TOWARD EFFECTIVE PARTIALLY PROTECTED AREAS IN TANZANIA: A REVIEW ON EXPERIENCES FROM UGALLA ECOSYSTEM

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ABSTRACT

Tanzania is understandably concerned about the deterioration of its partially protected areas (PPAs, e.g. game controlled and open areas) due to unauthorised resource use activities. Its 2007 wildlife policy recognises that PPAs are managed as buffer zones so they provide a cushion against land use impacts on core protected areas, and support local livelihoods. Ensuring effective protection of PPAs is especially timely given the fact that Tanzania's human population is now large and growing rapidly, with rising demand for natural resources, and that protected areas are becoming increasingly isolated. This paper draws insight from research activities in Ugalla ecosystem, western Tanzania, to draw attention to the threats facing PPAs in the country, and discuss strategies for addressing them. Ugalla ecosystem consists of Ugalla Game Reserve and the surrounding vast PPAs that experience logging, poaching, forest invasions, and pressure from other livelihood activities. Consequently, wildlife populations are contracting and habitats are quickly disappearing. Law enforcement, participatory conservation and improving household livelihoods are key to effective deterrence of unauthorised activities; increasing access to family planning services would enable people to better manage the size of their families, and thus ease pressure on resources due to the growth of local populations; community outreach and engagement would help win local support for conservation; effective wildlife management areas would benefit both local community and conservation; monitoring is critical to informing conservation actions; introducing some strict protectionism would slow persistent offtake. Lastly, local conservation authorities should be supported to address the underlying causes of conservation problems in the PPAs.

INTRODUCTION

As Africa's population rises alongside the need to improve living standards, exploitation of natural resources appears to be a problem of incomparable magnitude (Caro and Scholte 2007, Newmark 2008). Human-induced pressures on natural resources in the continent have attracted a great deal of attention from researchers and conservation practitioners (e.g. West et al. 2006, Milner-Gulland and Rowcliffe 2007). Conservation-related illegal behaviours such as poaching, logging, fishing, illegal settlements and agricultural encroachment into areas of conservation importance are posing overwhelming pressures on remaining natural resources (Taylor and Dunstone 1996, Tranquilli et al. 2014). Protected areas are increasingly becoming islands in seas of anthropogenic land use, and animal populations are vulnerable to extinctions (Newmark 2008). Buffer zones are often recommended to reinforce protected areas to address conservation

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problems and ensure the survival of wildlife, as they offer opportunities to strike a balance between conservation goals and livelihood needs (Bennett 2003).

Buffer zones are defined in various ways, including the following: "zones peripheral to national parks or equivalent reserves where restrictions are placed upon resource use or special development measures are undertaken to enhance the conservation value of the area" (Sayer 1991 pg 2) and "areas adjacent to protected areas on which land use is partially restricted to give an added layer of protection to the protected area itself while providing valued benefits to neighbouring rural communities" (Mackinnon et al. 1986 pg 90). Here therefore, buffer zones are a conservation strategy aimed at promoting sustainable use of unprotected or partially protected conservation-worthy areas around core protected areas like game reserves and national parks. Common types of buffer zone include forest buffers (forests outside protected areas, on public lands, which can be sustainably used by local people as a source of forest-based resources), economic buffers (controlled use of natural resources within or outside protected areas for local social and economic benefits), and physical buffers (where protected area boundaries are built to discourage the outward movement of animals and deter unauthorised entry into protected areas; Mackinnon et al. 1986).

Buffer zones can be critically important in managing areas of matrix between protected areas (Dudley 2008) as protected areas alone cannot effectively achieve the conservation of biological diversity (Borgerhoff Mulder et al. 2007). Buffer zones around sensitive habitats along wildlife corridors can promote movements of wildlife and increase connectivity between core protected areas (Bennett 2003), benefiting wide-ranging species, such as wild dogs *Lycaon pictus*

(van der Meer et al. 2014) and jaguar *Panthera onca* (Morato et al. 2014).

In Tanzania, both the 2007 Wildlife Policy and the Wildlife Conservation Act 2009 implicitly acknowledge the importance of partially protected areas (PPAs) (IUCN categories IV & V) that are near or immediately adjacent to core protected areas and act as buffer zones (MNRT 2007, URT 2009). Official designations of Tanzanian PPAs include open areas, game controlled areas and wildlife management areas (WMAs). The first two of these designations are state-owned, where subsistence and other forms of consumptive use are sanctioned under the supervision of local government. WMAs are a relatively new conservation category in Tanzania created to enhance community-based wildlife conservation, where the management and use of natural resources is primarily administered by local communities. The Tanzania Wildlife Management Authority (TAWA) is promoting the maintenance of PPAs to improve Tanzania's protected area network and secure wildlife and habitats outside protected areas, while meeting the needs of natural-resource dependent communities near these areas (URT 2009).

All PPAs in the country face a number of challenges, as acknowledged in section 3.2.1 of the 2007 Wildlife Policy that "besides illegal taking of wildlife" PPAs are "facing exerted pressures for settlement, agriculture, grazing, mining and logging; compounded by human population increase and over-exploitation of resources. These have resulted to loss of wildlife habitat and wetlands degradation, which threaten viability of the wildlife protected area network" (MNRT 2007 pg 22). Recent research suggests that the country's top conservation priority at present should be conserving natural resources beyond protected areas (in PPAs) to provide safe

passages for wildlife and guarantee genetic connectivity between protected core populations (Caro and Davenport 2015, Riggio and Caro 2017). The Ugalla ecosystem (hereafter Ugalla) has been identified as potentially crucial in connecting isolated mammal populations within Tanzania but currently under pressure from anthropogenic threats (Riggio and Caro 2017). Therefore, this manuscript uses Ugalla as a case study to draw attention to the nature of threats and what can be done to improve conservation efforts under current land use pressures. It draws insight from the author's 10 years (2006 - 2016) experience as a researcher and 2 years (2004 - 2005) as a game officer in the area, as well wider conservation literature, to present key threats to the PPAs and discuss strategies for addressing them.

