

Natural Conservationists? Evaluating the Impact of Pastoralist Land Use Practices on Tanzania's Wildlife Economy

**Fred Nelson
Maliasili Initiatives
Arusha**

March 2009

Summary

The land management practices of pastoralist Maasai communities have a major bearing on landscapes and wildlife habitats in northern Tanzania. Pastoralists manage lands according to locally devised rules designed to manage and conserve key resources such as pastures and water sources. Dry season grazing reserves are an important part of traditional land management systems in many pastoralist communities, providing a 'grass bank' for livestock to consume during the long dry season when forage invariably becomes scarce and domestic animals are stressed for water and nutrients. Maintenance of grazing reserves, and other pastoralist management practices, helps to conserve wildlife on pastoralist lands. The available evidence suggests that pastoralists and wildlife continue to co-exist in northern Tanzanian savannahs ecosystems, with pastoralists having few significant negative, and in some cases positive, impacts on wildlife densities and diversity. Wildlife relies extensively on pastoralist managed lands, both those immediately adjacent to state protected areas and across the broader landscape.

Pastoralists' customary land use and management practices constitute a tangible contribution to the conservation of wildlife habitat and wildlife populations in northern Tanzanian ecosystems. Because of the scale and importance of northern Tanzania's wildlife-based tourism industry, these ecological services have an important economic dimension. By conserving large proportions of northern Tanzania's wildlife ecosystems, local pastoralist communities collectively make an important contribution to the national and regional economy.

Tanzania's northern safari circuit is focused around state protected areas such as Serengeti and Tarangire National Parks, which are both part of larger ecosystems that extend well beyond the confines of state protected areas onto pastoralist lands. The northern safari circuit generates approximately \$550 million in revenues, and Serengeti, Lake Manyara, and Tarangire National Parks generate nearly half of the revenues generated by the country's national park system. Tarangire is part of the vast Maasai Steppe ecosystem, more than 80% of which falls on lands managed by pastoralists, including key wet season dispersal habitat for wildlife such as the Simanjiro plains. In the Serengeti ecosystem, state protected areas cover more than 25,000 km², and the migratory herds of wildlife spend only about 3% of their time on pastoralist lands. Using data regarding the degree that wildlife depends on pastoralist lands, and the relative importance of different parks and ecosystems in terms of generating revenue for the northern safari circuit, I estimate the annual value of pastoralist land management practices to the wildlife-based tourism industry in northern Tanzania of approximately \$85 million. This is a minimum figure and does not include wider indirect benefits from pastoralist conservation measures. The economic value of pastoralists' contribution to wildlife conservation highlights the importance of Tanzanian policies in land, livestock, tourism, and wildlife sectors prioritizing measures that promote communal rangeland management and support traditional local management systems.

1.0: Pastoralists, Wildlife, and Tourism in East Africa- An Overview

East Africa's savannahs and grasslands contain some of the world's most diverse and abundant remaining wildlife populations. More large mammals exist in northern Tanzania, which contains most of the Serengeti ecosystem and the vast Maasai Steppe, than in any other land area of similar size in the world. This abundance of wildlife has, during the past twenty years, been the key asset underlying the development of one of Africa's fastest-growing tourism industries. By 2008, tourism was estimated to contribute \$900 million directly to Tanzania's economy, accounting for up to 10% of national economic activity if indirect contributions are included (Mitchell et al., 2008). As a result, Tanzania's northern tourism circuit is "one of the most valuable strips of tourism real estate in Africa," accounting for "more than half of Tanzania's total foreign earnings from tourism" (Ibid.).

In order to conserve wildlife and their habitats, and latterly to develop government-controlled sites for tourism activities, a large number of state protected areas- national parks and game reserves- have been established in northern Tanzania's savannah landscapes. These parks provide the core attractions and infrastructure of the northern tourism circuit (Figure 1).

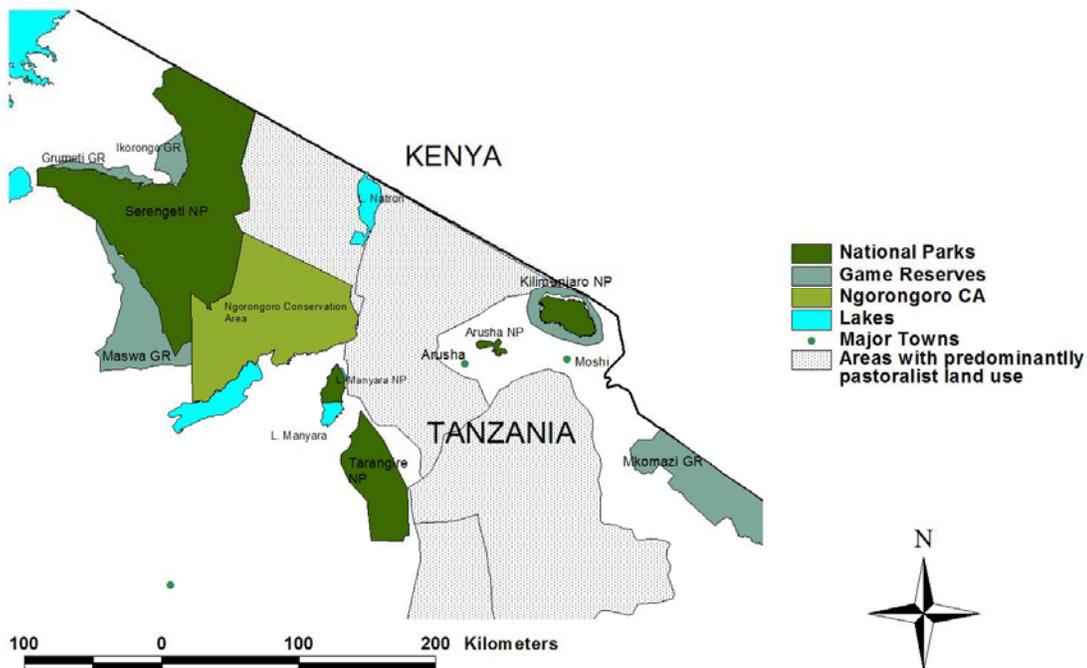


Figure 1: Main state protected areas and tourism attractions of the northern Tanzanian safari circuit, and areas with predominantly pastoralist land uses.

The areas which are now designated as state protected areas were formerly used and occupied by local communities, and in northern Tanzania national parks such as Serengeti and Tarangire were largely or entirely occupied by pastoralists prior to their gazettement. When the colonial and post-independence governments established national parks and game reserves in these customarily owned lands, local people were evicted and rights of occupancy gradually extinguished. Despite this long-running effort to divide the landscape into areas for people and areas for wildlife conservation, northern Tanzania continues to be characterized by a high level of interaction and co-existence between local resident people and wildlife. Parks and reserves are invariably situated within larger ecosystems, and wildlife continues to move across the artificial boundaries dividing communal and state lands. Many species of large mammals, such as elephants, wildebeest, and zebra, undertake annual migrations based on the seasonal availability of water and forage. Wildlife in northern Tanzanian ecosystems continues to rely on many lands and resources which are located outside protected areas on private and community lands, making these latter areas essential for the long-term conservation of wildlife.

The ways that local pastoralist communities manage their lands and resources thereby has a major impact on the conservation of wildlife in savannah ecosystems in northern Tanzania. Indeed, pastoralist land management practices such as grazing and the use of fire has had a major influence over the course of the past 3,000-4,000 years in shaping East African savannah landscapes. Many observers attribute the contemporary abundance of wildlife in East Africa to the historic influences of pastoralists on savannah landscapes, and on the general ecological compatibility between pastoralists and wild large mammals (Ole Parkipuny, 1979; Collett, 1987; Western, 1989). Pastoralist communities actively manage their lands in ways that provide important benefits to wildlife and wildlife conservation aims. Maasai communities in northern Tanzania traditionally manage their livestock pastures according to customary rules governing seasonal use and access to different grazing areas. These traditional management systems govern livestock movements between different pastures, but also result in conserving vegetation and forage over large areas of communal land. Such measures effectively maintain large areas of community land as traditional reserves or 'community conserved areas' where wildlife has access to resources with limited human use or presence for long periods of the year.

