LOCAL PERCEPTIONS OF RISK AND VULNERABILITY ASSOCIATED WITH HUMAN-WILDLIFE CONFLICTS IN NAMIBIAN CONSERVANCIES

By

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ABSTRACT

LOCAL PERCEPTIONS OF RISK AND VULNERABILITY ASSOCIATED WITH HUMAN-WILDLIFE CONFLICTS IN NAMIBIAN CONSERVANCIES

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In northeastern Namibia human-wildlife conflicts (HWC) pose risks to livelihoods and wildlife, creating challenges for conservancies mandated to promote conservation and sustainable development. Insights about factors influencing local stakeholders' risk perceptions and vulnerability associated with HWC is lacking; such information is crucial for effective management strategies. To better understand stakeholders' perceptions of HWC-related risks to livelihoods and wildlife, I (a) assessed the effects of conservancy status on residents' HWC-related risk perceptions in an emerging (n= 61) and established (n = 65) conservancy, (b) evaluated stakeholders perceptions of HWC-related risks relative to non-HWC related risks, and (c) described the conceptual and physical space between assessed and perceived poaching-related risks. Results show that the establishment of a conservancy influenced study residents' characterization, prioritization and perceived severity of HWC-related risks. Additionally, non-HWC-related risks, such as lack of employment, were cited as exacerbating human and wildlife vulnerability to and decreasing stakeholder tolerance of HWC. Conservancy residents described the spatial and conceptual relationships between HWC-risks, such as crop damage and poaching, that may undermine conservation and development in their conservancies. Understanding local stakeholders' perceptions of risks and vulnerability can inform the content, format, and design of HWC interventions and prioritize risk management and mitigation to assist the conservancies' most HWC-vulnerable residents and promote wildlife conservation.

DEDICATION

To the diverse people and wildlife of the conservancies of Mudumu South, *Tatumeri*.

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KEY TO ABBREVIATIONS

Community-based natural resources management (CBNRM)

Human-wildlife conflicts (HWC)

Human-wildlife interactions (HWI)

Integrated Rural Development and Nature Conservation (IRDNC)

Ministry of Environment and Tourism (MET)

Mudumu South Complex (MSC)

Namibian Association of Community Based Natural Resource Management Support Organizations (NACSO)

National Park (NP)

Non-governmental organization (NGO)

Participatory risk mapping (PRM)

Participatory risk ranking and scoring (PRRS)

Problem animal incident (PAI)

World Wildlife Fund (WWF)

CHAPTER 1: HUMAN-WILDLIFE CONFLICT, RISK PERCEPTION, AND VULNERABILITY IN CAPRIVI, NAMIBIA

1.1. INTRODUCTION

1.1.1. Human-wildlife conflicts.

Globally, human-wildlife conflicts (HWC) pose risks to human livelihoods and wildlife conservation; HWC occurs when the actions of either humans or wildlife have adverse effects on the other (Conover, 2002). Concerns about HWC can shape public attitudes, beliefs, and support for wildlife management activities (Knuth, Stout, Siemer, Decker, & Stedman, 1992), influence wildlife tolerance among stakeholders (e.g., Knuth et al., 1992; Marker, Mills & MacDonald, 2002) and stimulate stakeholder action (Decker, Lauber & Siemer, 2002). Often, when HWC occurs, it represents a lose-lose situation for both humans and wildlife (Conover, 2002) through its myriad negative effects, discussed below, on both natural systems and human livelihoods (Woodroffe, Thirgood & Rabinowitz, 2005). Reducing risks to both people and wildlife from HWC is a conservation imperative.

The direct effects of HWC on human livelihoods occur across a continuum and range from nuisance behavior (e.g., bears eating from birdfeeders) to life-threatening interactions (e.g., wildlife-vehicle collisions, wildlife attack) (Conover, 2002; Ogra 2008; Thirgood, Woodroff & Rabinowitz, 2005). Direct HWC effects on livelihoods can include crop raiding, livestock predation (Conover, 2002; Ogra, 2008), attacks on humans (Aust, Boyle, Fergusson & Coulson, 2009; Dunham, Ghiurghi, Cumbi & Urbano, 2010), and zoonotic disease (e.g., bubonic plague) transmission (Swift, Hunter, Less & Bell, 2007). These HWC-related risks may reduce food security and livelihood resources and threaten human health and safety. HWC has the potential to result in indirect effects as well, including increased

labor burdens, economic hardship, or fear to leave home in search of livelihood resources (Ogra, 2008). Ogra (2008) noted indirect HWC effects often go uncompensated, are temporally delayed and can lead to negative psychological, health or social consequences. Additionally, although they are not discussed extensively in the extant literature or incorporated into conservation action, conflicts between people about HWC are also part of the spectrum (Peterson, Birkhead, Leong, Peterson & Peterson, 2010).