STUDY AREA
The two ecosystems in western Tanzania, Katavi-Rukwa (Katavi National Park, Rukwa and Lukwati Game Reserves, and the adjoining PPAs) and Ugalla (Ugalla Game Reserve [UGR], and the adjoining PPAs) (Fig. 1), are widely separated by a matrix of human settlements and other unsustainable land use activities. The Katavi-Rukwa ecosystem enjoys stricter protection because of Katavi National Park, in which any form of consumptive use of natural resources is prohibited (Borgerhoff Mulder et al. 2007). Ugalla, on the other hand, does not contain a national park, and thus suffers from persistent consumptive use. The only core protected area in Ugalla is UGR.
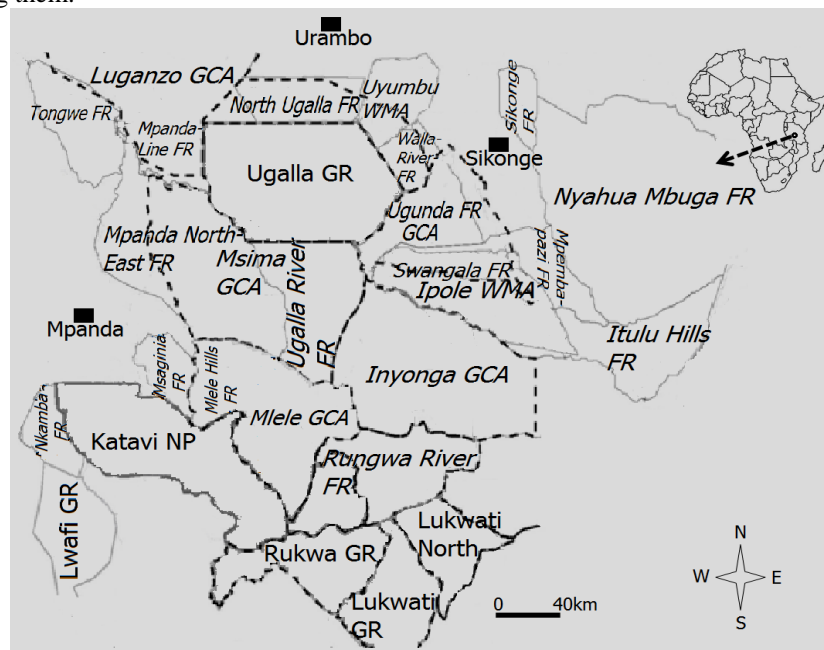
Figure 1: Partially protected areas (forest reserve [FR], game controlled area [GCA] and wildlife management area [WMA]) around game reserves (Ugalla GR, Lwafi GR, Rukwa GR and Lukwati GR) and Katavi National Park (Katavi NP) in the Ugalla and Katavi-Rukwa ecosystems of western Tanzania. Inset shows approximate location of the ecosystems in Tanzania. Filled rectangles show approximate locations of the districts around Ugalla.

UGR (5°31$^'$ to 6°03$^'$S, 31°26$^'$ to 32°23$^'$E) covers approximately 5000 km², with an altitude ranging from 1100 - 1300m above sea level. The climate is defined by a distinct wet season from January to June, and a dry season from July to December. Rainfall varies between 700 - 1000 mm per year, and the mean maximum and minimum temperatures are between 28 - 30°C and 15 - 21°C respectively (UGR 2006, Hazelhurst and Milner 2007). The dominant vegetation in UGR is miombo woodland characterised by valuable tree species from two genera in the subfamily Caesalpinioideae; *Brachystegia* and *Julbernardia* (UGR 2006). A wide range of wildlife species are found in UGR, including large mammals such as African elephant *Loxodonta Africana*; medium and small-sized antelopes like impala *Aepyceros melampus* and dik-dik *Madoqua kirkii*, and the endangered African wild dog *Lycaon pictus* (Wilfred and MacColl 2016). Ugalla is a vital part of the Malagarasi-Muyovosi Ramsar Site–a wetland of international importance (Kalumanga 2015). The wetland provides essential habitats for the endangered shoebill *Balaeniceps rex* and wattled crane *Bugeranus carunculatus* (John et al. 2013). Other habitat types in the area include the floodplains and relatively flat, grassy plains, and riverine forests (UGR 2006).

As in many other rural areas in Tanzania, the livelihoods of the local people around Ugalla rely fundamentally on a mixture of activities, such as keeping livestock, crop farming, fishing, hunting, beekeeping, and the harvesting of forest products (Wilfred 2012*a*). Rain-fed agriculture plays a central role in people's livelihoods, but the soil is not rich enough to consistently support subsistence farming (Hazelhurst and Milner 2007). Popular crops grown in the area include maize, cassava, sweet potatoes, rice, groundnuts, tobacco, and sunflower (Kikoti

2009). Trophy hunting is the principal legal form of wildlife use in Ugalla. To help win local support for conservation efforts, the government allows local communities, by permit, to carry out fishing and beekeeping activities across the entire landscape and subsistence hunting inside the PPAs (UGR 2006, Wilfred 2012*a*). Other permitted resource uses in the PPAs are controlled extraction of fuel wood and building poles (Wilfred 2012*a*). The two WMAs, Uyumbu and Ipole (Fig. 1) were created to provide a venue for and empower local communities to administer the management and utilisation of natural resources on village lands near UGR (Nelson 2007). However, the degradation of natural resources continues.