Pastoralists in northern Tanzania's savannah ecosystems therefore provide an economically valuable ecological service by conserving wildlife on their lands, which in turn helps to sustain the natural resources that Tanzania's tourism industry depends on. This report describes the nature and extent of that ecological service, and provides estimates of its economic value in the context of Tanzania's wildlife-based tourism industry. Such an understanding is central to the development of economically efficient and productive national policies in sectors such as land, livestock, and wildlife in Tanzania, and the harmonization of rural livelihoods with national and international conservation objectives.

2.0: Sharing the Land: Pastoralist and Wildlife Interactions

It has long been recognized that pastoralists and their livestock, and wild ungulates (hoofed mammals), live alongside one another in East African savannah ecosystems, where they exhibit a high degree of spatial overlap or co-existence. It is also clear that pastoralists and wildlife depend on the same resources in savannah ecosystems- pasture, water, and minerals- and rely on flexible foraging strategies based on mobility (seasonal migrations or transhumance) in order to utilize those resources in an unpredictable environment (Homewood and Rodgers, 1991).

A more contentious issue, and subject to various debates over the years, is the degree to which pastoralist-livestock interactions are characterized by conflict and competition, on the one hand, or relatively harmonious co-existence or even symbiosis, on the other hand. In the 1950's and 1960's, the general perception was that pastoralist overgrazing resulted in environmental degradation and damage to wildlife habitat. This 'overgrazing' narrative was a central factor in the creation of the Serengeti National Park and re-location of resident people, including about 1,000 Maasai pastoralists, in 1959 (Collett, 1987; Neumann, 1998; see also Grzimek and Grzimek, 1960). A core concept of range science at this time was the notion of 'carrying capacity', the notion that a given unit of land area can only support so many livestock (or wild animals) due to the limitations of a given volume of forage (Pratt and Gwyne, 1977). Pastoralists, so the traditional science argued, would exceed the carrying capacity of the land by producing more livestock over time but not selling (or eating) sufficient numbers of animals, leading to more grazing pressure on limited forage resources. Driving this process of overgrazing was the so-called 'cattle complex', meaning the cultural value pastoralists place on building up large herds of livestock, and the 'tragedy of the commons', whereby communally owned and managed pastures lacked controls limiting livestock numbers and consumption of forage, making overgrazing inevitable (Lamprey, 1983; see also Hardin, 1968).

Many of these ideas about overgrazing, the 'cattle complex', and a 'tragedy of the commons' on communal lands continue to inform policy debates over livestock, land tenure, and natural resource management in East Africa (Mattee and Shem, 2006). However, during the past thirty years a wide range of ecological, anthropological, and institutional studies have changed thinking about rangelands and discredited or modified many of the earlier ideas about pastoralist land management practices. Ecological research in semi-arid areas across Africa has demonstrated the key role that rainfall plays in the condition of above-ground vegetation; during droughts, areas tend to lose cover but recover fairly rapidly following rainfall (Dodd, 1994; Scoones, 1995). Because semi-arid and arid areas, such as East African savannahs, tend to have very unpredictable and widely variant levels and patterns of rainfall, it is effectively impossible to calculate a single uniform 'carrying capacity' for these areas. Livestock grazing has relatively limited impacts on the conditions of rangelands in such areas, where pasture condition is primarily determined by levels of rainfall.

Pastoralists and the Environment: Managing Uncertainty

Pastoralists themselves respond to these highly variable and unpredictable, 'non-equilibrium', conditions by moving between different local pastures depending on where rain has fallen at a given time, and maintaining reciprocal relationships with neighboring and distant communities so that livestock may seek refuge or access pastures in areas where conditions are better during times of drought. A vast body of research has emerged during the past thirty years demonstrating that pastoralist management strategies such as mobility, rotational pasture use through different wet season and dry season grazing areas, and building up cattle numbers so as to be able to endure catastrophic but relatively common periods of drought, are ecologically rational measures for coping with the variable semi-arid and arid environments that such people live in (Homewood and Rodgers, 1991; Scoones, 1995; Bourn and Blench, 1999).

A major change has also occurred in thinking about the 'tragedy of the commons', both more generally and specifically in relation to pastoralists. The classic formulation of the 'tragedy of the commons' by Hardin (1968) argued that land owned in common (communally) would inevitably be subject to degradation because the community of users would each seek to appropriate as much forage as possible from such shared pastures, thus inevitably leading to depletion of the resource because nobody possessed incentives to limit their own consumption. Hardin's core assumption was that such commons are effectively ungoverned by the community of resource users which utilizes these areas. By the 1990's, though, an array of research (e.g. Berkes, 1989; Ostrom, 1990) was able to document that, in fact, many commons around the world are subject to locally-devised and enforced rules that govern communal uses of shared resources. These rules may serve to limit rates of resource use and prevent the scenarios of depletion and environmental disaster that the 'tragedy of the commons' depicts. In many instances, local rules governing resource use are more effective at conserving resources such as forests than the state protected areas that formal conservation efforts often emphasize (Hayes, 2006; Ostrom and Nagendra, 2006). For example, Blomley et al. (2008) provide evidence of local community participation leading to forest recovery across different parts of Tanzania, and ultimately better forest conditions than found in comparable state forest reserves.

East African pastoralists generally manage rangelands collectively through community-level institutions (Barrow, 1988; McCabe, 1990; Homewood and Rodgers, 1991). Customary rules and norms govern the way rangelands are used in terms of who can access pastures at a given time period, and are specifically geared towards conserving resources such as pasture and water. These rules and norms are designed to buffer pastoralist communities against the regularly-occurring stresses brought on by droughts, and to lend resilience to their livelihoods in a difficult environment. For example, pastoralists enforce local rules protecting forests, due to the value that forests and woodlands play as a refuge for livestock during droughts and as well as forests' water

catchment value. The Loita Forest in southern Kenya is a well-documented example of a forest that has been conserved as a result of such customary measures, even while Kenya has lost the vast majority of its forests during the past forty years (Karanja et al., 2002). In northern Kenya, isolated forests and scarce sources of permanent water are protected by local Borana communities through strict rules governing access and activities such as tree felling or permanent settlement in or around these valuable areas (Bassi, 2006).

Maasai communities traditionally divide their collective pastures into different types of areas governed by certain traditional rules. The most fundamental division is of pastures between areas used during the wet season and areas used as dry season refuges. Wet season pastures tend to be those without permanent water that can only be accessed during periods of rainfall. Dry season pastures tend to be areas which have permanent water nearby or which are particularly resistant to drought, such as forests which retain vegetation that livestock can access even during severe droughts. In addition, some pastures are designated for use by calves and weak or infirm livestock. These areas, called *olokeri*, are close to permanent settlements and sources of water, and are allocated to particular households rather than being managed at the community or village level. Figure 2 illustrates this traditional land use scheme as mapped and formalized in village by-laws in one pastoralist village in Loliondo Division, northern Tanzania.

