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Protected Areas: Conservation Cornerstones or Paradoxes? Insights from Human-Wildlife Conflicts in Africa and Southeastern Europe

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1. Introduction

Protected areas (PAs) are considered the cornerstone of biodiversity conservation (Chape et al., 2005), and according to the International Union for Conservation of Nature (IUCN), are defined as “A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values” (Dudley, 2008). The IUCN set the first ‘target’ for protection, by agreeing at the 1992 World Parks Congress in Caracas, Venezuela, that PAs should cover a minimum of 10% of each biome by 2000. There are now over 120,000 PAs worldwide, taking into account both those classified under any of the six IUCN management categories, and those not classified, including private reserves and community-conserved areas (UNEP-WCMC, 2008). The overall trend in the total surface of PAs has been steadily upward during the last few decades in all regions of the world, but has been leveling off somewhat since 2000 (Fig. 1). Recognising the importance of PAs to global efforts to halt biodiversity loss, in late 2010 at the Convention on Biological Diversity’s 10th Conference of Parties in Japan, twenty targets were set for biodiversity conservation (‘Aichi Targets’). These include a global increase of terrestrial and inland water PAs to 17% (from 13%) by 2020, and coastal and marine PAs from 1% to 10% in the same period (Secretariat of the Convention on Biological Diversity, 2010).

Despite this growth, however, the effectiveness of PAs in conserving habitats and species cannot simply be interpreted as the result of their number and size as it also depends on their location, structure (size, shape, connectivity) and, of equal importance, their management (Cantu-Salazar & Gaston, 2010; Rodrigues et al., 2004). Traditionally, a top-down approach was employed to PA establishment and management which excluded local participation (Ervin et al., 2010; Kiss, 1990; Stevens, 1997). As a result, people whose livelihoods chiefly involve the direct exploitation of local natural resources often come into conflict with the institutions of PAs. Frequently, communities living in and around PAs have important and longstanding relationships with these areas that embrace *inter alia* cultural identity and subsistence practices essential to sustaining livelihoods, and often contribute to maintenance of biodiversity (Anthony & Bellinger, 2007). Consequently, PAs

are increasingly being recognised as 'social spaces' (Ghimire & Pimbert, 1997) and as such, cannot be decoupled from their human context in terms of management regimes (Brechin et al., 2002). Reinforcing this shift, it is now widely postulated that PAs cannot coexist in the long term with communities that are hostile to them (McNeely, 1993; Pimbert & Pretty, 1997; West & Brechin, 1991).

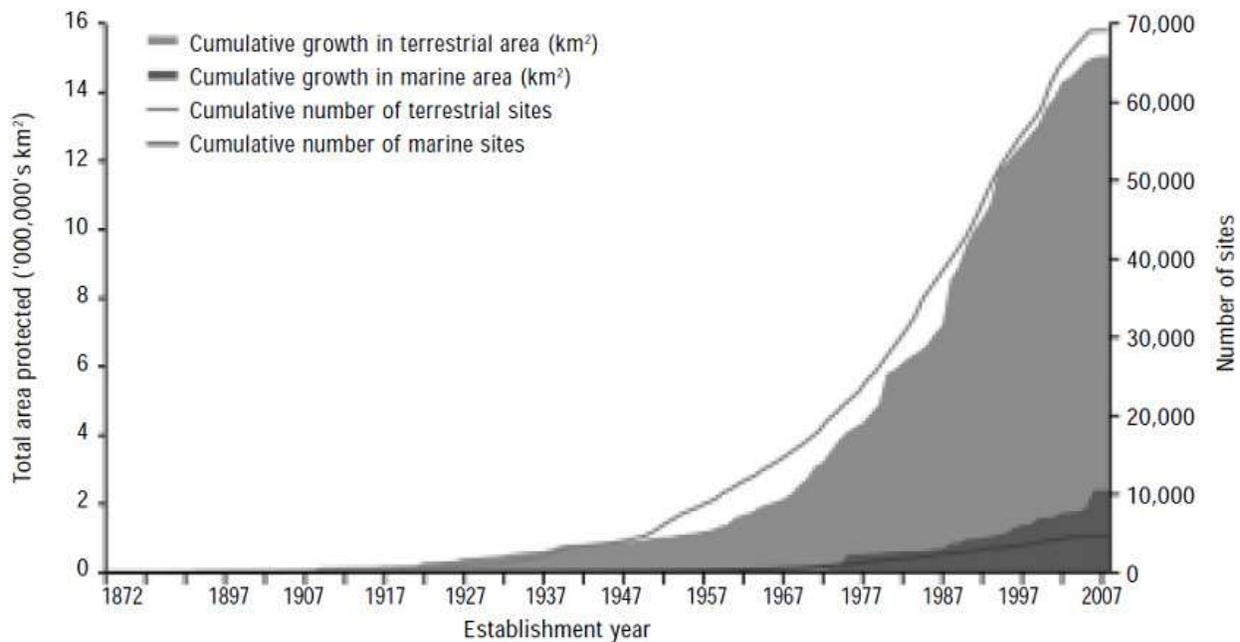


Fig. 1. Cumulative global growth in the area and number of nationally designated protected areas (1872-2007). Reproduced with permission from Coad et al. (2008)

A particular management challenge confronting PAs is human-wildlife conflict (HWC), the consequence of spatial proximity between people and their activities, and wildlife (Knight, 2000; Naughton-Treves & Treves, 2005; Treves, 2009). This poses additional challenges for biodiversity conservation as conflict tends to lead to an increase in opposition from local people and undermines political support for conservation efforts (Madden, 2004; Naughton-Treves, 1998; Newmark et al., 1994, Treves, 2009). Conflicts between humans and wildlife are the product of socio-economic and political landscapes (Graham et al., 2005) and the institutional architecture designed to manage these conflicts, and are controversial because the resources concerned have economic value and the species involved often have high profile and are legally protected (McGregor, 2005; Treves & Karanth, 2003). While humans and wildlife have a long history of co-existence, the frequency of HWC has grown in recent decades (Decker et al., 2006; Graham et al., 2005; Mishra, 1997; Wang & Macdonald 2006), mainly because of (i) extension of human presence and activities into wildlife habitat and shrinking prey populations (Linnell et al., 2001; Woodroffe, 2000; Woodroffe et al., 2005), (ii) expansion of some wildlife distributions including into the matrix surrounding PAs (Bisi & Kurki, 2005; Breitenmoser, 1998; Cozza et al., 1996; Stahl et al., 2001; Zedrosser et al., 2001), as well as (iii) a frequent inability of institutions that are meant to mediate such conflicts to respond effectively (Anthony et al., 2010; Hewitt & Messmer, 1997). Moreover, particularly in developing countries, poor and politically marginalised people frequently come into conflict with wildlife and are pitted against the state and its wildlife agencies in strongly unequal power relationships.