HISTORICAL BACKGROUND TO CONSERVATION IN UGALLA

Exploring the history of conservation and evolution of protected areas is crucial if we are to understand relationships between people and conservation, and improve conservation strategies (e.g. Chatty and Colchester 2002). This history usually revolves around local communities' connections to and the pressures exerted on natural resources (Prins et al. 2000). Each country in Africa has its own conservation history that has shaped people's interaction with natural resources across its different ecosystems (Chatty and Colchester 2002). Like most other countries in Africa, the evolution of contemporary strategies for nature conservation in Tanzania started with conflicts over access to, use and control of natural resources between colonial governments and indigenous African societies (Neumann 1998). The conservation of natural resources in Ugalla followed suit, and can be traced as far back as the 1900s. It owes its evolution to forced displacement and resettlement during the colonial era (Fisher 2002). In the mid 1920s the British colonial government forcibly resettled local

people in the area as a direct response to an outbreak of sleeping sickness because the area was heavily infested with tsetse flies (Thomas 1961, Fisher 2002). The disease continued to be the predominant reason for evacuations from forested areas until the 1930s.

Following the London Convention of 1933 ("the Convention Relative to the Preservation of Fauna and Flora in the Natural State"), the Tanganyika (now Tanzania) game preservation ordinance, which had been established in 1921, was replaced by the Game Ordinance of 1940 (Neumann 1998). This introduced significant reforms in the conservation of natural resources across the country including the creation of a new category of protected areas, namely the national park. The ordinance recognised game reserves, national parks and controlled customary use of natural resources (Neumann 1998). As part of these reforms, forested areas in western Tanzania, from which people had been removed due to the sleeping sickness epidemic, were protected in the 1950s as forest reserves and game controlled areas, with stricter restrictions on indigenous livelihood activities such as hunting, settlement and agriculture (Fisher 2002). The Ugalla River Game Controlled Area (deriving its name from the Ugalla River) was created in 1954 through Government Notice No. 83. The area (now UGR) was created to protect numerous concentrations of large game like greater kudu *Tragelaphus strepsiceros* and sable antelope *Hippotragus niger*, and provide a breeding sanctuary for animals inhabiting the woodlands (Thomas 1961, Fisher 2002). Three major types of land use were sanctioned in the controlled area; trophy hunting by foreigners and limited beekeeping and fishing by locals.

Due to their traditional dependence on natural resources for fishing, honey collecting, subsistence hunting, agriculture and settlement, people who had been displaced from Ugalla held a strong desire throughout the 1940s, 50s and 60s to return to their previous areas of settlement (Smith 1960, Roberts 1968). In the 1960s, tensions escalated between African members of the local government (who supported people's efforts to return to the area) and the Game Department, which was dominated by Europeans. Unauthorised use of natural resources increased because of the limited livelihood opportunities resulting from the restrictive land use policies (Fisher 2002). The situation was further worsened in 1965 when the status of Ugalla River Game Controlled Area was elevated to a game reserve (Government Notice 281 & 282, June 1965). Permanent settlements were forbidden, with fishing and beekeeping also deemed undesirable activities within the reserve. But, two years later, in 1967, these two activities were allowed to continue under government control (Fisher 2002). The forests around UGR were partially protected in the subsequent years to integrate the reserve and people, but resource exploitation in these areas cannot be overstated (UGR 2006).

UNAUTHORISED USE OF NATURAL RESOURCES

Ugalla is currently characterised by a number of different forms of unauthorised use of natural resources. Extensive subsistence agriculture and illegal settlements are common in the PPAs (Wilfred 2012*a*). As the miombo woodlands of Ugalla are characterised by poor soil fertility, villagers and outsiders encroach new areas within the PPAs in the search for fertile agricultural land (Hazelhurst and Milner 2007, Wilfred 2012*a*). Salerno et al. (2014) argued that pressure on forests in western Tanzania is chiefly caused by the search for suitable agricultural land by farmers and pastoralists. Local and migrant

farmers and livestock keepers establish temporary settlements in forested areas, which involves clear-cutting large tracts of forest to create open spaces for agricultural activities. The government through the Ministry of Natural Resources and Tourism has been working hard to discourage such activities, especially by removing migrants from the PPAs. However, the success of such measures depends on the support of local authorities (*see* Kajembe et al. 2004, Hausser et al. 2009) and it is not uncommon for local leaders and villagers to put their interests first with little regard for conservation needs. For example, in some cases local communities have requested amendment of the UGR boundary to give them additional agricultural land. One such amendment occurred in 1991/1992, where about 150 km² of the reserve was lost (WD 1998). The northern, north-western and north-eastern parts of the reserve have all been affected by relatively high numbers of agro-pastoralists, especially around Luganzo Game Controlled Area, and North Ugalla and Walla River Forest Reserves (WD 1998, Fig. 1). Activities that undermine conservation efforts are common elsewhere in the East African region, for example, in the Serengeti the plan to build "a two-lane road through 50 km of the Serengeti National Park" was propelled by a strong political motivation (Dobson et al. 2010). The Maasai Mara ecosystem in south-western Kenya experiences habitat degradation due to illegal settlements and unsustainable agricultural activities (Mundia and Murayama 2009).

Poaching and illegal logging put additional pressure on wildlife and habitat within the PPAs. The increasing demand for bushmeat and timber tends to push more people into these activities (Wilfred 2012*a*, Wilfred et al. 2017). Locally made guns (muzzle loaders) and modern/automatic guns are the most commonly used hunting gear.