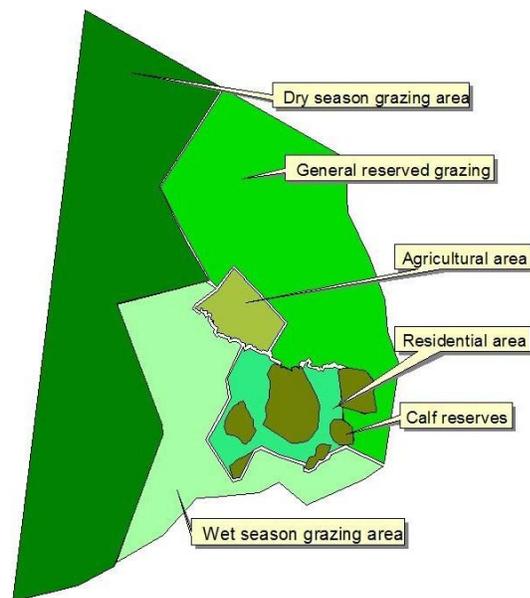


Figure 2: Land use zones for a pastoralist village in Loliondo, northern Tanzania, based on traditional pasture management system and formalized through a land use plans and village by-laws. Source: Ujamaa Community Resource Trust.

Pastoralist-Wildlife Interactions in East Africa

In terms of better understanding livestock-wildlife interactions in East African savannahs, a key underlying factor is the reality that different types of animals eat different types of forage (Vesey-Fitzgerald, 1960). Species such as giraffe, gerenuk, kudu, and domestic goats are browsers, eating leaves from trees and bushes, whereas species such as wildebeest, zebra, buffalo, gazelle, and cattle, are grazers. Some wild ungulates such as eland and impala are 'mixed feeders', eating both grass and browsed forage. Bell (1971), based on research carried out in the Serengeti, describes how different species of wild ungulates, such as wildebeest and zebra, can co-exist without directly competing for grazing because their feeding preferences are different- zebra eat higher, more coarse grass while wildebeest prefer shorter swards of grass. This enables wildebeest to graze areas that zebra have already passed through and grazed over initially. Gazelle are very selective grazers, with small mouths capable of selecting individual blades of grass and efficient digestive systems, and can also extract forage from areas that have already been grazed by larger, less selective grazers such as zebra, wildebeest, or cattle.

In general, cattle, which make up the majority of livestock biomass in pastoralist areas, compete most directly with zebra and buffalo, which like cattle are large-bodied, relatively unselective grazers. By contrast, the presence of animals like zebra or cattle, which can feed on high and coarse grasses, can increase the availability of forage for more selective grazers such as gazelles. Gichohi's (1992) study of Nairobi National Park in Kenya describes how after pastoralists were excluded from the park in the 1960's, a management change that reduced levels of cattle grazing as well as the use of fire, selective grazers preferring a low grass sward, such as hartebeest, warthog, and Thomson's gazelles, became greatly reduced in numbers inside the park. These species had benefited from the presence of livestock and pastoralist land management practices. This work illustrates what Western and Gichohi (1994) term 'segregation effects' in savannah ecosystems, whereby human interventions that remove people from areas where they have had long-term influences on ecological processes and species composition can have negative cascading effects on certain native species.

In Tanzania's Ngorongoro Crater, Maasai pastoralists were evicted from living on the caldera floor in 1974 (Homewood and Rodgers, 1991). Following the removal of livestock as a permanent presence in the crater (livestock are still allowed to descend into the crater to access mineral licks), different species of ungulates showed both increasing and decreasing trends over the course of the following twenty years (Table 1). Buffalo populations increased substantially after the removal of pastoralists, while in contrast wildebeest decreased significantly. Other species showed more modest and variant increases and decreases. Overall, wildlife biomass was unchanged after the removal of pastoralists and their livestock from the Ngorongoro Crater (Runyoro et al., 1995). In their comprehensive review of the interactions between people and wildlife in the Ngorongoro Conservation Area (NCA), Homewood and Rodgers (1991) conclude that

while pastoralists in NCA “have helped shape the present environment and have long helped protect the wild animal populations...there are no negative impacts of Maasai land use on wildlife values.”

Table 1: Changes in the population trends and overall numbers for large mammal herbivores (grazers only) in Ngorongoro Crater following the eviction of resident pastoralists in 1974. Source: Adapted from Runyoro et al., 1995.

Species	Trend before 1974	Trend after 1974	Overall difference in population before and after 1974
Wildebeest	Increase	Decline	Decline
Buffalo	Slight increase	Sharp increase	Increase
Hartebeest	Increase	Decline	Increase
Thomson’s gazelle	Increase	Decline	Decline
Eland	Constant	Decline	Decline
Zebra	Constant	Decline	Decline

More recent research provides more detailed, if not entirely explained, evidence of a positive interaction between resident pastoralists and wildlife in the NCA as a whole. Researchers have found that wildlife densities in the NCA peak at around 2-3 kilometres from pastoralist settlements, declining within 1 km and declining dramatically farther than 5-6 km (Ellis et al., 2001). Possible explanations for this distribution are the concentration of nutrients in the vicinity of human settlements, such as resulting from concentration of livestock in temporary kraals or enclosures, and benefits in terms of predator avoidance (Ibid.). The study concludes that “pastoral production and wildlife conservation are not only compatible, but represent a positive interaction, at least for wildlife.” (Ibid.)

The Loliondo area is a part of the Serengeti Ecosystem but, unlike NCA, comprises village lands managed by Village Councils, giving local communities a much greater jurisdictional control over land use decisions. Maddox (2003) carried out surveys of both herbivore and large carnivore populations in Loliondo, comparing species densities and abundance to areas he simultaneously surveyed inside NCA and Serengeti National Park (SNP). He found no difference in wildlife diversity between the three areas, with animal biomass higher outside SNP, and concludes that there is “no evidence that the presence of the Maasai and their livestock was particularly detrimental to any single species” and “no evidence that livestock biomass replaces wild species biomass outside the park.” His findings echo earlier Serengeti ecosystem surveys reported by Campbell and Borner (1995) which found “no marked changes in density on either side of the protected area boundaries” dividing community-managed pastoralist lands in Loliondo from the state-managed SNP.

Maddox (2003) also found a high density of large predators such as lions and spotted hyenas in Loliondo's pastoralist lands, with lion densities there at about 1:2.7 km², a density comparable or exceeding that found in many state protected areas. He concludes that "lion populations were equally healthy in the study areas inside and outside the park and persisting at densities comparable to the healthiest populations in recent history" (Ibid.). Lions persist at high densities in such areas despite conflicts with pastoralists resulting from predation on livestock; Maddox also found that 89% of Loliondo residents had experienced livestock predation although vastly more livestock were lost to drought and disease than large carnivores. In Loliondo and other areas, Maasai regularly kill lions in retaliation for livestock predation as well as for ceremonial purposes. Lichtenfeld (2005) estimates an annual off-take of about 40 lions per year from seven pastoralist villages east of Tarangire National Park. Indeed, it has been speculated that smaller carnivores, particularly endangered wild dogs and cheetahs, do better in human-occupied pastoralist lands where lion densities may be lower than in state protected areas where lions tend to be abundant and cheetah and wild dog incur high levels of juvenile mortality from lion predation (Creel and Creel, 1996; Woodroffe et al., 1997; Maddox, 2003). For example, the largest population of wild dogs in Tanzania occurs in the largely communal lands of the southern Maasai Steppe (Woodroffe et al., 1997).

In summary, the available evidence suggests that pastoralists and wildlife- both ungulates and large carnivores- continue to co-exist in East African savannahs with pastoralists having few significant negative, and in some cases positive, impacts on wildlife densities and diversity. However, it should be emphasized that the impact of pastoralists on wildlife vary from species to species, with pastoralists causing significant mortalities amongst some livestock predators such as lions, at least in some locales, and cattle competing more directly with certain large and relatively unselective grazers such as zebra and buffalo. For other more selective grazers, the impact of cattle on forage composition in shared pastures may be more positive.

