the same time, some social scientists are scornful of environmental scientists who, they believe, refuse to accept that people's activities are partof the natural ecology (Niamir-Fuller *et al*., 2012). Besides, pastoralists clearly understand that their actions both compete with and are compatible with wildlife. For example, the Borana pastoralists of Ethiopia recognize that high livestock grazing pressure result in overgrazing of pasture and promotion of shrubs and reduction of pasture productivity (Desta and Coppock, 2004). In the Northern Tanzania pastoralists clearly understand that somelandscapes are more sensitive to grazing than others and carefully manage their grazing on the fragile landscapes (Oba and Kaitira 2006). Therefore, in order to develop natural resource conservation and sustainable livestock production strategy we need to work in a multidisciplinary fashion and take on board skills and

experiences of livestock keepers and crop farmers in respective areas.

In many cases wildlife conservation and livestock interface result to human versus wildlife conflict because livestock are possessed and controlled by human. Any effect that happens to livestock as a result of wildlife conservation has a direct impact to the human who may respond either positively or negatively to the effect imposed by the conserved wildlife. In semi-arid areas in general, where livestock production constitutes a major part of local livelihoods, high levels of conflicts can occur between livestock owners and wild carnivores due to depredation (Muruthi, 2005). Human-wildlife conflicts can have adverse impacts on wildlife and humans. In Kilimanjaro, Muruthi (2005) found that in 1996 and 1997 at least 15 elephants, representing three-quarters of the local population's mortality, had been killed in conflict. The main problems were crop damage, competition for water and grazing, killing of livestock by predators and risk of disease transmission, and human fatalities. In Uganda (Virunga), habitat destruction and human population

growth increased contact with mountain gorilla and other forest animals, such as elephant and buffalo that caused increase in conflicts (Macfie 2003). Nearly all species of wild animals can cause damage to human possessions, however, large potentially dangerous species include those that move in large groups and cover long range (move long distances) than smaller species with restricted ranges. In Kenya Ogada and Ogada (2004) documented reported cases of wildlife that caused death to livestock as lions (35% of reported deaths), leopard (35%), hyena (18%), baboon (4%), elephants (3%), buffalo (2%), wild dog (2%) and cheetah (1%). This poses a big challenge in development of innovative technologies to alleviate the conflicts because different species of wild animals differ in body size and behaviour hence they differ in effects they cause to human properties.

Principally there are two main approaches in managing human wildlife conflicts that include prevention and mitigation. In addition, there is a new socio-economic approach in alleviating conflict which is based on changing attitudes to wildlife through education and ensuring that

affected communities and individuals are active participants in, and enjoy tangible benefits from, wildlife conservation.

Preventive Measures to Human Wildlife Conflicts

Measures that can prevent or minimise the risk of conflicts arising between people and animals include the extreme one of completely removing either the people or the animals, physically separating the two by the use of barriers, managing by a variety of means the numbers of animals to reduce the risk of conflict, and employing a variety of scaring and repelling tactics.

Eradication

In the past local people were removed from large tracts of land when these were formed into national parks and other protected areas. Eradication of animals such as lions, leopards, elephants, buffalo, rhino and the larger species of antelope has been undertaken in the past over large areas of Africa, such as the former white farming areas in the Kenyan Highlands and large parts of South Africa.

Managing the Size of Populations

Falling short of total eradication, there are a number of approaches to managing the size of the population to reduce the risk of human-wildlife conflict arising. These include selectively killing animals as well as controlling their reproduction.

Regulated Harvesting

In many regions of the world, wildlife species and the damage they can cause are managed by regulated harvesting or cropping. A policy of sustainable harvest needs to include some means of scientifically monitoring populations, using methods sensitive enough to detect significant declines. The programmes should have prescribed, enforceable limits on the number and type of animals that can be harvested, as well as on the timing, location and methods of hunting, and allow for the distribution of benefits, such as meat, to stakeholders.

Fertility Control

As an alternative to killing animals, their fertility can be controlled as a means of limiting their populations.

Fertility control of wild animals can, at least in theory, be achieved by a variety of mechanical, surgical, endocrine disruptive or immune-contraceptive methods. One problem limiting many such methods is the difficulty of administering drugs to or capturing free-ranging animals. Contraception as a wildlife management tool is still largely at an experimental stage; attempts to utilise immune-contraceptive methods in elephants began in Kruger National Park in 1996 but to date have met with little success.

Exclusion by Use of Physical Barriers

Exclusion of wild animals by use of physical barriers can, in many situations, be an effective method of settling human-wildlife conflicts. If they are properly designed, constructed and maintained, fences can be completely effective in preventing conflict between people and wild animals. The major factor limiting the wider use of wildlife fences is their cost.