According to the UGR management team, hunters use firearms to target medium- to large-bodied animals like impala *Aepyceros melampus*, Giraffe *Giraffa camelopardalis*, African elephant, and hippopotamus *Hippopotamus amphibious*. Such species are targeted for both meat and commercial purposes (F. Mwombeki, pers. comm.). Bushmeat is traded locally, with most consumers coming from villages and district town centres (Wilfred 2012*a*). Caro and Martin (2009) noted the presence of bushmeat trade chains in Tanzania that involve poachers, middlemen and consumers. Unfortunately, unlike in West and Central Africa where bushmeat is traded openly (Bakkegaard et al. 2016, McNamara et al. 2016), it is difficult to fully understand or control the bushmeat trade in the country due to its cryptic nature (Caro and Martin 2009).

AUTHORISED USE OF NATURAL RESOURCES

Legal resource use activities in Ugalla are trophy hunting, subsistence fishing and beekeeping (conducted in UGR and the PPAs), and subsistence hunting (in the PPAs). Authorised resource use activities in UGR and the PPAs are administered by TAWA and district governments, respectively. Subsistence activities are aimed at furnishing local people with alternative sources of protein or income to encourage them to appreciate and support conservation efforts. UGR is one of the few protected areas in Tanzania where the surrounding local communities are still allowed, through permit, to carry out selected subsistence resource use activities. Hunting quotas, days, and other regulations for all types of legal hunting are administered and enforced by TAWA through local authorities. However, in the PPAs, there is no sound control to ensure that allocated days and quotas are not exceeded, that hunting takes place in areas

specified in permits, that only specified species are targeted, or that a number of other related requirements set out in the Wildlife Conservation Act 2009 are adhered to (P.W., unpublished data).

MOTIVATIONS FOR RESOURCE USE

Each of the common types of unauthorised use of natural resources is influenced by an array of factors. Poaching is partly influenced by proximity to the PPAs (Wilfred and MacColl 2015). Mgawe et al. (2012) reported a similar observation in the Katavi-Rukwa ecosystem of western Tanzania. It is not surprising that bushmeat hunters consider distance in their activities to ensure effective use of their time, transport, hunting gear and other resources (Coad 2007). Poverty and food insecurity are also prominent factors driving poaching in Ugalla, in particular because many local people are unable to meet the requirements for legal subsistence hunting, such as payment of the prescribed hunting fees. Negative relationships have been found between agricultural yields and wildlife poaching in the area (Wilfred and MacColl 2010). Poverty and food insecurity have been reported to influence bushmeat hunting elsewhere in Tanzania, such as the Katavi-Rukwa ecosystem (Borgerhoff Mulder et al. 2007), and the Serengeti (Knapp 2012).

Illegal logging is driven by three factors (Wilfred and MacColl 2014*a*): first, the increase in living standards that has caused a huge number of local people to carry out logging activities in collaboration with commercial loggers from Tabora as well as some other major cities like Dar es Salaam and Mwanza. Of the timber tree species found in Ugalla, *Pterocarpus angolensis* DC ('Mninga') is especially favoured by loggers for its hard wood and high market price. Second, the rising demand for wood products locally and elsewhere in the country impacts upon miombo in western

Tanzania (*see also* Borgerhoff Mulder et al. 2007). And third, the use of sophisticated logging equipment such as chainsaws makes it easier for loggers to cut as much wood as possible in a short period of time.

Unauthorised behaviours in authorised activities are exacerbated by conservation authorities' lack of integrity, which potentiates abuse of power and corruption (Wilfred 2012*a*). For example, in all types of legal hunting, irresponsible game officers and rangers may turn a blind eye to inappropriate behaviours by hunters like hunting in areas not authorised by the hunting licence, exceeding hunting quotas, and shooting animals not specified in the licence. Inadequate skilled human and financial resources promote corrupt practices and bribery in legal hunting. For example, fewer available game rangers to supervise subsistence hunting in the PPAs has led to increased dependency on village game scouts–volunteers from villages near WMAs who are informally trained and involved in conservation-related activities in these areas on an irregular basis but rarely get paid for their service. This presents an incentive for hunters to bribe them so they overlook violations of the hunting laws (P.W., unpublished data).

Conservation conflicts related to natural resources and land use play a significant role in promoting unauthorised use of natural resources in Ugalla (Wilfred et al. 2017). Local communities perceive Ugalla as being protected for trophy hunting by foreigners. They feel isolated, and blame conservation authorities for wrongful arrest, beatings and other verbal or physical harassment by game rangers during anti-poaching operations. Poor communication skills and a lack of respect for villages on the part of authorities act as barriers to effective participatory conservation. Disputes between the authorities and people over the PPAs and