1.1 Definitions

To define human-wildlife conflict, Madden (2004) uses the 5th IUCN World Parks Congress recommendation which states that it 'occurs when the needs and behavior of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife.' Knight (2000) offers an anthropological perspective: 'People-wildlife conflicts are relations of rivalry or antagonism between human beings and wild animals which typically arise from territorial proximity and involve reliance on the same resources or a threat to human wellbeing or safety.' There are many variations on these definitions in the literature (Conover, 2002; Graham et al., 2005; Marshall et al., 2007; Treves, 2009) but overall they can be summed up as including 'both competition and predation' (Knight, 2000) with a bidirectional character.

The conflict between people and wildlife takes many forms: attacks on people, attacks on livestock, crop-raiding, damage to forestry, competition for forage resources and for wild prey, building infestations, traffic accidents, disease, threats to other species and biodiversity, and human-induced wildlife mortality (Conover, 2002; Knight, 2000; Kruuk, 2002; Sillero-Zubiri et al., 2007; Thirgood et al., 2005). It has two dimensions, occurring *between people and wildlife* but also *between various people* with dissimilar views about wildlife (Knight, 2000; Linnell et al., 2010; Madden, 2004; Marshall et al., 2007). This latter form of conflict stems from differences in values held by those involved (Knight, 2000; Treves, 2009) as well as from distinct perceptions that people have regarding their own and others' positions (Marshall et al., 2007).

In this chapter, HWC is understood as both a clash between people and wildlife over 'space, food and life' (Treves, 2009), in agreement with the two definitions mentioned above, and a socio-political conflict. This latter dimension of conflict cannot be omitted especially taking into account that our case studies are (in the least) nationally designated PAs. As Treves (2009) emphasised, often PAs bring out 'the fundamental dilemma posed by global and national concerns for biodiversity conservation on the one hand and individual and economic motivations to safeguard human life and livelihood on the other hand.'

1.2 Factors contributing to conflict

The growing trend towards greater spatial proximity between people and wildlife and their reliance on the same resources will likely lead to an increase in the frequency and intensity of conflict. Research has shown that different areas experience dissimilar levels of conflict with some so-called conflict 'hot spots' experiencing recurring problems (Breck, 2004). In order to develop effective strategies that will allow people and wildlife to share the landscape it is necessary to understand the complexities posed by the local situation and to tease out underlying factors that lead to negative interactions, some of which we outline below.

Attacks on humans are particularly important drivers of conflict as fear of personal injury and death builds strong antagonism toward wildlife, in particular toward elephants and large carnivores (Dublin & Hoare, 2004; Loe & Röskaft, 2004; Saberwal et al., 1994). Moreover, perceptions are crucial (Naughton-Treves & Treves, 2005; Zinn et al., 2000) and any successful solution to conflict must address them directly (Madden, 2004; Treves et al., 2006). Research and practice show that perception of potential risk and of level of control over the situation are often the most important factors driving public reactions to HWC (Johansson & Karlsson, 2011; Sillero-Zubiri & Laurenson, 2001), even though perceptions are frequently incongruent with reality (Dublin & Hoare, 2004).

Furthermore, the socio-cultural context in which the conflict is embedded is significant. Such is for example the case with wolves which traditionally have elicited a strong negative reaction from the public despite the fact that they pose little danger to people (Kellert et al., 1996). Nevertheless, more recently people's attitudes toward wolves have undergone a significant transformation under the influence of changing cultural beliefs. Kellert et al. (1996) emphasised the important place of large carnivores in North American consciousness and their roles as indicators of changing attitudes toward wildlife and nature. Moreover, cultural values also inform the approach undertaken to conserving wildlife. Clark & Slocombe (2009) show how aboriginal people's respect for grizzly bears has led to the formation in southwest Yukon (Canada) of a resource management system that could impart knowledge to new strategies for managing human-bear interactions.

Another significant factor is represented by the severity of conflict between people and wildlife. This is influenced by the spatial and social distribution of damage, as well as by the ability of individuals to cope with losses inflicted by wildlife. When risk is carried at household level, material wealth is an important determinant of who is able to cope with wildlife inflicted damage (Naughton-Treves & Treves, 2005). Local people's inadequate knowledge of the ecology and behavior of wildlife (e.g. growing crops in wildlife areas) also affects the severity of conflict and, coupled with limited coping capacity, leads to increased vulnerability to wildlife damage (Naughton-Treves & Treves, 2005).

1.3 Significance

The investigation of HWC and its influence on biodiversity conservation is important for a number of reasons. First, wildlife damage represents a very tangible threat to livelihoods in terms of personal injury, crop and livestock losses, property damage, and lost opportunity costs (Choudhury, 2004; Emerton, 2001; Happold, 1995; Hill, 2004; Graham et al., 2005; Linnell et al., 2010). Second, attitudes towards PAs are often influenced by real or perceived damage caused by wildlife (Anthony, 2007; de Boer & Baquete, 1998; Els, 1995; Hill, 2004). Third, active persecution by humans following wild predator attacks on livestock has been identified as an important factor in observed carnivore declines (Hazzah et al., 2009; Mishra, 1997; Woodroffe, 2001), and may lead to increased 'edge effects' along the peripheries of PAs (Woodroffe & Ginsberg, 1998). Finally, HWC are potentially socially corrosive, creating and reflecting larger conflicts of value and class and other interests (McGregor, 2005). Especially in less developed countries and countries in transition, such conflicts have the potential to undermine both biodiversity conservation efforts and human security, and further weaken the effectiveness and legitimacy of state institutions including national parks and other PAs (Anthony et al., 2010).

These aforementioned complexities are also juxtaposed within contextual PA management regimes. As PAs establish and implement management strategies and plans which increasingly embrace socio-economic interests, they must make difficult decisions about their objectives in terms of HWC, particularly to 'identify and explicitly acknowledge the trade-offs and hard choices that are involved in advancing conservation in specific places and through specific approaches' (McShane et al., 2011). These choices have repercussions that can last for many decades and, in some cases, can affect the suite of options available for park administrations to mitigate HWC in the future. Drawing on case studies, we outline selected factors and 'choices' contributing to HWC, to what extent relevant institutions are addressing these conflicts and what the likely outcomes are for biodiversity conservation.

Finally, we show that in order to manage HWC more effectively in such contexts, five components of the conflict must be addressed: (i) baseline research, (ii) evaluation of damage, (iii) conflict management, (iv) adaptive management, and (v) identifying and acknowledging management trade-offs.

2. Methods

Our four case studies involve PAs which are currently facing HWC challenges, and with which we have personal experience. They are located in South Africa (Kruger National Park, hereafter KNP), Malawi (Vwaza Marsh Wildlife Reserve, hereafter VMWR), and Romania (Măcin Mountains National Park, hereafter MMNP; Rodna Mountains National Park, hereafter RMNP) (Fig. 2). They differ in terms of size, date of designation, ecosystems represented, and tenure (Table 1).

In order to explore the complexity of HWC issues, including the perspectives of relevant stakeholders, multi-method approaches were utilised in each of our four cases (Table 2). For more detailed descriptions of methods used, see indicated sources.