3.0: Pastoralist Land Management and Wildlife Conservation in Northern Tanzanian Ecosystems

Throughout the East African savannahs of Kenya and Tanzania, wildlife relies extensively on pastoralist managed lands, both those immediately adjacent to state protected areas and across the broader landscape. Even in the Serengeti ecosystem, which includes over 25,000 km² of state protected areas, migrating wildlife relies extensively on community lands to the east, west, and north of the park (Thirgood et al., 2004). For example, Norton-Griffiths (1995) estimates that if the ecosystem's migratory wildebeest could not access the private and communal lands to the north and east of Kenya's Maasai Mara National Reserve, which is the dry season refuge for these herds, the total number of animals the Serengeti ecosystem could support might be reduced by one-third. Indeed, large-scale wildlife declines of resident wildlife populations and the Loita-

Mara wildebeest population of 56% and 81%, respectively, have been attributed to land use changes on these private and communal lands (Homewood et al., 2001). In total, 40% of Kenya's wildlife is today found on community and private lands, with only 10% in national parks and about 25% accounted for by the Maasai Mara National Reserve alone (Western et al., 2006). In other words, pastoralists and other landholders host the majority of Kenya's wildlife populations, sustaining the key asset in the national tourism industry (Norton-Griffiths, 2007).

In northern Tanzania, wildlife similarly relies on dispersal areas and habitats outside state protected areas, although in general state protected areas cover larger areas than in Kenya, with Tanzania having devoted about 30% of its total land area to protected areas where human residence is excluded (Brockington, 2006).

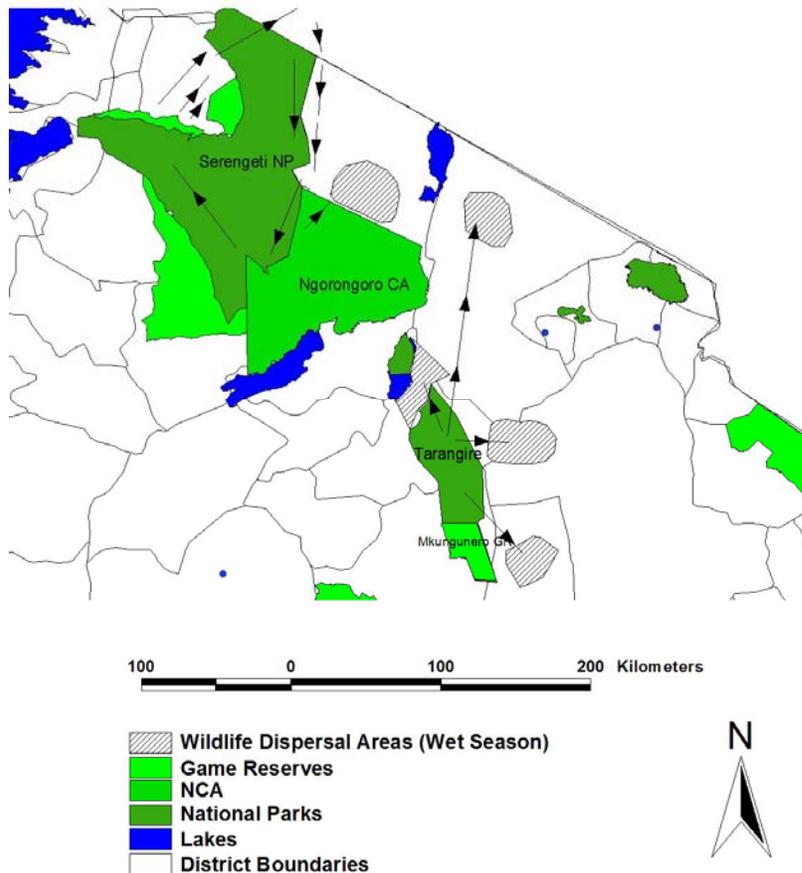


Figure 3: Migration routes and dispersal areas in protected areas and village lands in northern Tanzania's main wildlife areas. Source: TNRF, 2008.

Northern Tanzania contains two major migratory wildlife systems, with some interaction and movement between the two. The largest number of wildlife lives within the Serengeti ecosystem, which as noted above extends to Kenya's Maasai Mara National Reserve and surrounding private lands. The Serengeti ecosystem is defined by the annual migration of some 2-3 million wildebeest, zebra, gazelles, and antelopes between dry season habitat in Kenya and the wet season grazing habitat of the Serengeti plains (Sinclair and Arcese, 1995). Those plains lie along the border of the Serengeti National Park (SNP) and Ngorongoro Conservation Area (NCA).

When the herds of wildebeest move south from the Maasai Mara at the onset of the rains, usually occurring around November, they pass through the community lands of Loliondo. From the Serengeti plains, the herds also spill out onto the Salei plains north of the Gol Mountains, located on the village lands of Malambo and Engare Sero villages. These community-managed areas provide important wet season habitat (Thirgood et al., 2004). To the west of Serengeti National Park, wildlife also moves outside the boundaries of SNP and the adjacent Ikorongo and Grumeti Game Reserves, onto village lands in Serengeti and Tarime Districts. Communities resident in these areas are however not transhumant pastoralist but agro-pastoralist members of the Kuria and Ikoma ethnic groups. These communities also prey extensively on wild ungulates as a source of food, and in contrast to pastoralists in Loliondo, who do not traditionally eat wild animals, wildlife densities to the west of the SNP show a marked decline outside the protected area's confines (Campbell and Borner, 1985).

The second extensive wildlife migratory system in northern Tanzania is the Maasai Steppe, which covers a vast stretch of about 35,000 km², from near the Kenyan border around Lake Natron south through the Simanjiro plains and Tarangire National Park, to the arid Makame depression of northern Kiteto District (Prins, 1987). Unlike the Serengeti system to the west, the Maasai Steppe is over 80% community and privately managed lands, with the vast majority being communal village lands managed by local people. As the name of the ecosystem suggests, the Maasai Steppe is inhabited almost entirely by pastoralist communities, with the exception of small peri-urban areas such as Mto wa Mbu. The southern part of the Steppe borders onto lands occupied by agricultural communities belonging to various Bantu ethnic groups; in recent years these groups of people have been extending smallholder agriculture into traditionally pastoralist areas in the southern Maasai Steppe, leading to occasional local conflicts over land use and tenure.

The most important dry season refuge for wildlife of the Maasai Steppe is located within Tarangire National Park, which contains the Tarangire River and the Silalo swamps, providing key water sources during droughts to water-dependent species such as elephant, buffalo, and zebra. During the wet season, these and other species disperse widely across the ecosystem (Borner, 1985). Short grass plains to the west of Mount Kitumbeine, and the Simanjiro plains to the east of Tarangire National Park, both provide major dispersal habitats for zebra and wildebeest. In the 1970's, Kahurananga

(1981) estimated the wet season population of the Simanjiro plains at approximately 6,000 zebra and 10,000 wildebeest. Elephants move north out of Tarangire towards Lake Manyara and another small volcanic mountain, Esimingori, during the rains (TCP, 1997). Another sub-population of elephants takes refuge in the southern part of Tarangire during droughts but primarily inhabits the Makame depression in the southern Maasai Steppe. During the wet season most wildlife is widely dispersed across the system, with few animals inside Tarangire National Park at that time. Although Tarangire National Park is the main site for large-scale tourism visitation in the system, wildlife is largely dependent on habitats located on community lands. The continued maintenance of these wet season habitats and migration corridors between key dry and wet season territories is consequently critical for wildlife and Tarangire's tourism product (Otto et al., 1998).