UGR boundaries are common, as the people feel they do not benefit from natural resources and conservation practices. The perception that natural resources are no longer a reliable livelihood option for local people, and thus cannot compete with other forms of land use like agriculture, has resulted in reduced local support for conservation. Generally, these negative attitudes have been a motivation for poaching and illegal logging (P.W., unpublished data). Conservationists realise that no single natural ecosystem is free from conservation conflicts that affect people's livelihoods and undermine conservation efforts (Redpath et al. 2013). Such conflicts in Africa emerge from three sources: human-wildlife conflicts, where there is direct interaction between people and wildlife that can negatively affect both or either of the two parties–for example, livestock depredation (Mwakatobe et al. 2013) and crop raiding (Sitati et al. 2005); exclusion, when local people are denied access to natural resources and their interests are excluded from conservation strategies; and top down conservation approaches, where local knowledge, views and perspectives are not integrated into conservation efforts.
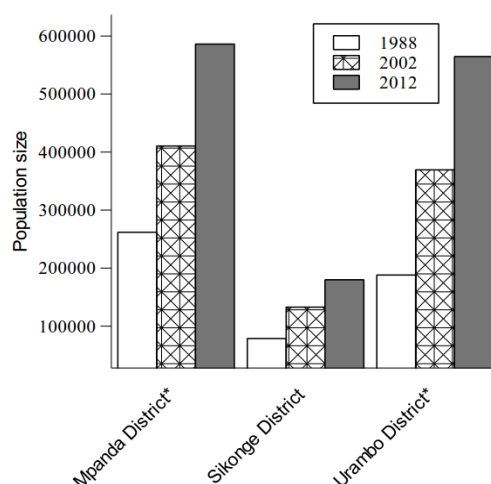
Figure 2: Human population size in administrative districts surrounding Ugalla ecosystem in western Tanzania (adapted from NBS 2006, 2013). *Includes data from newly formed districts within the same area to ensure consistency in geographical coverage.

The rapidly increasing human population intensifies unauthorised use of natural resources, and the need for more land for agricultural activities and settlements. Fig. 2 presents changes in the population size of Ugalla across different censuses from 1988 to 2012 using data from the districts (Mpanda, Sikonge, Urambo) encompassing the ecosystem (NBS 2006, 2013). High birth rate in western Tanzania may be one of the factors contributing to this increase (*see* NBS 2013). A household survey conducted in 2016 (Wilfred et al. 2017) suggests that high fertility rate represents a great concern for conservation in the area, as the bulk of the sampled population falls into the 1-to-20-year-age brackets (Fig. 3). The average household size, 7.1 individuals per household, is significantly higher than the national average of 4.8. The survey findings further suggest that unemployment is a growing concern, whilst other income

generating opportunities are limited. In terrestrial ecosystems, population growth threatens protected area edges mainly through the use of natural resources and

habitat conversion (Linkie et al. 2003, Wittemyer et al. 2008).
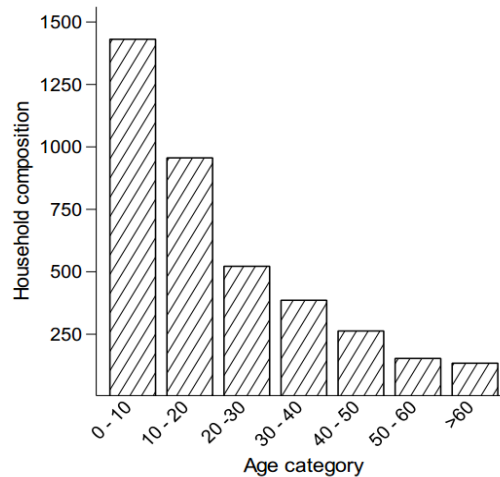
Figure 3: Household composition by age including members of the household during all or part of the past 12 months before the survey conducted from December 2015 to April 2016 in Ugalla, western Tanzania (adapted from Wilfred et al. 2017). Non-parametric Kruskal-Wallis one-way ANOVA was conducted to compare age groups. There was a significant difference in household composition between the age categories (Kruskal-Wallis test: $\chi^2 = 1127.8$, d.f. = 6, p<0.001).

IMPACTS OF RESOURCE USE

Different types of resource use in western Tanzania's conservation areas have impacts on wildlife and habitat (e.g. Caro 2008). For instance, the long-term wildlife population and habitat monitoring in the Katavi-Rukwa ecosystem indicates that wildlife populations are in decline as a result of poaching and legal hunting (Caro 2008, Waltert et al. 200, Caro 2011). Poaching is proven to present the leading cause of wildlife declines in western Tanzania (Caro 2008, Waltert et al. 2009). A comparison of animal densities between Katavi and Ugalla revealed substantially lower density estimates in the latter as a consequence of unsustainable consumptive use of wildlife (Wilfred and MacColl 2016, Wilfred et al. 2017).

Habitat loss is another major concern in Ugalla, particularly in the PPAs. An attempt was made to estimate levels of unauthorised activities performed by the communities around Ugalla. The most prevalent activity was logging, followed by poaching and bushmeat consumption (Wilfred et al. 2017). Logging has accelerated loss of wildlife habitats in the PPAs (UGR 2006, Hazelhurst and Milner 2007, Wilfred 2012a). Other accompanying activities which aid the execution of logging are equally destructive. Logging is done by larger groups of loggers as lumber is produced by pitsawing which involves activities like digging pits, setting up logs for sawing, and collecting logs and sawn timber by bicycles and trucks. In so doing, soils and vegetation are trampled by multitudes of foot and bicycle paths (Wilfred

2012*a*). The current magnitude of the impacts of livestock grazing by nomadic herders, extensive farming, and settlements have not yet been evaluated, but previous reports suggest that these have led to a severe decline of wildlife habitats (Hazelhurst and Milner 2007). Elsewhere, conservation biologists argue that anthropogenic factors like prolonged grazing, informal settlements, and farming undermine ecological integrity and cause loss of biodiversity in forest ecosystems (Benitez et al. 2012, Pour et al. 2012).