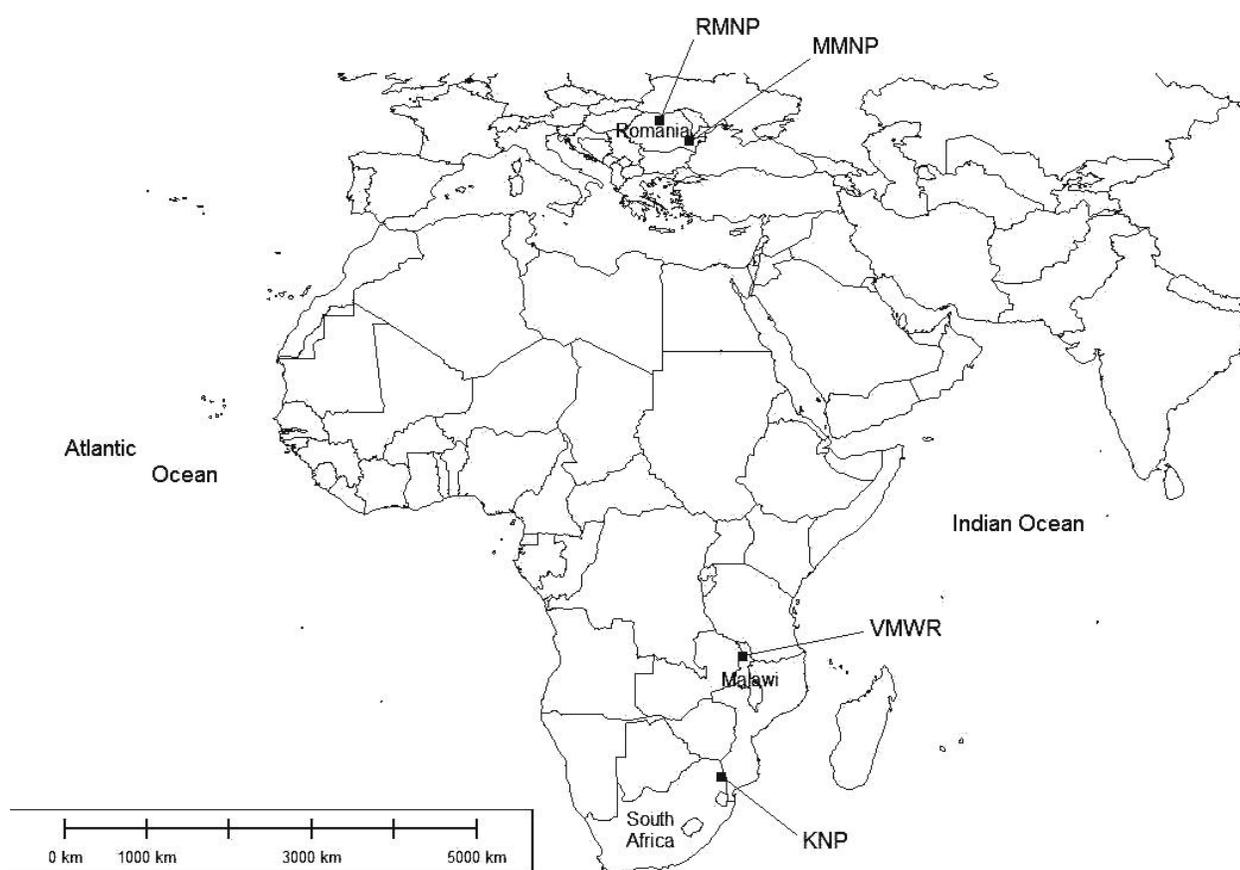


Fig. 2. Location of selected PAs in sub-Saharan Africa, and Romania in southeastern Europe

PA	Date of Designation	Area (ha)	Representative ecosystems	Tenure
KNP	1926	1,898,900	16 'ecozones' ranging from wooded hills to open plains and savannas, and riverine bushveld	state-owned, although portions subject to land claims
VMWR	1977	98,200	Mopane and miombo woodland, marshy wetlands	state-owned (100%)
MMNP	2003	11,142	Balkan-Pontic steppe and sub-Mediterranean and Balkanic forest	most (99%) state-owned; 1% municipally-owned
RMNP	1990	46,417	Eastern Carpathian Mountains including temperate forests and alpine grasslands	most (~93.4%) owned by local communities; state-owned (6.4%); private & church owned (0.17%)

Table 1. Characteristics of selected protected areas

PA	Methods	Fieldwork	Source(s)
KNP	archival analysis of policies, reports, and legislation questionnaire survey (240 households; 38 villages, C.I. = 6.28, C.L. = 95%) semi-structured interviews participant observation	Jan - Nov 2004	Anthony (2007) Anthony et al. (2010)
VMWR	archival analysis of policies, reports, and legislation village meetings (7 zones; 300+ participants) community mapping semi-structured interviews participant observation	July - Aug 2009	Anthony & Wasambo (2009)
MMNP	archival analysis of policies, reports, and legislation questionnaire survey (374 households; 14 villages + 1 town, C.I. = 5.0, C.L. = 95%) unstructured interviews	May - July 2007	Anthony & Moldovan (2008)
RMNP	archival analysis of policies, reports, and legislation semi-structured interviews participant observation	June 2010 - April 2011	Szabo, unpublished results

Table 2. Multi-method approaches used in selected case studies

3. Case studies

In this section, we provide an introduction to each of our case studies, including its history, and type and extent of human-wildlife conflict. This is followed by a description of selected factors which we believe lead to particular outcomes in terms of HWC management options for each PA.

3.1 Kruger National Park, South Africa

The KNP, established in 1926, is situated in the north-eastern region of the Republic of South Africa, and covers nearly 2×10^6 hectares (Mabunda et al., 2003). KNP is unequalled among South Africa's national parks system, being home to an unparalleled diversity of wildlife and maintained by one of the world's most sophisticated park management systems (Braack, 2000). Internationally, KNP functions as a major tourism destination with up to 1 million visitors annually, and serves as an important socioeconomic and ecological component of the Great Limpopo Transfrontier Park, a multi-lateral initiative involving South Africa, Mozambique, and Zimbabwe (SANParks, 2006).

Prior to 1994, as in other parts of southern Africa, the familiar approach to proclaiming PAs in South Africa was to remove (often forcefully) resident rural people and relocate them elsewhere without adequate compensation (Callimanopoulos, 1984; Campbell & Shackleton, 2001; Lahiff, 1997; Volkman, 1986). These and other neighbouring communities were then customarily deprived of access to PAs, any participation or input in their management, or any share of their benefits (Khan, 1994; Magome & Collinson, 1998). The result was that, despite successes gained in conserving biodiversity by producing South Africa's extensive PA network, in the process much human misery and hostile attitudes towards PAs resulted, including from communities evicted from KNP (SANParks, 2000). However, since the lifting of Apartheid and the democratic elections of 1994, the National Parks Board, whose name changed in 1997 to South African National Parks (SANP), has undergone major changes with regard to philosophy, policy and organisational structure to reflect the new economic and socio-political realities of South Africa as underpinned by the new Constitution. In addition to core objectives of conserving biodiversity and maintaining landscapes, new park management policy has moved towards integrating the interests of neighbouring communities. This includes redressing past injustices through facilitating land claims within the park.