These community lands are managed by local pastoralists for a range of livelihood purposes, but the overwhelming land management aim of pastoralist communities in both the Serengeti ecosystem and the Maasai Steppe is oriented towards livestock production. As noted earlier, Maasai pastoralists in northern Tanzania manage their lands according to rules designating different pastures as wet season and as dry season grazing areas. Dry season reserved areas are particularly important in providing a 'grass bank' for livestock to consume during the long dry season of roughly June-October, when forage invariably becomes scarce and animals are stressed for water and nutrients. These dry season reserves are thus a key element of pastoralist livelihoods and natural resource management in northern Tanzania.

Traditionally, the use of dry season grazing reserves is governed by decisions made by customary Maasai leadership structures, which involve the leaders (*ilegwanak*) of the different age-sets meeting to decide when community members' herds may access the reserves. The date when entry will be allowed (e.g. July 1st) will depend on the amount of rain that has fallen in a given year and the condition of forage in the various grazing areas. In recent years, pastoralist communities have been able to formalize their customary land management systems through written village by-laws and land use plans. These measures, prepared based on Tanzania's local government and land policy and legislation, enable communities to formalize their traditional rules and translate them into a modern legalistic form which can be understood by outsiders and given some level of legal force.

Dry season grazing reserves compose a variable but significant proportion of the communal village lands throughout northern Tanzania's pastoralist areas. These grazing reserves function as de facto village-level conserved areas or, to use the IUCN (World Conservation Union) terminology, as 'Community Conserved Areas' (Kothari, 2006). The maintenance of reserved grazing areas in pastoralist villages, managed at the communal scale, is a key reason why extensive unfragmented savannah landscapes continue to exist in northern Tanzania, across vast areas such as the Maasai Steppe. Pastoralist grazing reserves give northern Tanzania much of its 'wild' or 'wilderness' character,

which in turn is a central reason why this landscape both supports wildlife and attracts foreign tourists to the degree that it does.

These grazing reserves also physically overlap with many of the key wildlife habitats and dispersal areas in northern Tanzania. For example, in Loliondo, dry season grazing areas are situated in the western portion of the seven villages whose lands lie adjacent to SNP's eastern boundary. Pastoralists' dry season grazing reserves therefore provide a 'buffer zone' under local management which helps to conserve wildlife populations in western Loliondo. This includes the resident wildlife populations noted by Maddox (2003) and others, as well as the southbound migration route of the ecosystem's large ungulate herds. To the east, when wildebeest move onto the Salei plains during the wet season, they utilize dry season grazing reserved areas in Engare Sero village, which straddles the Rift Valley escarpment from Salei down to Lake Natron.

In the Maasai Steppe, key habitats such as the Simanjiro plains are partially protected by traditional dry season grazing reserves. For example, Terrat village, which holds about one-third of the Simanjiro plains within its village land boundaries, traditionally allows livestock onto the plains from July up until around January. In January, if rain has fallen, wildebeest usually begin calving on the plains and livestock move away until the dry season grazing period begins again in July (approximately). To the west and southwest, Loiborserrit and Emboreet villages situate their dry season grazing reserves along the eastern border of Tarangire National Park, in an area that provides extensive habitat for buffalo, elephant, and other large mammals moving back and forth across the unseen park boundary. As in Loliondo, these local customary land management practices serve to conserve a large expanse of wildlife habitat adjacent to the park, effectively extending the area conserved and preventing the encroachment of agriculture against the park boundary.

4.0: Estimating the Economic Value of Pastoralist Land Use Practices to Wildlife-based Tourism in Northern Tanzania

The previous section describes the way that traditional pastoralist land management practices across northern Tanzania function to conserve important wildlife habitats, complimenting state protected areas and enabling wildlife to continue moving between seasonal habitats across expansive ecosystems. These customary land use and management practices clearly contribute to the conservation of wildlife habitat and wildlife populations in northern Tanzanian ecosystems. Moreover, these ecological services have an important economic dimension given the scale and importance of northern Tanzania's tourism industry.

Tanzania's tourism industry generated an estimated \$900 million in direct contributions and an estimated \$1.6 billion in indirect economic value in 2008 (Mitchell et al., 2008). The northern safari circuit, which includes Serengeti, Lake Manyara, and Tarangire

National Parks and the Ngorongoro Conservation Area, and adjacent pastoralist lands, attracts about 300,000 international tourists and total in-country tourist expenditure estimated at around \$550 million annually (Ibid.). In other words, the northern safari circuit, which relies entirely on wildlife using both state protected areas and local pastoralists lands (even if most tourism activity is situated within the former rather than the latter), accounts for over 60% of Tanzania’s total national tourism industry. As Table 2 demonstrates, the three national parks of the northern circuit provide nearly half of the revenue earned by the country’s fifteen national parks in total. As such, revenue earned by northern parks helps to pay for the management and conservation of ecosystems in other parts of the country, such as relatively new national parks on the coast (Saadani) and southern highlands (Kitulo). In this way, pastoralist lands in northern Tanzania contribute to biodiversity conservation nationwide.

Table 2: Tourist arrivals, total earnings, and proportion of earnings in relation to total Tanzania National Parks (TANAPA) earnings. Data is for 2006/07 financial year (July-June). (Revenues are translated from Tshs to USD at the exchange rate of 1271:1 as prevailed on January 2, 2007). Source: TANAPA, 2007.

Park	Tourist arrivals	Total Revenue	% of Total Tanzanian National Park Revenue
Serengeti	265,880	\$17,824,944.62	32.81%
Lake Manyara	141,226	\$3,949,941.44	7.27%
Tarangire	102,562	\$3,812,736.68	7.02%
Totals	509,668	\$25,587,622.74	47.10%

It is clear that by conserving large proportions of northern Tanzania’s wildlife ecosystems, local pastoralist communities collectively make an important contribution to the national and regional economy. But precisely how much do these ecological services contribute to the overall wildlife-based tourism economy? What proportion of total northern circuit tourism earnings is attributable to pastoralist land management practices?

The relative importance of pastoralist lands in the Serengeti ecosystem and the Maasai Steppe ecosystem varies considerably between the two areas, as does the relative value of the two ecosystems with regard to the total economic value of the northern tourism circuit. Using the total number of tourist visitors to the different areas (NCA and SNP for the Serengeti ecosystem; TNP and LMNP for the Maasai Steppe ecosystem), the proportional values of the two systems in relation to the northern circuit’s total direct economic value of \$550 million can be estimated. Dividing this total between the two ecosystems that comprise the northern circuit, based on visitor numbers at the different areas, results in a total value attributable to the Maasai Steppe of about \$153 million,

and for the Serengeti ecosystem of \$394 million (Table 3). Note that this figure of \$394 million includes revenue from both SNP and NCA. In reality, NCA includes both a large portion of the Serengeti plains, which are a part of the greater Serengeti ecosystem, and the relatively enclosed Ngorongoro Crater, where wildlife is generally resident and does not follow the migratory patterns of wildlife elsewhere in the Serengeti system. If we only include half of the total revenue from NCA, then we obtain a perhaps more realistic figure for the Serengeti ecosystem that excludes Ngorongoro Crater, of about \$281 million.

Table 3: Proportional value of different areas (national parks and NCA) in the northern circuit based on proportion of northern circuit visitor numbers at each area. Source: TANPA, 2007; Mitchell et al., 2008.

Area	No. of tourists	Proportion of northern circuit visitors	Estimated proportion of total northern circuit revenue
L. Manyara NP	141,226	16%	\$88,957,628
Serengeti NP	265,880	31%	\$167,476,628
Tarangire NP	102,562	12%	\$64,603,347
NCA	360,000	41%	\$226,762,397
Total value attributable to Maasai Steppe			\$153,560,975
Total value attributable to Serengeti ecosystem (including all NCA)			\$394,239,025
Total value attributable to Serengeti ecosystem (including 50% NCA)			\$280,857,827

In the Maasai Steppe, over 80% of the total wildlife range lies on private and communal lands, the vast majority of it within predominantly pastoralist villages. However, the key wildlife habitats comprise a smaller area, and are focused on areas such as the Simanjiro plains and similar short grass plains near Mount Kitumbeine for herds of zebra and wildebeest, as well as areas such as Lolkisale and Makame for elephants. We can conservatively estimate that about 50% of the wildlife habitat is conserved by pastoralists on village lands in the Maasai Steppe, and that if all pastoralist lands were unavailable for use by wildlife the total value of the ecosystem in terms of wildlife-based tourism would decline by half.