The sustainability of permitted use of natural resources inside the PPAs is questionable. For example, the trend of legal subsistence hunting indicates that hunters can hardly realise their quotas as the forests are degraded and increasingly empty of the targeted game species (Wilfred and MacColl 2014*b*, P.W., unpublished data). The hunting success rates (individuals shot per quota per hunter) decreased consistently between 2004 and 2015 (P.W., unpublished data). As regards trophy hunting activities, a study of the trends and variations of trophy sizes of wildlife removed suggests that trophy sizes are close to the Safari Club International's minimum standard (Wilfred 2012*b*, Table 1). This means that sustained trophy hunting removes relatively young individuals, which in turn could lead to a severe wildlife loss. Although trophy hunting earns Tanzania a significant share of foreign income (Caro et al. 1998, Baldus 2008), there has been a lot of debate over its sustainability (e.g. Weber 2000, Coltman et al. 2003, Lindsey et al. 2007). Arguments revolve around the fact that quotas are not decided based on reliable information about species-specific density and other population parameters (Lindsey et al. 2007), and that the selective nature of trophy hunting affects demographics, genetics and social structure of the hunted species (Milner et al. 2006).

Table 1: Trophy size measurements (inches) for selected wildlife species hunted in Ugalla in the period from 2006 to 2010. Species arranged in order of decreasing offtake (adapted from Wilfred 2012b).

Species	Offtake	Standard[a] trophy size	Mean trophy size	Measurement
Topi (*Damaliscus korrigum*)	53	16	16.17	Horn length
African buffalo (*Syncerus caffer*)	50	42	38.97	Horn length (tip-tip)
Impala (*Aepyceros melampus*)	37	26.4	22.84	Horn length
Common warthog (*Phacochoerus africanus*)	35	13	11.08	Tusk length
Hartebeest (*Alcelaphus buselaphus*)	34	18.5	18.63	Horn length
Nile crocodile (*Crocodylus niloticus*)	24	14	14.68	Body length
Greater kudu (*Tragelaphus strepsiceros*)	7	52	51.2	Horn length

[a]Minimum standard trophy size measurements set by Safari Club International.
There was no significant difference between standard trophy size and mean trophy size of the removed species (t-test: t = 0.14825, df = 11.985, p = 0.8846).

CONSERVATION RESPONSES

Effective community-focussed conservation interventions can help tackle conservation challenges (Travers et al. 2017). The conservation literature has recommended a number of such interventions (which normally vary from ecosystem to ecosystem), including alternative sources of illegally harvested resources, wildlife-friendly enterprises, conservation outreach, conservation education, resolution of human-wildlife conflicts, controlled subsistence resource use, participatory conservation schemes, and law enforcement (Borgerhoff Mulder et al. 2007, Caro and Davenport 2015, Harrison et al. 2015, Travers et al. 2017). The last three are practiced in Ugalla, but law enforcement is the most common intervention option there. In general, like other ecosystems in Africa, the survival of the PPAs will ultimately depend on efficient and sustainable interventions, so Table 2 contains proposed recommendations to promote their management based on the author's experience and long-term research of conservation efforts in Ugalla:

Table 2: Proposed long- and short-term approaches to partially protected areas management in Ugalla ecosystem, western Tanzania, listed in descending order of importance based on the author's experience.

Approach	Timeframe
Law enforcement	Short-term
Wildlife management areas	Long-term
Family planning	Long-term
Strict protectionism	Short-term
Monitoring	Long-term
Community outreach	Short-term
Intensive agriculture	Long-term
Alternative livelihoods	Long-term

Law enforcement

Law enforcement in the PPAs is characterised by fewer armed patrols than in UGR, and there are usually around 10 patrol days in a month (game ranger, Zonal Anti-poaching Unit, western Tanzania, pers. comm.). The TAWA's Zonal Anti-poaching Unit in western Tanzania patrols the PPAs. The anti-poaching unit currently has 42 rangers who are supposed to cover an area of $> 5000 \text{ km}^2$, which means it is overstretched. In addition, local communities hold negative attitudes toward the game rangers' patrol activities (Wilfred et al. 2017). Anti-poaching efforts in PPAs in which trophy hunting is conducted are enormously dependent on trophy hunting companies, as government resources are inadequate. Hunting companies concentrate their patrols on hunting sites, which means that their contribution to anti-poaching stops whenever they leave these sites because their licences are terminated or expired, or sites no longer have game animals. Additionally, some hunting companies do not place a strong emphasis on patrolling their hunting blocks. This has been experienced in most of the PPAs lying to the south and east of UGR, which suffer high levels of poaching in part because of poor law enforcement at trophy hunting sites (P.W., unpublished data).

For a more effective and sustainable law enforcement, anti-poaching should actively involve local communities as in some other African countries. For example, the Communal Areas Management Programme for Indigenous Resources program (CAMPFIRE) of Zimbabwe managed to reduce illegal killings of wildlife because local communities supported anti-poaching activities (Child 1996). Child and Child (2015) highlighted the importance of the Zimbabwe's Intensive Conservation Area movement (ICA) in controlling the exploitation of natural resources through community engagement. Namibia's Communal Conservancies are another example that have successfully engaged local community members who work with law enforcement officers as local informants and community rangers (Wilkie et al. 2016).

Studies argue that law enforcement is useful but not a panacea for controlling poaching (e.g. Challender and MacMillan 2014, Travers et al. 2017). The initiative is closely related to the American Yellowstone model known as 'fortress conservation' or 'fences and fines' conservation approach (Norgrove and Hulme 2006) that excludes the interests of people near conservation areas (Pimbert and Pretty 1995). Therefore, it cannot offer a long-term solution to reducing poaching unless local communities are placed at the centre of the process and other underlying drivers of the problem (such as poverty and food insecurity) are understood and dealt with effectively (Challender and MacMillan 2014, Travers et al. 2017). This calls for participatory anti-poaching that goes hand in glove with other activities that can promote sustainable local livelihoods like ecotourism, income generating activities, and sharing of benefits accrued from conservation activities (e.g. Travers et al. 2017). Furthermore, it is important that all the necessary anti-poaching resources (game rangers, vehicles,

and financial resources) be made adequately available to the conservation authorities in Ugalla.