Concomitant with these changes, KNP established its own Social Ecology Program, which facilitates seven participatory communication structures with the park's neighbouring communities, consisting of about 120 villages and private game farms with an estimated total human population of 1.5 million (SANParks, 2000). The Hlanganani Forum (representing 27 villages), in whose jurisdiction this case falls, was initiated in 1994, and meets monthly to strengthen park-neighbour relationships (Anthony, 2006). The historical background of these communities, which forms part of the former Gazankulu homeland, is characterised by a general dissatisfaction with park authorities (Els, 1994), in part due to damage to crops, livestock and property caused by wildlife, particularly lion (*Panthera leo*), hyena (*Crocuta crocuta*), elephant (*Loxodonta africana*), and buffalo (*Syncerus caffer*) which were regularly escaping from the park (Cock & Fig, 2000; Freitag-Ronaldson & Foxcroft, 2003; Tapela & Omara-Ojungu, 1999).

Until the late 1990s, KNP section rangers had authority to deal with damage-causing animals themselves, but currently their agreement with Limpopo Province stipulates that the park can only assist in controlling animals exiting the park after first obtaining permission from the provincial government *in each case*. To complicate matters, the border fence is under the responsibility of the Department of Animal Health, which is obliged to maintain it in order to prevent transmission of disease from wild animals to domestic livestock. However, despite the provincial government being the lead agency responsible for controlling animals outside the park, it currently suffers from under-funding and understaffing, and is therefore a weak actor with little capacity to solve local problems (Anthony et al., 2010). This is exacerbated by poor communication, slow response times, weak reporting and monitoring, and vulnerability to illegal hunting practices by professional hunting outfitters tendered by the province to control animals, involving the luring of lion from the park with livestock and/or poached zebra (Anthony et al., 2010). This lion luring is a man-induced population sink, which may increase the prevalence of 'edge effects' along KNP's border (Woodroffe & Ginsberg, 1998), and subject lions to a change of prey preference if they have increased cattle-killing opportunities (van Dyk & Slotow, 2003). Tension and problems are therefore inherent in the current institutional arrangements within which HWC are dealt with. This institutional reform for controlling damage-causing animals has resulted in a piecemeal process, fraught with gaps and loopholes, which has produced increased opportunities for corruption and illegal activity. Moreover, it demonstrates the need for an improved and streamlined system of control that minimises risk and damage, an issue of acute concern for communities neighboring the park.

Community perceptions of HWC are an important aspect of KNP's interaction with its neighbors, and have great potential in shaping attitudes towards the park and its objectives. KNP is perceived by many neighbours as contributing to current injustices by harbouring dangerous animals causing extensive damage and threatening livelihoods of the very communities it seeks to empower. Based on their questionnaire, Anthony et al. (2010) reported that 12.1% of their respondents had experienced HWC between 2002 and 2004. If one considers all households within 15 km of the park border, an estimated 2,216 households had been affected. They also showed that households that had higher numbers of mammalian livestock and are closer to the park were significantly more likely to experience HWC. Moreover, those who had suffered damage were significantly less likely to believe that KNP would ever help their household economically. Negative attitudes toward KNP by community members primarily centre on HWC, including the lack of adequate maintenance of the KNP border fence, control of animals once they escape from the park and affected farmers not being financially compensated for losses, despite promises that compensation would be forthcoming. These aspects of HWC threaten, and in some cases prevent, economic diversification through sustaining or enhancing agricultural livelihoods. They also have left many community members with a sense of hopelessness.

In addition to simply influencing attitudes, due to the perceived inadequacy of control by the current institutional structure, many locals were resorting to retaliatory killing of wildlife, including the shooting of problem lions, and using snares (Anthony, 2006). In addition, carcasses have often been laced with poison to indiscriminately kill lions and hyenas, which has had lethal consequences for other species, including vultures, which are specially protected in Limpopo Province (LEMA No. 7 of 2003; Schedule 2).

3.2 Vwaza Marsh Wildlife Reserve, Malawi

Analogous to South Africa, previous conservation policies in Malawi focused solely on the conservation of wildlife resources within PAs without taking the rights and needs of the surrounding human population into account. Consequently, the primary focus of PA management was law enforcement and the relationship between PA authorities and neighboring communities was openly antagonistic (MDNPW, 2004). To change this relationship, the Department of National Parks and Wildlife embraced a collaborative management program in the early 1990s with the aim of developing a sustainable and interdependent relationship between PAs and the neighbouring rural populations by ensuring direct flow of benefits to these communities (MDNPW, 2004).

Vwaza Marsh Wildlife Reserve (VMWR) occupies almost 100,000 ha of diverse terrain in Northern Malawi in the Central African Plateau. The reserve comprises a region of hills and pediments in the east, and a region of wetland and alluvium in the west. It is home to a wide variety of large mammals, including buffalo, hippopotamus (*Hippopotamus amphibius*) and elephant, and an extensive range of lowland bird species. The reserve's water source is the Nyika plateau which lies to the north and east within Nyika National Park, running along the South Rukuru River. The western and part of its northern boundary coincides with the Malawi - Zambia border where wildlife can roam freely between the Reserve and the Luangwa Valley in Zambia.

Protection of the area as a group reserve began in 1941 with the proclamation of Lake Kazuni Game Reserve (Government Notice no. 166 of 1941). This included all land and water within a 5 mile distance of the centre of Lake Kazuni (Nxumayo et al., 2008). According to the Vwaza Marsh Wildlife Reserve Revised Master Plan (2004), the Vwaza Marsh was proclaimed a Wildlife Reserve in 1977 (GN 33 of 1977), which subsequently involved the eviction of most villages in the area. Bell & Mphande (1980) estimated the human population to have been approximately 2,075 immediately prior to 1977. Inhabitants were removed from the reserve through 1979 and the last group of people to leave were those of the Mowa village in the north-west of the reserve in 1984.

Despite more than a decade of active engagement between VMWR and its neighbouring communities, little is known about how those relationships have developed and what factors influence their success or failure in fostering cooperation. Previous studies have emphasised the general dissatisfaction with reserve authorities by local communities, largely subsistence farmers, in part due to village evictions and damage to crops and property caused by wildlife (Msiska 2002; Nxumayo et al. 2008; VMWR 2003). Further, VMWR Annual Reports (2003-2004 through 2008-2009) consistently highlight (i) problem animal incidents, and (ii) the ongoing challenges associated with problem animal control, alleviating damage, and adequately responding to communities' demands for compensation.