In the Serengeti ecosystem, the proportion of wildlife habitat provided by Tanzanian pastoralist communities is much lower. Thirgood et al. (2004), using radio-telemetry studies of wildebeest during 1999-2000, estimate that the wildebeest herds spend about 3% of their total time in Loliondo and the Salei plains. Although community lands to the west of SNP, in the Ikoma area, and to the north of the Maasai Mara National Reserve in Kenya are more important to wildebeest and other migratory wildlife, these areas are not included in the scope of this study, which is concerned only with pastoralist lands in the Loliondo/Salei area. We will therefore estimate the relative contribution that pastoralists make to the conservation of the Serengeti ecosystem at

3%. This figure is also conservative because it does not in any way factor in the role pastoralists have played for hundreds of years in maintaining the landscape of the NCA, which is unlike the national parks is a multiple-land use area with over 50,000 resident Maasai pastoralist residents (Homewood and Rodgers, 1991). However, since pastoralists in this area, unlike in Loliondo, do not have clear rights over land management decisions and are not able to make and enforce their own land use plans due to regulatory powers exercised by the Ngorongoro Conservation Area Authority (Shivji and Kapinga, 1998), it is difficult to credit pastoralists in NCA with responsibility for land management decisions that contribute to conservation in the way that one may in other pastoralist areas.

Using the figures of 50% of habitat conserved by pastoralists in the Maasai Steppe, and 3% in the Serengeti ecosystem, and the relative economic values of the two different systems in terms of tourism earnings, we estimate a total economic value in relation to wildlife conservation and tourism revenue of approximately \$85.2 million annually. This figure would fluctuate according to the inherent variability of the national and northern safari circuit tourism industry- it may, for example, decline considerably in 2009 if the expected downfall in Tanzanian tourism due to the global financial crisis is realized. This is nevertheless a significant economic contribution that pastoralists make through their land management practices in relation to Tanzania’s wildlife-based tourism industry.

Table 4: Estimated value of pastoralist lands to wildlife-based tourism in the Maasai Steppe and Serengeti ecosystems, based on the relative degree that wildlife relies on pastoralist lands outside the boundaries of state protected areas.

Ecosystem	Degree of wildlife reliance on pastoralist lands	Economic value of pastoralist lands as a % of total tourism earnings
Maasai Steppe	50%	\$76,780,487.73
Serengeti Ecosystem	3%	\$8,425,734.80
Total		\$85,206,222.53

It should also be noted that this estimate can be considered a minimum valuation of pastoralist contributions to the wildlife-tourism economy. These estimates focus on the northern safari circuit’s two main ecosystems- the Serengeti and the Maasai Steppe- but other less significant forms of wildlife utilization also generate revenue. For example, most pastoralist lands are allocated by the central government as tourist hunting concessions, which as of 2003 generated an average of \$40/km² in direct government revenue (Baldus and Cauldwell, 2004). Nearly all of such predominantly-pastoralist districts such as Longido, Monduli, and Simanjiro are allocated as hunting concessions, covering an area of at least 35,000 km². The revenue from tourist hunting in pastoralist areas, which is largely enabled by the co-existence of pastoralist communities with diverse and relatively abundant populations of large mammals on their lands, is

therefore at least \$1.4 million annually. Due to recent raises in hunting fees the actually total is in all likelihood several times that amount in direct revenue alone, without including any indirect benefits or economic multipliers.

5.0: Policy Implications

It has long been recognized that pastoralist lands and land use practices provide much of the habitat that migratory wildlife in East African national parks continues to rely on for seasonal habitat requirements (Myers, 1972; Western, 1982). As northern Tanzania's tourism industry has grown, with the northern safari circuit now comprising about 6% of the country's total national economy, the economic importance of pastoralist conservation practices in these extensive ecosystems has increased. This report is the first to attempt to quantify economically, in necessarily approximate terms, the contribution of pastoralists to wildlife conservation in northern Tanzania, based on the tourism earnings of various parts of the northern safari circuit and the relative reliance of those different areas on pastoralist lands outside protected area boundaries. The findings highlight the considerable value of pastoralist land management practices in supporting wildlife-based tourism in the northern safari circuit, and thus the strategic economic importance to the country of these land use practices.

Given the economic importance of pastoralist land management practices, Tanzanian policy in sectors such as land, livestock, wildlife, and tourism should take into account these strategic economic considerations and support the ability of local pastoralist communities to maintain communal pastures and reserved grazing areas. The key, from a public policy perspective, is to craft policy and legal measures that enable pastoralist rangelands to continue to maintain wildlife and livestock in communally-managed rangelands. In Kenya, for example, a national wildlife policy which concentrates control over wildlife utilization in centralized state agencies, and land tenure policies which encourage the individualization of communal rangelands, has contributed to widespread declines of wildlife as pastoralists' rangelands are fragmented (Norton-Griffiths, 2007). In Tanzania, pressures on communal grazing areas are increasing as a result of population growth resulting from natural increases and immigration from overpopulated highlands, as well as growing demand for pastoralist lands for tourism and other commercial investments. In areas such as Loliondo, these pressures are resulting in the abandonment of customary systems of land management and reservation of dry season pastures, at least in some villages (M. Sinandei, pers. comm.). For Tanzania to be able to sustain its wildlife resources and tourism attractions, it will need to carefully consider policy measures that support the maintenance of integrated wildlife and livestock land uses in its rangelands.

Land Tenure

A key issue in the future of Tanzanian savannah ecosystems will be the ability of local communities to continue managing rangelands at the communal scale, rather than

fragmenting rangelands into individually-owned properties. Converting rangeland from communal pastures to individual properties will likely prevent the movements across large areas of land that both livestock and wildlife in semi-arid landscapes depend upon.

Tanzania's land tenure laws and policies provides a relatively enabling framework for communal land management. The Land Act and Village Land Act, passed in 1999, make customary rights in land legally equivalent to granted rights, and specifically cater for rights to be held and exercised collectively (Alden Wily, 2003). The Village Land Act also provides for villages to zone their land between individual and communal areas, which supports land use planning measures that reserve different seasonal grazing areas, as has been done in many northern Tanzanian pastoralist communities.

However, the Land Act also includes 'unused community lands' within its definition of 'general lands' which are under the control of the Ministry of Lands and may be allocated for use to applicants. Seasonally used pastoralist lands are often perceived by outsiders as 'unused' and therefore are often subject to attempts to allocate them in this way (Mattee and Shem, 2006).

In addition, although the land tenure law and policy are supportive of communally held rights in land, there remains a general perception in some policy circles that individualized landholdings are more modern and developmentally progressive than collectively managed land. For example, Tanzania has a high-profile Property and Business Formalization Programme (known by its Kiswahili acronym, MKURABITA) which seeks to promote individualized titling of lands in order to enable smallholders to use land as collateral for loans and credit. Although such initiatives do not inherently undermine continued exercise of communal rights in land, measures that lead to the individualization of pastoralist rangelands will have substantial costs in terms of livestock production and wildlife movements across such landscapes.

Livestock

Tanzanian livestock policy and legal reforms in recent years have consistently emphasized modernization and increasing commercial meat, milk, and hides production. These modernization models generally prioritize development of large-scale, privately owned ranches as the key to increasing commercial production, and view traditional pastoralist production as inefficient and relatively archaic (Mattee and Shem, 2006).