WMAs

WMAs were introduced in Tanzania to act as a platform for practicing decentralised management of natural resources on village lands, especially in areas near core protected areas (Kiwango et al. 2015, Salerno et al. 2016). It was envisaged that the scheme would effectively engage local people in wildlife conservation and enable them to realise the resulting benefits in a sustainable manner. In practice, however, WMAs have so far failed to achieve their intended goal (Bluwstein et al. 2016, Moyo et al. 2016). But, despite the challenges, there's still hope for them if they become truly community-based and their benefit sharing schemes take adequate account of people's interests (e.g. Wilfred 2010, Kiwango et al. 2015, Moyo et al. 2016). With only two (Uyumbu and Ipole WMAs), the great majority of villages in Ugalla lack WMAs. Like elsewhere in the country, even the WMA member villages realise little tangible benefits, and do not normally have decision-making powers over their WMAs or influence over resource use therein (P.W., unpublished data). People inside these villages have largely negative attitudes toward the government and foreign investors (precisely trophy hunting companies) who reap the lion's share of the benefits accrued from the WMAs. In a study conducted in 2017, participants acknowledged the importance of WMAs, if only their administrative complexities and other challenges are properly addressed (P.W., under prep.). Table 3 presents selected quotes from study participants to highlight their perspective on their experience of WMAs. Uyumbu and Ipole largely encompass open and game controlled areas. Ipole, for instance, includes a large chunk of Ugunda Game Controlled Area (Fig. 1). This offers suggestive evidence that

most of the PPAs, especially open areas, could potentially be included in the WMA scheme to protect and make them more useful to people.

Table 3: Selected quotations related to wildlife management areas, based on participants in a study conducted in Ugalla ecosystem, western Tanzania in 2017 (P.W., under prep.).

'We do not see the benefits of these investors. They trick us by constructing a few classrooms, donating a vehicle for JUHIWAI (a community-based organisation representing villages that form a wildlife management area), and offering football jerseys and balls. But these are peanuts compared with what they have harvested for the past ten years.'

'The process of establishing wildlife management areas, initiated by Africare (a local non-governmental organization)…should be revived and completed to protect Game Controlled Areas and Open Areas…'

'There is a need for expanding wildlife management area network around Ugalla…'

'There should be wildlife management areas in every District'

Family planning
If population growth is left unchecked, demand for the limited natural resources in Ugalla will continue to grow. Like other ecosystems in Tanzania, human population in Ugalla increases concomitantly with the expansion of settlements and agricultural activities. For the PPAs to sustainably accommodate livelihood needs and conservation interests, family planning campaigns are necessary to slow human population growth. Caro and Davenport (2015) argued that human population growth should be given its due importance and tackled as a matter of urgency to prevent conservation areas from becoming "isolated sanctuaries, in a sea of agricultural land with little natural cover or genetic connectivity between them". In their current state, the PPAs in Ugalla largely isolate UGR from other protected areas in western Tanzania, like Katavi NP. Ugalla conservation authorities can learn from other places; for example, the Blue Ventures programme of southwest Madagascar has effectively addressed conservation challenges related to rapid human population growth and intensified resource use by integrating family planning services into conservation interventions through an approach called Population-Health-Environment (Mohan and Shellard 2014). A better understanding of how in-migration contributes to population growth and how much is locally generated (e.g. Salerno et al. 2014) could help to inform conservation interventions like this one.

Strict protectionism
Upgrading the conservation status of UGR into a national park (non-consumptive), and then allowing controlled consumptive use in the PPAs would promote connectivity conservation in Ugalla. Game controlled areas directly connected to UGR, for example Luganzo (2,500 sq. km.) can either be annexed to the reserve or managed as separate game reserves to improve their protection. In the short term, given the current state of exploitation (legal and illegal), it would be helpful to urgently suspend all forms of hunting to allow recovery as many animal species now occur at low densities (*see* Wilfred and MacColl

2016), and design an improved and sustainable hunting scheme. The PPAs could remain accessible for controlled beekeeping and fishing still, as others are temporarily suspended.

Monitoring

Regular monitoring would keep TAWA and local conservation authorities informed of the status of natural resources and wildlife habitat, as well as enable them to identify conservation priorities and translate these into resource plans by quantifying needed inputs in terms of skilled personnel, equipment and financial resources (e.g. Borgerhoff Mulder et al. 2007). Monitoring is a key conservation tool depending on what the monitoring is for, who is doing it, and what people do with the information that they receive. It can improve management by informing the decision-making of TAWA and local game officers and enabling them to adapt to changing circumstances (e.g. more effective patrolling, or instituting effective community conservation). For example, regular studies that assess the status of wildlife populations through counting animals by driving vehicle transects (*see* Caro 2011) would inform quotas and other offtake decisions. Monitoring can change behaviour if it is done by local people (e.g. participatory monitoring) to enable them to manage their own resources without interference from outside. This approach has proved effective in the Sustainable Development Reserves of Brazil (Vieira et al. 2015). As a by product, monitoring can change behaviour of poachers just because there is a presence of outsiders in an area, which puts them off (Piel et al. 2015). Moreover, frequent socio-economic and anthropological studies would help inform the management of relations between conservation practitioners and local communities. Such studies are normally ecosystem-specific because different people respond differently to conservation

interventions. In northern Tanzania, for example, studies suggest that for conservationists to win local support, community outreach initiatives should be conditional on desired conservation outcomes (e.g. Sachedina and Nelson 2010), whereas in western Tanzania that is not necessarily the case (Borgerhoff Mulder et al. 2007). Information gathered by conservation managers, game rangers and other field officers in their day-to-day activities can be used in monitoring programs. However, these people should be trained so they can collect suitable information and make meaningful interpretation of it for conservation purposes.