Anthony & Wasambo (2009) undertook a HWC study involving about 60 villages (organised into 7 zones) within 5 km of the reserve, in part to examine institutional roles and the effectiveness of policies and practices of VMWR and local communities in managing HWC, and offer perspectives from rural community members who live within the area. They found that of 19 identified problem taxa by local communities, elephants were perceived as the 'worst' problem animal, followed by chacma baboons (*Papio ursinus*)/monkeys (*Cercopithecus aethiops*), hyena, bushpigs (*Potamochoerus porcus*), and hippopotamus. Meeting participants were adamant in voicing their concerns over the widespread destruction of both crops and livestock in the area by problem animals (Table 3).

Zone	crop depredation	destroying food stores	chasing/killing livestock	threatening people	killing people	other
Zolokele	✓	✓		✓		
Mwazisi	✓	✓	✓	✓	✓	
Mphangala	✓	✓	✓			
Kamphenda	✓	✓	✓	✓		
Kazuni	✓	✓	✓	✓	✓	'drinking our traditional beer'
Thunduwike	✓	✓	✓	✓		'drinking our water'
Zaro	✓	✓	✓	✓		'bringing tsetse flies'

Table 3. Types of human-wildlife conflict in village zones surrounding VMWR

Participants from all 7 zones unanimously believed that incidents with problem animals had been increasing in recent years, particularly with elephants. Their reasons for saying so are based on perceived problems with the reserve border fence, increasing animal populations, insufficient buffer zone between reserve and communities, and poor control of problem animals as a consequence of low capacity within the reserve to manage the conflict.

Despite the fact that legislation and policies are in place at both the national and local reserve level concerning the control of problem animals, the implementation of these policies is weak on the ground (Anthony & Wasambo, 2009). The perceived result is that incidents with problem animals have increased in recent years, the response times by VMWR staff are variable, and the results of animal control are largely inadequate, often with animals habituating to the methods used. This has had profound consequences on local livelihoods, both directly and indirectly, including financial, social and cultural losses ranging from crop raiding and damage to water sources, to increased anxiety and loss of human life. This has led to increasingly frustrated communities who have, in some cases, over-exaggerated the extent of elephant damage (Anthony & Wasambo, 2009).

When asked about possible strategies for mitigating HWC, a wide variety of suggestions were made by participants, including adjustments in staffing, benefit sharing, increased community involvement, and improved wildlife management (Anthony & Wasambo, 2009). For our purpose here, a noteworthy suggestion was that of the role of fencing as a HWC control measure. Experience shows that where PA boundaries abut onto settlements and cultivation, especially in a densely populated country like Malawi, then HWC is inevitable. This is especially the case with species like elephants, hippopotamus, baboons and bushpigs, all of which occur in VMWR. The alignment of boundaries, as with the South Rukuru River and floodplain forming the southern boundary of Vwaza Marsh, with an inadequate buffer zone between wildlife habitat within the park, and cultivation outside, complicates the issue enormously (Hall-Martin et al., 2007). If properly designed and maintained, electric game fences have been shown to prevent unwanted movement of animals out of PAs (Hoare, 2001). Yet, communities surrounding VMWR are polarised on their use. Some would like to see the fencing extended and/or improved, whilst many

others want to see the existing fence eliminated altogether, as it represents a permanent reminder of the fact that their land was illegitimately taken from them by the previous regime. This sentiment was also echoed by VMWR staff, who claim that proposals to improve the fence has always elicited mixed reactions from the community for this reason.

3.3 Măcin Mountains National Park, Romania

MMNP is a relatively small (approx. 11,000 ha) PA situated in southeast Romania. MMNP is the only PA in Europe where ecosystems typical of the Pontic-Sarmatian steppe, sub-Mediterranean and Balkan forests can be found on Hercynian mountains, the oldest in Romania and some of the earliest in Europe (Parcul National Muntii Macinului, 2006). According to Institutul de Cercetari si Amenajari Silvice (1996), steppe ecosystems once covered 16% of Romania's territory but they are now restricted to the Macin Mountains. MMNP is among the newest national parks in Romania, being designated in 2003. The park is administered by the MMNP Administration, within the National Forest Administration - Romsilva. The majority (99.6%) of MMNP is forest, along with smaller areas of pasture and arable land (Parcul National Muntii Macinului, 2006). Although comprehensive surveys regarding the biodiversity of Macin Mountains have not been undertaken, an estimated 150 vertebrate and 72 plant species classified as protected are present in the park (UNDP, 2005). Similar to our African cases, MMNP primarily treated its neighboring communities in a top-down fashion until 2006, at which time it established a Community Liaison position within its organisational structure. This person interacts with a Consultative Council, the members of which represent local municipalities.

MMNP keeps no HWC incident records, therefore no park data is available, with the exception of *ad hoc* observations provided during park staff interviews. In their MMNP-communities interaction study, Anthony & Moldovan (2008) report that 24 (6.4%) of 374 survey respondents from neighboring villages declared their household had experienced some form of damage from wildlife in the past 5 years. When the spatial reference was extended to the whole village, 18.4% declared they knew about HWC incidents in their village. Most frequently (68.1%), the identified problem was chasing or killing of livestock, followed by crop depredation (55.1%). In 13% of the cases, wildlife inflicted property damage and in four cases, human life was supposedly threatened. Wild boars (*Sus scrofa*) are thought to be the most damaging animal, followed by fox (*Vulpes vulpes*) and golden jackal (*Canis aureus*).

Given its relatively recent establishment, and the absence of radical changes in the forestry exploitation regime, local residents have not had extensive interaction with the park's administration structures and representatives. Thus, most local people tend to hold a neutral attitude towards MMNP (Anthony & Moldovan, 2008). However, those that do hold negative attitudes largely justified their opinion by stating that they believe the park plans to introduce nose-horned vipers (*Vipera ammodytes*) to the area, and this will consequently be a threat to local inhabitants. Other negative responses were derived from the perceived increase in restrictions and associated fines related to wood collection and grazing. A particularly sensitive issue is the closing of adjacent quarries due to the designation of the park, an aspect that produces mixed feelings. Some stated that quarry closure has brought about decreased air and noise pollution, while others claim it has contributed to locally high unemployment.

Reinforcing the trepidation about the park's management objectives in terms of reintroductions, although most respondents (80.2%) agreed that wild animals should be

protected, a significant proportion believed that only those animals that 'do not harm people or destroy crops should be protected' (Anthony & Moldovan, 2008). Bears, wolves and, especially, snakes (vipers) were characterised as 'animals that can do harm' and, consequently, should not be protected. According to the MMNP biologist, there are no bears or wolves on the park territory, nor does the park have plans to reintroduce vipers to the area.

Due to the short history of MMNP, people have had minimal experience with the institution of the park. Thus, their attitudes are based rather on pre-existing knowledge and, therefore, on pre-constructed notions that have yet to be fully tested with prolonged interaction with the park. Therefore, MMNP must be aware of both negative and positive perceptions that its establishment and management can generate among local residents, and work to integrate the diversity of opinions, attitudes and values in order to reflect this reality. The MMNP is now at a crossroads at which its local populace can be greatly affected by future interaction with the park, including how it communicates and dispels existing rumors concerning species reintroductions.