When wildlife is involved, or thought to be involved, in HWC, the resultant human response may be lethal control (legal or illegal). This is especially true in instances where wildlife is viewed as a threat to human livelihood systems (e.g., agriculture, ranching), health and safety, or property (Treves, Wallace, Naughton-Treves & Morales, 2006a; Woodroffe et al., 2005). Orders of wildlife, such as Carnivores, are often the target of predator eradication efforts (Carpaneto & Fusari, 2000; Kissui, 2008), which has led to population suppression, range collapse or extinction for some predators (Woodroffe et al., 2005). Indirectly, increases in human and livestock populations can change the availability of resources upon which species depend for survival (Vaughan & Long, 2007). Additionally, altering wildlife habitats can affect species structure, composition, and overall biomass (Foley, DeFries, Asner, Barford, Bonan, Carpenter et al., 2005).

1.1.2. Managing human-wildlife conflicts.

Early HWC studies focused on measuring and mitigating impacts from HWC on local livelihoods and were framed within the context of wildlife damage management. Overall, these studies focused on evaluating the effectiveness of wildlife-focused methods for HWC management (e.g., wildlife deterrence, relocation, lethal control) (Conover, 2002). HWC-related research then began examining the effectiveness of human-focused methods for

HWC management such as economic incentives, compensation schemes, or other efforts designed to increase human tolerance of problem wildlife and foster co-existence of human and wildlife populations (Bulte & Rondeau, 2007; Fascione, Delach & Smith, 2004; Woodroffe et al., 2005). Most recently, HWC has examined stakeholders' perceptions of risks from wildlife to their livelihoods (Aust et al., 2009; Gore, Knuth, Curtis & Shanahan, 2007; Marker et al., 2003), stakeholder attitudes towards various wildlife species (Kissui, 2008; Kuriyan, 2002; Romañach, Lindsey & Woodroffe, 2007), human vulnerability to direct (e.g., economic) and indirect (e.g., psychological) impacts of HWC (Ogra, 2008), and stakeholder preferences for HWC management and interventions (Ogra, 2009; Treves, Wallace & White, 2009). These newer studies focus on how people cope with living with wildlife.

HWC-related interventions can be people-focused, wildlife-focused, or focused on both people and wildlife. Many types of wildlife-focused interventions, such as lethal control (e.g., poisoning, sharp shooting), may be incompatible with conservation goals. For example, wildlife-focused interventions designed to reduce the rate and magnitude of HWC (e.g., fencing, habitat modification), may result in changes to the availability of resources upon which wildlife depend for survival (Woodroffe et al., 2005). Additionally, wildlife-focused interventions can impact disease transmission between livestock and wildlife (Daszak, Cunningham & Hyatt, 2000), disrupt foraging and breeding behavior, and alter migration patterns (Woodroff et al., 2005).

People-focused interventions can include direct methods to reduce interactions with wildlife (e.g., excluding people from wildlife habitat) or indirect methods to change human attitudes, tolerance or behavior (e.g., compensation, education) (Treves et al.,

2009). For instance, programs that compensate farmers for crop damage or livestock depredation often aim to increase tolerance of wildlife species that damage livelihood resources and decrease the use of lethal methods on wildlife (Bulte & Rondeau, 2007). State and federal agencies can create regulations (e.g., no feeding wildlife in protected areas) to decrease the likelihood of a negative encounter, or provide outreach to ease fear about wildlife and increase tolerance (Conover, 2002). People-focused interventions are often linked with broader conservation and development projects, such ecotourism ventures, and are implemented by diverse stakeholders (Gore, Knuth, Scherer & Curtis, 2008).

Empirical insight about the human dimensions of wildlife is essential for developing more effective HWC interventions (Manfredo & Dayer, 2004; Ogra, 2009; Treves et al., 2006a) as well as evaluating their ability to achieve objectives (Gore et al. 2008). Information about stakeholders' vulnerability and risk perception associated with HWC can enhance practitioners' ability to respond to the social consequences of HWC and foster co-existence between people and wildlife.