A key policy implication that emerges from this report is that the individualization or spread of privately-owned ranches in northern Tanzania would have significant costs in relation to the tourism industry, due to the impacts on wildlife of rangeland fragmentation. When private ranches are carved out of communal pastures, the private parcels tend to be much smaller and are often demarcated through fencing. It is debatable if the development of smaller, privately held landholdings out of larger-scale,

communal pastures would lead to more commercial production of livestock in northern Tanzania. However, it is indisputable that such changes would have major costs in terms of wildlife populations and tourism enterprises, as Kenya's experience with rangeland fragmentation illustrates (Norton-Griffiths, 2007). Rather than promoting private ranch-based livestock sector development models, policy-makers should focus on measures that enable pastoralist livestock producers to improve their production and profit margins, such as enhanced market information or veterinary services.

Wildlife and Tourism

This report echoes the findings of numerous other studies, including those produced by Tanzanian policy-makers, regarding the importance of wildlife being able to continue to access habitats on community lands outside state protected areas (e.g. MNRT, 1998; TNRF, 2008). Although pastoralists continue to manage lands in ways that support wildlife and thus the tourism industry, there are significant tensions between pastoralist livelihoods and wildlife conservation objectives, most of which are rooted in policy and other institutional factors.

Pastoralists have lost key lands and resources to state protected areas over the years, and continue to lose access to areas. For example, the Mkungunero Game Reserve's creation in the late 1990's in the southern Maasai Steppe has created conflicts with local pastoralist villages and widespread apprehension about expanding protected areas and land loss in the area (Sachedina, 2008). The allocation of centrally-managed tourist hunting concessions on community lands is a widespread source of conflict and results in local people having insecure rights over land and resources. Pastoralists in Loliondo and the Maasai Steppe have also had recurrent disputes with protected area authorities regarding the boundaries of their lands and national parks. These tensions between protected areas and local communities can create perverse incentives which are not conducive to maintaining integrated wildlife and livestock land uses in pastoralist rangelands. For example, in Emobreet village, on the border of Tarangire National Park, there is evidence that local pastoralists have expanded farming in key wildlife habitats as a response to fears that external agencies will appropriate their land for purposes of wildlife conservation (Ibid.). In Loliondo, local communities fear that they will lose access to customary lands within their villages if they maintain dry season grazing reserves that are not permanently occupied, and this is contributing to the erosion of traditional land use systems (M. Sinandei, pers. comm.).

In order to support the continued presence of wildlife on pastoralist lands, it is imperative to create local incentives for wildlife as a form of land use, particularly given the costs that wildlife imposes through livestock predation (TNRF, 2008). Tanzania adopted wildlife policy reforms in the late 1990's providing for the establishment of Wildlife Management Areas (WMA's) that would enable greater local control over wildlife management and benefits from wildlife (MNRT, 1998).

However, these reforms have not led to significant new forms of wildlife benefits for the majority of pastoralist communities in northern Tanzania. The development of WMA's has been limited by complex procedural requirements and lack of clarity on benefit-sharing in WMA's (Nelson, 2007). In some areas such as Loliondo, pastoralists have opted not to implement proposed WMA's due to concerns about these factors as well as the security of grazing areas under the wildlife-focused WMA framework. In theory, WMA's should be able to reconcile local livelihoods and pastoralist land use objectives with wildlife conservation, particularly given the historic co-existence of wildlife with pastoralist land use systems. However, in order to do this policy-makers could resolve the current lack of clarity surrounding benefit-sharing as well as concerns pastoralists possess with regards to land tenure security and governance (TNRF, 2008).

References

- Alden Wily, L. 2003. *Community-based Land Tenure Management: Questions and Answers about Tanzania's New Village Land Act, 1999*. Drylands Issue Paper No. 120. London: International Institute for Environment and Development.
- Baldus, R.D. and A.E. Cauldwell. 2004. Tourist Hunting and its Role in Development of Wildlife Management Areas in Tanzania. Paper presented to the Sixth International Game Ranching Symposium, Paris, July 6th-9th.
- Barrow, E. 1988. *Trees and pastoralists: The case of the Pokot and Turkana*. Overseas Development Institute, Social Forestry Network, Network Paper 6b. London: ODI.
- Bassi, M. 2006. Community conserved areas in the Horn of Africa. *Parks* 16(1): 28-34.
- Bell, R.H.V. 1971. A grazing system in the Serengeti. *Scientific American* 224: 86-93.
- Berkes, F. 1989. *Common Property Resources: Ecology and Community-based Sustainable Development*. London: Belhaven Press.
- Blomley, T., K. Pfliegner, J. Isango, E. Zahabu, A. Ahrends, and N. Burgess. 2008. Seeing the wood for the trees: towards an objective assessment of the impact of participatory forest management on forest condition in Tanzania. *Oryx* 42: 380-391.
- Borner, M. 1985. The increasing isolation of Tarangire National Park. *Oryx* 19: 91-96.
- Bourn, D. and R. Blench. 1999. *Can Livestock and Wildlife Co-exist? An Interdisciplinary Approach*. Oxford: Overseas Development Institute.
- Brockington, D. 2006. The politics and ethnography of environmentalisms in Tanzania. *African Affairs* 105: 97-116.
- Campbell, K. and M. Borner. 1995. Population trends and distribution of Serengeti herbivores: implications for management. In A.R.E. Sinclair and P. Arcese (eds.), *Serengeti II: Dynamics, Management, and Conservation of an Ecosystem*. Chicago: University of Chicago Press, pp. 117-145.
- Collet, D. 1987. Pastoralists and wildlife: image and reality in Kenya Maasailand. In D. Anderson and R. Grove (eds.), *Conservation in Africa: People, Policies, and Practice*. Cambridge: Cambridge University Press, pp. 129-148.
- Creel, S. and N.M. Creel. 1996. Limitation of African wild dogs by competition with larger carnivores. *Conservation Biology* 10(2): 526-538.

- Dodd, J.L. 1994. Desertification and degradation in sub-Saharan Africa: the role of livestock. *Bioscience* 44(1): 28-34.
- Ellis, J., S. Lynn, J. Mworio, J. Kinyamario, S. BurnSilver, M.S. Maskini, R. Kidunda, R.S. Reid, M. Rainy, A.J. Mwilawa, and V.A. Runyoro. 2001. Ecosystem interactions: Implications for human welfare and wildlife conservation. In R.B. Boone and M.B. Coughenour (eds.), *A System for Integrated Management and Assessment of East African Pastoral Lands: Balancing Food Security, Wildlife Conservation, and Ecosystem Integrity*. Final report to the Global Livestock Collaborative Research Support Program, pp. 23-48.
- Gichohi, H. 1992. *The Effects of Fire and Grazing on Grasslands of Nairobi National Park*. MSc Thesis, University of Nairobi, Nairobi.
- Grzimek, B. and M. Grzimek. 1960. *Serengeti Shall Not Die*. New York: E.P. Dutton & Co., Inc.
- Hardin, G. 1968. The tragedy of the commons. *Science* 162: 1243-1248.
- Hayes, T.M. 2006. Parks, people, and forest protection: an institutional assessment of the effectiveness of protected areas. *World Development* 34: 2064-2075.
- Homewood, K.M. and W.A. Rodgers. 1991. *Maasailand Ecology: Pastoralist Development and Wildlife Conservation in Ngorongoro, Tanzania*. Cambridge: Cambridge University Press.
- Homewood, K., E.F. Lambin, E. Coast, A. Kariuki, I. Kikula, J. Kivelia, M. Said, S. Serneels, and M. Thompson. 2001. Long-term changes in Serengeti-Mara wildebeest and land cover: Pastoralism, population, or policies? *PNAS* 98(22): 12544-12549.
- Igoe, J. and D. Brockington. 1999. *Pastoral Land Tenure and Community Conservation: A Case Study from North-east Tanzania*. Pastoral Land Tenure Series. London: International Institute for Environment and Development.
- Kahurananga, J. 1981. Population estimates, densities and biomass of large herbivores in Simanjiro Plains, northern Tanzania. *African Journal of Ecology* 19: 225-238.
- Karanga, F., Y. Tessema, Y. and E. Barrow. 2002. *Equity in the Loita/Purko Naimina Enkiyio Forest in Kenya: Securing Maasai Rights to and Responsibilities for the Forest*. Forest and Social Perspectives in Conservation No. 11. Nairobi: IUCN-EARO.