3.4 Rodna Mountains National Park, Romania

The Rodna Mountains National Park (RMNP) is located within the Carpathian Mountain chain in northern Romania. The first attempts at protecting nature in this region occurred in 1932 when 183 ha around the Pietrosu Mare peak were declared as a PA, one of the first initiatives of this kind in Romania. This was followed by successive expansions to 2700 ha in 1971, 3300 ha in 1977, to 46,399 ha in 1990 when it was declared as a national park, and finally to its current size of 46,417.1 ha as stipulated in the park's draft management plan (Administratia Parcului National Muntii Rodnei, 2010). The park administration (APNMR) was set up only in 2004 as a structure within the National Forest Administration - RNP - Romsilva (NFA). The administration is helped by a Scientific Council which has decision-making powers and includes several experts and interacts with stakeholders through a Consultative Council which includes approximately 100 people belonging to 60 institutions. The stated purpose of the RMNP combines biodiversity conservation with encouraging and supporting local communities' traditional way of life (Administratia Parcului National Muntii Rodnei, 2010).

The importance of this PA for biodiversity conservation is demonstrated by its triple status as national park, biosphere reserve and a Natura 2000 site under both the Habitats and Birds Directives of the European Community. Forest ecosystems cover approximately 60% of the park area while alpine grasslands represent 30%. Diverse geomorphology, climate and soil types resulted in the presence of a rich biodiversity, with important habitats, and more than 2000 species each of both flora and fauna, including several endemics (Administratia Parcului National Muntii Rodnei, 2010). The internal zoning of the park currently includes the following areas (listed from highest to lowest level of protection): scientific reserves and areas of strict protection (12.2%), integral protection (43.02%), sustainable conservation (44.73%), and sustainable development (0.05%). The park's draft management plan proposes to extend the integral protection zone to 56.39% and to reduce the sustainable conservation area to 31.36% (Administratia Parcului National Muntii Rodnei, 2010). Forests and pastures included in the park are administered by several state and private structures and this fragmentation of ownership and administration poses a great challenge to the park administration and its goal of promoting integrative management in accord with biodiversity conservation.

Agriculture and forestry are the main sources of income for communities adjacent to the RMNP. Agriculture involves the cultivation of a few crops that are suitable to the harsh climate and mountainous terrain (potatoes, some corn, apples and plums) and livestock husbandry (sheep, goats, cattle, horses and pigs). Local people still practice transhumance, taking their sheep up to alpine pastures every spring and back to their villages in the autumn. In the past, mining was an important sector but this activity was decommissioned between 2004 and 2007 leading to increased unemployment in the area and greater pressure on forest resources (Administratia Parcului National Muntii Rodnei, 2010).

Previous to this research no studies were conducted on HWC and people-wildlife coexistence aspects in the area of the RMNP. Three species of large carnivores are present in the park area, namely brown bear (*Ursus arctos arctos*), gray wolf (*Canis lupus*) and Eurasian lynx (*Lynx lynx*), but data about their distribution, abundance and population dynamics are minimal, the main source of information being annual game censuses and rangers' and foresters' knowledge. No database integrating these data exists however. Moreover, habitat assessments and mapping are only partially available and more detailed assessments are planned to commence. In addition, no socio-economic investigations have been undertaken.

During this study a series of issues came to the fore. These could be grouped into conflict type (parties involved), and factors affecting large carnivores directly, for example hunting and poaching, or indirectly through habitat and prey management, and compensation for damages to livestock owners. Investigations revealed that the main direct conflict occurs between shepherds and large carnivores as a result of depredation events at sheepfolds located in alpine pastures during the summer grazing season. In this area (and elsewhere in Romania) HWC is difficult to assess and study because no records are kept of attacks and many events go unreported. No conflict monitoring system or adaptive management approaches have been implemented in the RMNP and no strategy (neither ecological nor social) for large carnivore management and for dealing with conflict has been developed so far. However, several informants stated that conflict level has decreased recently due to a decline in livestock, prey and wolf numbers and the interdiction of baiting inside the park.

The conflict between people and large carnivores is affected by several factors. Hunting plays a role despite the fact that no hunting is permitted inside the national park. However, the RMNP is surrounded by ten hunting grounds that overlap the park. Large carnivores have a protected status in Romania but hunting quotas are set yearly with the aim of bringing the populations within habitat carrying capacity or to address conflict caused by 'problem animals'. Supplementary feeding is allowed on hunting grounds and some informants stated that large carnivores are attracted outside the park where they can be hunted. Poaching of large carnivores was not perceived as a major factor although it is believed to occur. However, poaching of prey species was considered to be a more pressing issue due, at least in part, to the ease with which guns can be procured. Habitat management is also important and several respondents commented on the fact that logging operations are a source of disturbance for large carnivores. At the same time young forest regeneration areas are prime feeding grounds for bears but are also appealing to shepherds and their flocks and consequently they become sites of conflict.

The issue of compensations for damages caused to livestock by large carnivores is also an important factor influencing conflict. Although Romanian legislation specifies that compensation is to be paid in such cases, several informants stated that the procedure is complicated. Moreover, in some cases the damage cannot be assessed because livestock remains are dragged away by large carnivores. Shepherds who were interviewed declared that they generally claim compensation only when the damage is large, one stating that they make a claim only if they lose more than 10 sheep in one attack.

Regarding the socio-political dimension of HWC in the RMNP area the complexity of the issue is easily apparent. A multitude of institutions and stakeholders are involved often with unclear roles and responsibilities. Moreover, various stakeholders hold conflicting views toward conservation and resource use and often decisions are not integrated. A case in point is represented by agricultural subsidies paid to livestock owners by the National Agency for Payments and Interventions in Agriculture with a potential to encourage farmers to increase their livestock numbers, which could lead to an increased pressure on alpine pastures within the park and heightened HWC. Already several problems have occurred inside RMNP, including the illegal building of sheepfolds in the Pietrosu Mare scientific reserve where no resource use is permitted.

This situation is complicated further by the fact that the park land is owned mostly by local communities which are restricted from resource use (a significant proportion of forests and some pastures) without being compensated for this although the legislation does stipulate it. Before 1989 the area currently included in the RMNP was state owned and all resource use was carefully controlled by the communist authorities. The RMNP was established through a top-down approach without the participation of local communities which, following successive restitution laws, gained their land back but found themselves faced with restrictions imposed on natural resource use due to the park's presence. This led to a great deal of mistrust in state institutions and negative attitudes toward the park and its administration. Consequently, APNMR is faced with tremendous challenges and as yet does not dispose of adequate resources to address them (Ioja et al., 2010).