1.2. CONCEPTUAL BACKGROUND

This research integrates theories of risk perception and vulnerability to better understand stakeholder attitudes associated with the negative effects of HWC on local livelihoods and wildlife. Below, I highlight key principles, review the historical significance, and identify key gaps in understanding associated with each theory. Table 1 summarizes key concepts and definitions.

1.2.1. Risk Perception.

Risk can be defined as an estimation of both the likelihood of a hazard (e.g., nuclear disaster, HWC) and the magnitude and character of the negative consequences of the hazard if it occurs (Sjöberg, 2000a). Estimations of risk can be made through technical assessments or intuitive perceptions. Risk assessments, or technical estimations, are objective calculations about the probability of occurrence and magnitude of the consequences related to a given hazard (Renn, 1992). The psychometric risk paradigm defines risk perceptions as subjective judgments about the characteristics of particular hazards, such as perceived control over a risk, the amount of dread a risk elicits, or the perceived severity of consequences associated with risk exposure (Slovic, 1987; Willis & DeKay, 2007). Originally, risk perception research focused on technological hazards (e.g., nuclear power generation, toxic waste disposal). Today, the notion is more broadly applied.

Risk perception has both theoretical and practical relevance to HWC. Theoretically, risk perception offers a lens with which to consider how individuals think and behave in response to risks. Practically, risk perception can foster deeper understanding of psychological factors that influence decision-making. Further, risk perception can be used to measure stakeholder support for management actions (Gore, Knuth, Curtis & Shanahan, 2006; McFarlane, 2005; Weber, 2006) and is important for predicting behavior (Knuth et al., 1992; O'Connor, Bord & Fisher, 1999). For example, Gore et al. (2006) asserted that understanding public perceptions of risk associated with HWC could inform policies designed to change human behavior and reduce HWC-related risk. Understanding stakeholders' risk perceptions can inform the content and format of communication and

education messages (Gore et al., 2006; Gore et al., 2007; Knuth et al., 1992; Schmidt & Wei, 2006; Weber, 2006) and improve risk communication efforts by better anticipating how messages may be interpreted (Gore et al., 2006). Finally, risk perception may improve research design, policy development and institutional decision-making (Gore et al., 2006; Knuth et al., 1992; Quinn, Huby, Kiwasila & Lovett, 2003). For example, Knuth et al. (1992) said that understanding stakeholder perceptions of risk and benefits of wildlife could inform the development of alternative management actions that better balance positive and negative outcomes associated with human-wildlife interactions (HWI).

The literature notes diverse factors influence stakeholder perceptions of risk associated with HWC (see Gore et al., 2007; Muter, Gore & Riley, 2009; Riley & Decker, 2000) and has been primarily focused on stakeholder perceptions of HWC impacts on human livelihoods (e.g., economics, health, safety) and acceptance of wildlife species, abundance and management (e.g., Aust et al., 2009; Gore et al., 2007; Hill, 2004; Riley & Decker, 2000). However, it appears that few scholars or practitioners have identified the difference between factors that influence stakeholder risk perceptions *to* and *from* wildlife associated with HWC. This is problematic because understanding stakeholders' risk perceptions to wildlife could, much like livelihood-related HWC risk perceptions, influence stakeholders' responses to HWC incidents (Hill, 2004) and influence preferences for HWC policy and management (McFarlane, 2005).

1.2.2. Vulnerability.

While psychometric risk perception research tends to focus on judgments about the characteristics of a particular hazard (e.g., hurricanes, nuclear technology) (Slovic, 2000), vulnerability research focuses on the factors that influence a system's (e.g., individual,

wildlife species, country) exposure and sensitivity (i.e., condition of susceptibility to harm) to a hazard (Schmidtlein, Deutsch, Piegorsch & Cutter, 2008). In the broadest sense, vulnerability is the potential for a loss when exposed to a hazard (Cutter, Boruff & Shirley, 2003; Schmidtlein et al., 2008). Vulnerability can manifest at a variety of social (e.g., individuals, groups, countries) and environmental (e.g., species, taxonomic groups, systems) scales (Smit & Wandel, 2007). Vulnerability is influenced by a combination of environmental (i.e., biophysical) and social factors that determine the propensity of being exposed to and constraining the ability to recover from exposure to a hazard (Smit & Wandel, 2006).