- Kothari, A. 2006. Community conserved areas: towards ecological and livelihood security. *Parks* 16: 3-13.
- Lama, L. 1998. *Conflict and Compatibility: An Inventory and Analysis of Land Use in a Tanzanian Wildlife Corridor*. PhD. Thesis, Binghamton University, New York.
- Lamprey, H. 1983. Pastoralism yesterday and today: The overgrazing problem. In F. Bourliere (ed.), *Tropical Savannas: Ecosystems of the World*. Amsterdam: Elsevier, pp. 643-666.
- Lichtenfeld, L.L. 2005. *Our Shared Kingdom at Risk: Human-Lion Relationships in the 21st Century*. PhD Thesis, Yale University, New Haven, Connecticut.
- Maddox, T. M. 2003. *The Ecology of Cheetahs and Other Large Carnivores in a Pastoralist-Dominated Buffer Zone*. PhD Thesis, University College, London and Institute of Zoology, London.
- Mattee, A.Z. and M. Shem. 2006. *Ambivalence and Contradiction: A review of the policy environment in Tanzania in relation to pastoralism*. Drylands Issue Paper No. 140. London: International Institute for Environment and Development.
- McCabe, J.T. 1990. Turkana pastoralism: A case against the Tragedy of the Commons. *Human Ecology* 18(1): 81-103.
- Ministry of Natural Resources and Tourism (MNRT). 1998. *The Wildlife Policy of Tanzania*. Dar es Salaam: Government Printer.
- Mitchell, J., J. Keane, and J. Laidlaw. 2008. *Making success work for the poor: Package tourism in northern Tanzania*. Overseas Development Institute and SNV.
- Myers, N. 1972. National parks in savannah Africa. *Science* 178: 1255-1263.
- Nelson, F. 2007. *Emergent or Illusory? Community Wildlife Management in Tanzania*. Drylands Issue Paper No. 146. London: International Institute for Environment and Development.
- Neumann, R.P. 1998. *Imposing Wilderness: Struggles over Livelihood and Nature Preservation in Africa*. Berkeley: University of California Press.
- Norton-Griffiths, M. 2007. How many wildebeest do you need? *World Economics* 8: 41-64.

- Norton-Griffiths, M. 1995. Economic incentives to develop the rangelands of the Serengeti: implications for wildlife conservation. In A.R.E. Sinclair and P. Arcese (eds.), *Serengeti II: Dynamics, Management, and Conservation of an Ecosystem*. Chicago: University of Chicago Press, pp. 588-604.
- Ole Parkipuny, M. S. 1979. Some Crucial Aspects of the Maasai Predicament. In A. Coulson (ed.), *African Socialism in Practice: The Tanzanian Experience*. A. Coulson ed. Nottingham: Spokesman, pp. 139-160.
- O'Malley, M.E. 2000. *Cattle and Cultivation: Changing Land Use and Labor Patterns in Pastoral Maasai Livelihoods, Loliondo Division, Ngorongoro District, Tanzania*. PhD Thesis, University of Colorado, Colorado.
- Ostrom, E. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge: Cambridge University Press.
- Ostrom, E. and H. Nagendra. 2006. Insights on linking forests, trees, and people from the air, on the ground, and in the laboratory. *PNAS* 103: 19224-19231.
- Otto, J., B. Kamara, and T.A. Lissu. 1998. *Closing Corridors: Impact of Policy, Practices and Privatisation on Wildlife Movements in the Tarangire-Manyara Area*. Final Report to EPIQ Tanzania, Dar es Salaam.
- Pratt, D.J. and M.D. Gwynne. 1977. *Rangeland Management and Ecology in East Africa*. London: Hodder and Stoughton.
- Prins, H.H.T. 1987. Nature conservation as an integral part of optimal land use in East Africa: the case of the Masai Ecosystem of northern Tanzania. *Biological Conservation* 40: 141-161.
- Runyoro, V.A., H. Hofer, E.B. Chausi, and P.D. Moehlman. 1995. Long-term trends in the herbivore populations of the Ngorongoro Crater, Tanzania. In A.R.E. Sinclair and P. Arcese (eds.), *Serengeti II: Dynamics, Management, and Conservation of an Ecosystem*. Chicago: University of Chicago Press, pp. 146-168.
- Sachedina, H. 2008. *Wildlife is Our Oil: Conservation, Livelihoods and NGOs in the Tarangire Ecosystem, Tanzania*. PhD thesis, University of Oxford, UK.
- Scoones, I. 1995. *Living with Uncertainty: New Directions in Pastoral Development in Africa*. London: Intermediate Technology Publications.
- Shivji, I.G. and W.B.Kapinga. 1998. *Maasai Rights in Ngorongoro, Tanzania*. London: IIED/HAKIARDHI.

- Sinclair, A.R.E. and P. Arcese. *Serengeti II: Dynamics, Management, and Conservation of an Ecosystem*. Chicago: University of Chicago Press.
- TANAPA (Tanzania National Parks). 2007. *Annual Report and Financial Statements 2006/07*. Arusha: TANAPA.
- TCP. (Tarangire Conservation Project). 1997. *Analysis of Migratory Movements of Large Mammals and Their Interaction with Human Activities in the Tarangire Area in Tanzania as a Contribution to a Conservation and Sustainable Development Strategy*. Final Report: Explanatory Section, Arusha.
- TNRF (Tanzania Natural Resource Forum). 2008. *Wildlife for all Tanzanians: Stopping the Loss, Nurturing the Resource and Widening the Benefits. An Information Pack and Policy Recommendations*. TNRF: Arusha.
- Thirgood, S., A. Mosser, M. Borner, S. Tham, G. Hopcraft, T. Mlengeya, M. Kilewo, E. Mwangomo, J. Fryxell, and A.R.E. Sinclair. 2004. Can parks protect migratory ungulates? The case of the Serengeti wildebeest. *Animal Conservation* 7: 113-120.
- Vesey-Fitzgerland, D.F. 1960. Grazing succession among East African game animals. *Journal of Mammalogy* 41: 161-172.
- Western, D. 1989. Conservation without parks: Wildlife in the rural landscape. In D. Western and M. Pearl (eds.), *Conservation for the Twenty-first Century*. Oxford: Oxford University Press, pp. 158-165.
- Western, D. 1982. Amboseli National Park: Enlisting landowners to conserve migratory wildlife. *Ambio* 11(5): 302-308.
- Western, D. and H. Gichohi. 1994. Segregation effects and the impoverishment of savannah parks: the case for ecosystem viability analysis. *African Journal of Ecology* 31: 269-281.
- Western, D., Russell, S. and Mutu, K. 2006. The Status of Wildlife in Kenya's Protected and Non-protected Areas. A paper commissioned by the Kenya Wildlife Policy review team, presented to the first stakeholders symposium of the wildlife policy and legislative review, September 27-28, 2006.
- Woodroffe, R. J. Ginsberg, and D. Macdonald. 1997. *The African Wild Dog: Status Survey and Conservation Action Plan*. Gland: IUCN Species Survival Commission.