4. Discussion

PAs are considered the cornerstones of conservation. Yet, at the same time, they can also represent conservation paradoxes, particularly as sources of HWC. The very serious problem of HWC, and its mitigation, identified in our case studies demands a solution in order to improve relationships between communities and management institutions, and to arrive at better outcomes for communities and biodiversity conservation alike. Fostering communication and trust, demonstrating effort and a willingness to address the issue, and following through can lead to improved governance (Lockwood, 2010) and have a positive effect on the attitudes and actions of people in conflict with wildlife (Madden, 2004). However, with such a complex issue, employing a suite of flexible instruments and policies adapted to the local situation is required. Based on our cases, we suggest that in order to manage HWC more effectively in such contexts, five components of the conflict must be addressed: i) baseline research, ii) evaluation of damage, iii) conflict management, iv) adaptive management, and v) identifying and acknowledging management trade-offs.

4.1 Baseline research

Understanding local perceptions of affected communities, and the ecology of 'problematic' species, including their life histories and propensity for causing damage should be at the forefront of any research designed to minimise HWC. Knowledge on the spatial and temporal variation of conflicts, as well as the behaviors of involved individuals/institutions is a critical first step in planning any intervention (Treves et al., 2006). While this paucity of information might be more understandable for relatively young PAs like MMNP and RMNP, older parks such as KNP and VMWR may also suffer from a lack of baseline studies because of *inter alia* institutional reform and/or low capacity. This may also be a product of originally top-down hegemonic models of PA establishment and management where the concerns of neighboring communities were largely ignored. The trade-off here is that, while efforts to build and maintain wildlife populations were the focus, comprehensive baseline research on existing HWC (or which could potentially occur) was left wanting. Indeed, our studies were the first to systematically document HWC in all of our cases.

By conducting baseline research on what species are present, and what human activities exist (and are planned) within and adjacent to PAs, better strategies for mitigating conflict can be negotiated. Where baseline information is lacking, research capacities and efforts need to be increased, not only in culturally-sensitive social science research on and with neighboring communities (Pollard et al., 2003), but also in the areas of livestock and crop depredation (Bauer & Karl, 2001; Kolowski & Holekamp, 2006; Macandza et al., 2004), and wildlife deterrent measures (Newmark et al., 1994; Ogada et al., 2003; Sitati & Walpole, 2006).

4.2 Evaluation of damage

In addition to baseline research, systematic and effective reporting and monitoring, record keeping, and quick responses are required to ensure that the HWC is being tracked, comprehended, and adequately addressed (Treves et al., 2006). Both the design and implementation of policies formulated to manage HWC are dependent on the availability of *current, accurate, and long-term* information on the problem. Unfortunately, this aspect of HWC mitigation is desperately lacking in each of our cases, although there is promise that an improved system, of at least reporting, will be implemented in VMWR. In the absence of good information, the scale and nature of HWC can simply become a matter of personal opinion (e.g. elephants in VMWR, vipers in MMNP). Conflict between people and wildlife is an emotional issue and, as a result, reports and opinions can be biased, creating a false impression of the size of the problem. The systematic and objective gathering of information allows stakeholders to put the problems and threats caused by HWC into context and perspective with other problems faced by local communities. It also ensures that resources are correctly directed at solving the real issues rather than the perceived problems (Mishra, 1997), particularly where management regimes suffer from tightly constrained budgets and personnel.

In cases where record keeping is unsystematic and attending to incidents is hampered by overlapping (KNP) and/or weak institutional arrangements (VMWR), valuable data concerning the nature and extent of damage can be left wanting. Consequently, measures to minimise real or potential loss of life or livelihoods will remain unrealised and negative attitudes towards PAs from affected communities will persist (Anthony, 2007; Hazzah et al., 2009), and may eventually escalate to retaliatory killings as evidenced in KNP, and

elsewhere (Mishra, 1997). Appropriate new, existing, or traditional systems and institutions need to be developed or empowered locally, and be evidence-based to ensure good management (Madden, 2004; Thirgood & Redpath, 2008). Such a system, we believe, must be mutually agreed upon and be clearly and broadly communicated to the relevant institutions, including local communities.

4.3 Conflict management

As outlined in our cases, the distributions of competencies between relevant institutions are not always aligned in structures that promote goodwill and biodiversity conservation in and around PAs. Although legislation and policies are in place to mitigate HWC in each of our four cases, their implementation on the ground is either weak or simply not carried out. We recommend that a system be created that, at least insofar as the issue of problem animals are concerned, helps establish the credibility and legitimacy of PAs. In order to achieve this objective the authority to control problem animals should be decentralised following the subsidiarity principle, in which 'the goal is to have as much local solution as possible and only so much government regulation as necessary' (Berkes, 2004). This may include local hunters to legitimately hunt valuable wildlife (KNP). Decentralisation of authority should also include allowing joint teams of qualified PA (and other institutional) staff with the authority to respond to problem animals as the need arises. These measures would go a long way in ironing out the procedural and practical difficulties now encountered in monitoring and responding to HWC incidents under the current institutional framework (KNP, VMWR, RMNP).

We believe that in situations where overlapping and/or competing institutions have a shared goal in mitigating, alleviating and eventually minimising HWC, these changes, in combination, will create a situation in which inherent institutional rivalries will be minimised due to cooperation on the ground as well as shared responsibility for oversight and low-level policy adjustments (Anthony et al., 2010). A process of social learning in which the various stakeholders understand the viewpoints of others and take some responsibility for meeting the core interests of their partners is likely to lead to greater mutual sympathy, a decrease in conflict, and more effective management in the long term.

In addition to these basic institutional arrangements, we recommend a number of other measures be taken, which are more unique to our cases. These include steps to improve relations with neighboring communities, such as maintaining and upgrading the park boundary fence (KNP), dispelling unfounded rumors about park objectives (MMNP), and following through on promises of compensation for damage(s) inflicted by wildlife (KNP, VMWR, RMNP). Although compensation schemes are generally not a good long-term solution as they may create continuing financial burdens and increase expectations (Crawshaw Jr., 2004; Graham et al., 2005), and be counter productive to conservation by stimulating agricultural expansion (Bulte & Rondeau, 2005), the legitimacy of institutions may be enhanced where following through on long-standing promises are made. Moreover, when designed and implemented appropriately, compensation schemes can be effective (see e.g. Nyhus et al., 2003; Ogra & Badola, 2008; Schwerdtner & Gruber, 2007).

4.4 Adaptive management

Building on the data gained from comprehensive baseline research and damage evaluation, institutions responsible for mitigating HWC are in a more profitable position to adapt to

changes, whether they are ecological, economic, or socio-political. Adaptive management is imperative to evaluate the effectiveness of interventions to minimise HWC (Curtin, 2002). We believe that in order to ensure performance improvement and provide a forum for timely feedback, an 'audit committee' of all relevant stakeholders where HWC challenges are faced by PAs should review cases on a regular basis and recommend changes in practice, if necessary. In the case of KNP, developing such a scheme is in the works but, to date, has not been implemented. In each of the other three cases, such a system is essential if institutions are to minimise conflicts in such dynamic ecological and socio-political landscapes, where the influences of agriculture and forestry sectors are so pronounced. However, adaptive management is superfluous, and may indeed be counter-productive, if it is not preceded by adequate evaluation of damage and conflict management.