Early vulnerability studies generally focused on the biophysical characteristics (e.g., geographic location) of a system and how those characteristics influenced vulnerability (Schmidtlein et al., 2008). Later, sociological characteristics (e.g., ethnicity, gender, wealth) of communities and individuals were studied (Cutter et al., 2003). Contemporary vulnerability research integrates biophysical and sociological theories to assess a system's overall vulnerability (Chazal, Quétier, Lavorel & Van Doorn, 2008; Cutter et al., 2003; Flint & Luloff, 2005).

We know that different species and ecosystems vary in their vulnerability and ability to adapt to environmental hazards such as drought and human hazards such as overharvesting (Beier, Patterson & Chapin, 2008; Kissui, 2008; Thuiller, Broennimann, Hughes, Alkemades, Midgley & Corsi, 2006). For example, Kissui (2008) found that the vulnerability of carnivores to retaliatory killing in Tanzania was driven by both biological factors (e.g., nocturnal predatory behavior) and social factors (e.g., human intolerance). Both biophysical and social factors are known to affect human vulnerability to HWC as well.

For instance, Naughton-Treves (1997) found that stakeholders' biophysical vulnerability to crop damage from wildlife among Ugandan farmers increased with proximity to protected area boundaries and varied depending on crop type. However, social determinants also influenced overall stakeholder vulnerability to HWC, as migrants and ethnic minorities in the community were only given access to the most HWC-prone land; many did not have the resources to conduct HWC prevention activities (Naughton-Treves, 1997).

Resource wealth, gender, ethnic affiliation and the capacity to engage in HWC deterrence activities (e.g., construct sturdy fences) may predict social vulnerability to HWC (Jones & Barnes, 2006; Naughton-Treves, 1997; Ogra, 2008). Variables such as decision-making authority, age, education, marital status, household size and livelihood strategy affect vulnerability to environmental hazards such as hurricanes (Cutter et al., 2003; Schmidtlien et al., 2008) and warrant further consideration within the context of HWC. Additionally, it is necessary to understand the broader context of local risks, as the presence and combination of non-HWC related risks (e.g., climate, HIV/AIDS) may heighten vulnerability of stakeholders and wildlife to HWC-related risks (Reid & Vogel, 2006; Tschakert, 2007).

Increased understanding about local livelihood and wildlife vulnerability to HWC-related risks would be advantageous for improving the management of those risks, as it can guide the prioritization of interventions designed to mitigate loss (Hill, 2004; Nathan, 2008; Naughton-Treves, 1997) and help identify opportunities for adaptation (Smit & Wandel, 2006; Tschakert, 2007). Jones & Barnes (2006), Ogra (2008) and World Wildlife Fund (WWF) (2008) identified the need to better understand what drives disparate HWC vulnerability of local communities and individuals so that HWC can be better managed.

The likelihood of exposure to a HWC-related hazard as well as the sociological drivers that constrain or enable the human response when encountering wildlife are not well understood.

1.2.3. Integrating risk perception and vulnerability.

The concepts of risk perception and vulnerability appear to be intertwined, however the relationship is nebulous. The concept of vulnerability emerged through the study of risk assessments (Marandola & Hogan, 2006). Local risk perceptions are often used to identify disparately vulnerable or influential stakeholders in regards to a specific hazard (Ogra, 2008; Quinn et al., 2003; Smith, Barrett & Box, 2000). However, few studies of risk perception overtly address the relationship between perceived risk and perceived vulnerability; most interpret high-risk perception as being equivalent to high vulnerability perception (Satterfield, Mertz & Slovic, 2004). Satterfield et al. (2004) found that people with high perceptions of vulnerability also exhibited higher perceptions of risk. However, Ogra (2008) found stakeholders with a higher assessed vulnerability to HWC risks perceived themselves to be equally affected by HWC as their less vulnerable counterparts.

To explore the relationship between perceived risk and vulnerability, I developed an integrated risk and vulnerability conceptual framework (Figure 1). In relation to HWC-related risk perceptions, I measured judgments about HWC characteristics for a variety of factors (e.g., control, dread, risk fairness). I considered perceived HWC vulnerability to be a function of exposure risk (i.e., perceived frequency of personal exposure to HWC) and perceived consequences (i.e., anticipated losses associated with HWC exposure) of HWC-related risks (see Nathan, 2008; Satterfield et al., 2004), ultimately embedding perceived vulnerability as a factor influencing risk perception. I also investigated the influence of

demographic characteristics (e.g., gender, age) on stakeholders' perceptions of vulnerability to HWC. Additionally, I investigated HWC-related risks relative to other risks to human livelihoods and wildlife. Lastly, I assessed the influence of risk management regime (e.g., conservancy establishment) on stakeholder perceptions of HWC-related risks.