Community outreach

Although community outreach can be effective in changing behaviours and attitudes toward conservation (e.g. Steinmetz et al. 2014), very little has been done in Ugalla so far. For example, the government sporadically holds awareness meetings and shows educational videos on conservation in a handful of villages around Ugalla. A 5-year community conservation project aimed, among other things, at raising conservation awareness was introduced by an NGO in 2000s, but had varied success. There is therefore a need for conservation outreach in the area. Outreach programmes have been proven useful in attracting local interest and support for conservation elsewhere in Uganda. The Uganda Wildlife Authority (UWA) conducts several activities to engage with local communities around conservation areas, including conservation awareness meetings, radio talk shows, and schools outreach (Travers et al. 2017). Such activities increase awareness of conservation, build better relations between locals and conservation authorities, help people gain a sense of connectedness to and ownership of natural resources near them,

and encourage them to share their ideas and opinions about conservation.

Intensive agriculture

The main challenge in Ugalla is to promote sustainable agriculture (Hazelhurst and Milner 2007). Intensification of agriculture is important to reduce pressure on the PPAs. Owing to the importance of agriculture in rural livelihoods in western Tanzania and the need to conserve wildlife habitats (Hazelhurst and Milner 2007, Kikoti 2009), the challenge of extensive farming must be addressed quickly. Yet there is a need for agricultural extension and advisory services to build the capacity of farmers. Wilfred (2012*a*) noted that the majority of the farmers lack the expertise to boost yield due to a lack of agricultural extension workers who could help and advise them on various technical aspects of yield maximisation. Introducing a suitable and secure land tenure system would help reduce agricultural expansion into forests. Robinson et al. (2017) argue that insecure tenure can drive forest clearing for agriculture. The same authors present a good framework for incorporating land tenure security into conservation. Land use planning to help resolve conservation conflicts by separating land uses that are incompatible with each other is also essential.

Alternative sources of livelihood

Alternatives of natural resource-based products and livelihoods have been widely discussed in the literature of conservation (e.g. Rentsch and Damon 2013, Machovina et al. 2015). For instance, fish, chicken, cattle, and other types of livestock are common substitutes for bushmeat as an animal protein source, which can reduce bushmeat demand locally (Travers et al. 2017). Rentsch and Damon (2013) noted that bushmeat consumption can be discouraged by undertaking initiatives that would make livestock-based protein sources

more affordable in comparison with bushmeat. For Ugalla, such initiatives may include measures to promote environmentally-friendly livestock production practices. For example, promoting sustainable peasant farming and cattle production (where manure produced by cattle is used to replenish soil fertility) can considerably contribute towards food security, consumption of domestic meat, and environmental management. A review by Mkhabela (2006) suggests that manure can increase and improve soil fertility. To reduce illegal logging and, indeed, other illegal activities as well, self-employment should be promoted especially among the youth through capacity building on small-scale income generating activities (Wilfred 2012*a*). Entrepreneurial activities like indigenous chicken production, fish farming, beekeeping, and other small businesses are crucial to improving locals' economic well-being. Nevertheless, any alternative livelihood initiative should be preceded by a thorough analysis of the underlying drivers of the problem, and whether people will actually change their behaviour if they are offered these alternatives (*see for example* Travers et al. 2017).

CONCLUSIONS

Tanzania is listed among African countries whose population is expected to more than double by 2050, and increase by at least five-fold by 2100 (United Nations 2015). Therefore, a serious commitment to effective conservation measures is needed to keep pace with human population growth. One effect of the rapidly growing population is to intensify land use conflicts and demand for natural resources in PPAs. Present efforts to deal with these challenges are already weighed down, and protected areas are increasingly isolated as a result of overwhelming pressures they face along their boundaries (Caro and Davenport 2015). Aware of the dangers this would pose to wildlife

populations in the country, the Tanzania Wildlife Research Institute (TAWIRI) and researchers have started to identify and document wildlife corridors and their conservation needs (Jones et al. 2009, Jones et al. 2012, Riggio and Caro 2017), with the aim being to meet the twin objectives of connecting protected areas and fostering sustainable use of PPAs.

Ugalla is one of the few ecosystems in the country that are potentially important in terms of connecting core populations. The reserve (UGR) is the only protected area of the highest category in the ecosystem. The PPAs cannot only act as a buffer zone around the reserve, but may also have the potential to serve as wildlife corridors, structurally connecting Ugalla with other ecosystems in western Tanzania, for example, Katavi-Rukwa and Moyowosi-Kigosi (Riggio and Caro 2017). To control the loss and degradation of natural resources in Ugalla, conservation efforts should consider conducting regular monitoring on a wide range of conservation-related topics, promoting human population control measures, attracting conservation interventions, preventing and resolving land use conflicts, addressing agricultural issues, and improving participatory conservation and livelihoods.

The intention of this manuscript has been to share experience, and inform conservation interventions outside protected areas. Its interest has been as a local illustration of the conservation issues in PPAs. The information presented is based on the author's long-term professional and research experiences with Ugalla, which ensures more realistic recommendations. Further work is needed to identify the specific issues in the PPAs and local communities in relation to the proposed conservation responses to guarantee targeted interventions. Local conservation authorities should be trained, supported and given the resources they need to address the underlying drivers of the unauthorised activities in collaboration with local communities in the PPAs.

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