4.5 Identifying and acknowledging management trade-offs

The goal to combine biodiversity conservation with sustainable management of natural resources and support for local communities is challenging and seemingly insurmountable (if not contradictory). This situation generates trade-offs and hard choices which are often not acknowledged and articulated and, thus, may result in unanticipated conflicts. Moreover, management decisions can affect temporal horizons in that the consequences of past management decisions can have cascading effects, leading to less-than-optimum solutions for managing current and/or future HWC. In the case of KNP, past injustices under Apartheid, and later unmet promises of compensation for wildlife damage, has led to elevated mistrust amongst local communities. Further, with the current institutional reform taking place, confusion from overlapping responsibilities coupled with a weakened response to HWC incidents is contributing to negative attitudes towards the park where, in some cases, poaching and retaliatory killing is taking place.

Similarly, in our Malawian case, past evictions from the park have created a general indignation by local communities towards the VMWR, which is limiting the options available for current park managers to mitigate HWC. Although electric fencing may be a viable option for controlling elephants in the reserve, many community members feel that such an object would represent a physical (and continual) reminder of their illegitimate removal from the area where the reserve now stands. Moreover, with the current organisational reserve structure and non-lethal techniques utilised to manage elephants, HWC are growing in the area and influencing increasingly negative attitudes towards the park and its biodiversity conservation objectives. In such situations, unless management decisions recognise these inherent trade-offs and are oriented to rectify the situation, it is inevitable that conflict will escalate beyond the capacity of the reserve to control.

Our first Romanian case is in perhaps the most enviable of all our cases. MMNP is a relatively young park, which has had limited interaction with neighboring communities. Community attitudes are mixed: some recognise and support the benefit of the park in conserving biodiversity; others feel that its restrictions on local mining operations have created heightened unemployment in an already impoverished area. Moreover, a falsely held belief of the park's intention to reintroduce dangerous vipers to the area is prevalent amongst many community members. How explicitly, and when, the MMNP communicates its position on these issues to local communities is of vital importance as it will affect outcomes and can sway the attitudes of local communities towards the park and its

conservation objectives. Fortunately, unlike our African cases, it does not also have to address past injustices in doing so.

Finally, concerning RMNP, the proposal to include most alpine pastures in the integral protection area of the park has the potential to encourage ecotourism development in the area, drive local livestock owners to reduce their stock and could result in a considerable reduction in HWC inside the park but, at the same time, it could deprive local people and communities of significant agricultural subsidies and generate a series of law suits from disenfranchised land owners. On the other hand, if the park does not follow up on its intention of extending the integral protection area it could be faced with increased pressure on grasslands and probably increased levels of HWC as a result of farmers being stimulated by subsidies to increase their livestock numbers. These choices are not simple as, in addition to biodiversity outcomes, they also involve issues of power and justice with respect to the distribution of their consequences (e.g. developing ecotourism could promote a local elite to the detriment of poorer shepherds).

5. Conclusion

Although protected areas are hailed as the primary mechanism of conserving the planet's biodiversity, they can also be sources of conflicts with communities living in and around these areas, particularly in terms of contributing to human-wildlife conflict. Incidents of HWC that are not adequately resolved assure the maintenance of tense relationships between PAs and communities, which has undesirable social consequences and poses risks for PAs and biodiversity conservation in the longer-term. Thus, developing adequate responses to HWC should be a high priority for PA authorities and other governmental bodies.

Our cases indicate that addressing baseline research, evaluation of damage, conflict management, and adaptive management are tantamount if conserving biodiversity is to persist where HWC exists. Moreover, recognising and articulating inherent management trade-offs amongst diverse actors are requisite if HWC is to be fully understood, and mitigated. Our case studies individually differ in terms of their attention to these components (Table 4), which is likely a reflection of principles of 'scale, context, pluralism and complexity' (McShane et al., 2011). Yet, there are opportunities for cross-learning here, as relatively young and inexperienced PAs (e.g. MMNP) can avoid making decisions that have had negative (and unexpected) consequences for PAs elsewhere.

Our chapter re-emphasises that HWC are complex, dynamic, and driven not only by ecological factors, but by economic as well as socio-political forces. Embedded within this framework is the need for conservation agencies to encourage the wise and sustainable use of natural resources, which in some cases, are becoming increasingly threatened. The question remains as to whether strategies developed by PAs (and others) to effectively integrate these identified components will gain normative weight so that local institutions will be able to meet both their biodiversity conservation and socio-economic objectives. We have shed some light on these complexities and it is hoped that this will contribute to a more stable and sustainable future for both PAs and their neighbours, where HWC continues to be a challenge. In a world in which biodiversity is under increasing pressure from human encroachment, and in which people's rights to justice and secure livelihoods

must be respected, investments in addressing HWC more holistically should be treated as mandatory.

	KNP	VMWR	MMNP	RMNP
Baseline Research	minimal; expertise available	none	none	minimal
Evaluation of Damage	better in past; poor now	poor, efforts in place to improve	<i>ad hoc</i> (poor)	<i>ad hoc</i> (poor)
Conflict Management	legislation & policies exist, but implementation lacking; compensation a concern	legislation & policies exist, but weak implementation; compensation a concern	legislation & policies exist, but uncertain realization	legislation & policies exist, but weak realization; compensation a concern
Adaptive Management	potential exists	lacking capacity	potential exists	potential exists
Trade-offs	PAST Apartheid > mistrust + land claims CURRENT institutional reform > confusion; negative attitudes; poaching and retaliatory killings (direct + indirect); possible edge effects	PAST evictions > mistrust; ambivalence towards fencing CURRENT poor animal control > negative attitudes	CURRENT a) mining > mixed attitudes b) viper reintroduction (false beliefs) > trepidation & negative attitudes	PAST land nationalization; strict resource control > forests and game thrived CURRENT land ownership change; negative attitudes; & fragmented management

Table 4. Summary of HWC components across selected case studies

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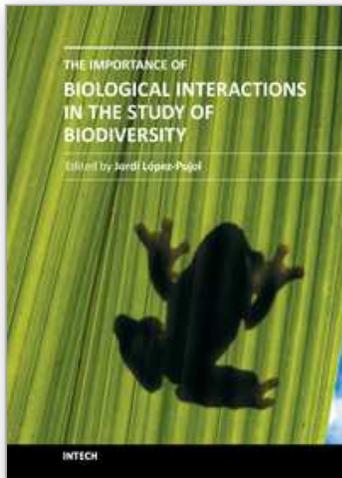
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The term biodiversity defines not only all the variety of life in the Earth but also their complex interactions. Under the current scenario of biodiversity loss, and in order to preserve it, it is essential to achieve a deep understanding on all the aspects related to the biological interactions, including their functioning and significance. This volume contains several contributions (nineteen in total) that illustrate the state of the art of the academic research in the field of biological interactions in its widest sense; that is, not only the interactions between living organisms are considered, but also those between living organisms and abiotic elements of the environment as well as those between living organisms and the humans.

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