Fear-Provoking Stimuli

Fear-provoking stimuli, be they visual (such as scarecrows), auditory (such as exploders, bangers, and distress calls) or olfactory stimuli (used to repel predators) have all been applied to resolve human wildlife conflicts. Though widely used, these methods face a common problem because the animals soon learn that they pose no real threat and then ignore them.

Chemical Repellents

Another way to alter animal behaviour with the goal of resolving human-wildlife conflicts is the use of chemical repellents. Area repellents are designed to keep wildlife out of an area, contact repellents are attached or sprayed to a food item and systemic repellents incorporated within the food plant or item.

Use of Diversion

A less commonly used approach is the use of diversionary tactics – providing an alternate source of food or water in an attempt to lessen competition with people for crops or water sources. Successful use of diversionary fields to reduce crop damage has been reported in USA.

Landscape Management and Land-Use Modification

Human-wildlife conflicts can be reduced, perhaps in some cases totally prevented, by implementing changes to the natural resource that causes the conflict or to its surroundings. This can be achievable by altering the resource itself, the way it is managed, modifying the resource's habitat, or making changes to the surrounding landscape. This can include planting crops that are less palatable to wildlife, such as substituting chillies for maize, changing the timing when a crop is planted or harvested, and altering animal husbandry practices to reduce risk of depredation and designing and building predator-proof livestock kraals.

Mitigation Approaches to Human-Wildlife Conflicts

Although prevention is clearly the best option, at times reactive approaches are required after human-wildlife conflicts have occurred. The main approach under this heading is Problem Animal Control (PAC), most often undertaken by the national wildlife authority. The

'problem animal' can either be killed or captured for translocation.

Lethal PAC

In lethal control it is obviously desirable to focus on those individuals actually causing the problem (the culprits) or at least to target the group of animals whose home range includes the site where the problem is occurring. In reality, often the problem animal is not identified, but rather any individual is killed to satisfy the demand for action and revenge by the aggrieved community – especially in the case of loss of human life or the killing of livestock.

Translocation

Translocation has been used to remove individual animals responsible for depredations and also, in some cases, to reduce populations in specific areas by removing relatively large numbers of animals. Translocation can be an appealing method to the general public, especially those who are particularly concerned about animal welfare, as they perceive that it gives the affected animal a second chance at a new site. Unfortunately the reality is often not

so positive and translocation can be a controversial means of resolving human-wildlife conflicts as it is quite common for translocated animals to return to the site from where they were originally captured.

Winning Hearts and Minds

The third approach to dealing with human-wildlife conflict involves changing the attitude of affected communities through education, consolation payments and broader sharing of benefits associated with the presence of wildlife.

Current technologies (Digital technologies)

Use of drones

The technology is still under research in Tanzania (TAWIRI). TAWIRI deployed unmanned aerial vehicles (drones) piloted by five trained teams of wildlife managers in the Tarangire–Manyara and Serengeti ecosystems. Game Scouts deployed the drones opportunistically during crop-raiding events at the peak of the maize ripening period in 2015 and 2016. In 100% of trials (n = 51) elephants responded to the presence of a drone by

departing rapidly from crop fields (n = 38) and settlements (n = 13).

Detection of carnivores

Davies, of the Arribada Initiative in the UK, created an innovative warning system in 2017 aimed at the early detection of carnivores, like polar bears and tigers. It uses a clever combination of traditional infrared sensors and thermic sensors capable of discriminating between species, allowing it to alert people to the presence of a specific animal, but not when a human or a dog passes.This affordable tool uses infrared sensors to detect the unique body heat and shape of polar bears and tigers, which then sends an alert to locals of the approaching carnivore. By offering more precise discrimination between species detected by the system, the frequency of false alarms will be reduced and enhance the sense of security of people living near tigers, polar bears or other carnivores.

Improving effectiveness of electric fences

In 2017 De Groot and Van Dam, of Shadow View Foundation in the Netherlands, aim to reduce conflicts

between people and elephants with their proposal based on the wireless LoRaWAN™ (Long Range Wide Area Network) telecommunication technology, to which a variety of sensors can be linked that detect animal presence and power leaks in electric fences that are currently used to keep out elephants. Alarms linked to the sensors alert people when a fence has been damaged or broken by elephants by setting off buzzer flashlights or sending SMS messages to villagers.

Conclusion

The continuous livestock grazing system in the paradigm of natural resources conservation and livestock interface in Tanzania shows signs of rangeland deterioration in communal grazing lands. This might entangle livestock keepers in a vicious cycle of poverty due to losses of livestock under the prevailing circumstances. The way out is to consider alternative to continuous grazing by blending indigenous knowledge and scientific rangeland management knowledge to restore vitiated grazing lands in villages. Integration of various conflicts prevention and

mitigation approaches are recommended to enhance both livestock productivity and wildlife conservation.

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