1.3. STUDY AREA

1.3.1. The Republic of Namibia.

Namibia is a democratic republic in southwestern Africa. A former South African territory that achieved its independence in 1990, Namibia encompasses approximately 824,000 km^2 and has over two million residents (Weaver & Skyer, 2005). The economy in Namibia is highly dependent upon renewable and non-renewable natural resources, particularly the export of minerals, livestock, and marine resources (Wardell-Johnson, 2000). The exploitation of key minerals, particularly diamonds, has fuelled the accumulation of wealth in Namibia (Krugmann, 2001). However, Krugmann (2001) stated that the rate of resource exploitation and lack of economic diversification has put Namibia at risk for unsustainable development. Additionally, there is great economic disparity among Namibians; the country has one of the world's most inequitable distributions of income, wealth and access to resources (Krugmann, 2001). Further, although state-owned communal lands comprise 40% of the country (Nott & Jacobsohn, 2004), more than 65% of the population lives as subsistence farmers on these lands (Weaver & Skyer, 2005). Historically, communal area residents have depended on subsistence-based agricultural and livestock to support local livelihoods. Today, these areas have integrated wildlife utilization and tourism into their economic development (Weaver & Skyer, 2005).

Namibia is home to over 250 species of extant mammals (Griffin, 1998), including Africa's largest cheetah population (*Acinonyx jubatus*) (Marker, 2001) and 644 species of birds (Robertson, Jarvis & Brown, 1998). Currently, greater than 38% of Namibia's land is under some form of conservation management regime including state protected areas (17%), communal conservancies (15%), privately owned conservancies (6%) and conservation concession areas (1%) (Namibian Association of Community Based Natural Resource Management Support Organizations (NACSO), 2009). Namibia faces numerous conservation challenges including invasive alien species, habitat alteration (Griffin, 1998) and human-wildlife conflict (Marker, 2001; O'Connell-Rodwell, Rodwell, Rice & Hart, 2000). Some wildlife species continue to persist widely (e.g., leopard, brown hyena) while other species (e.g., lion, spotted hyena) have been largely eliminated due in part to conflicts with agriculture and livestock operations (Barnes & Jones, 2009). Reducing HWC in Namibia is a critical development and conservation issue (Ministry of Environment and Tourism [MET], 2009).

1.3.2. Namibian communal conservancies.

Namibia's communal conservancies, a form of community-based natural resource management (CBNRM), are joint management ventures between rural communities, relevant government agencies and non-governmental organizations. Local communities maintain the right to financially benefit from local wildlife (Stuart-Hill, Diggle, Munali, Tagg & Ward, 2005). Although tourism (e.g., trophy hunting, lodges, campsites) provides the majority of economic benefits to conservancy residents (Suich, 2010), selling crafts, veld products (e.g., thatch, commercial plant products) and wildlife products (e.g., meat, skins or trophies from hunting) provide additional income to conservancy residents (NACSO, 2009).

Namibia's conservancies are often lauded as a successful example of a CBNRM regime in that they simultaneously conserve natural resources and preserve livelihoods (Hoole & Berkes, 2010; Suich, 2010).

The legislative precedent for conservancies in Namibia was set in 1968 when commercial farmers were granted limited rights over wildlife found on their land (Weaver & Skyer, 2005). However, the model for what would become the conservancy program emerged in the 1980's in the form of Community Game Guards, which was a CBNRM program administered by the non-governmental organization (NGO) Integrated Rural Development and Nature Conservation (IRDNC) (Weaver & Skyer, 2005). After majority rule was enacted in post-apartheid, independent Namibia, there was political and social backing to extend the wildlife use rights conferred on white commercial farmers to communal area residents (Hoole & Berkes, 2010; Roe, Nelson & Sandbrook, 2009). In 1992 the MET began drafting policies that would extend rights over wildlife and other natural resources to communal land residents. The legislation passed in 1996 and was implemented in 1998 (Suich, 2010). Today, the conservancy program includes over 50 registered conservancies covering approximately 12.2 million hectares of communal land and over 224,000 residents (NACSO, 2009).

Key features of the Namibian conservancy system include: 1) legally secure communal rights over the management of natural resources, with no term-limits (Roe et al., 2009); 2) a legislative basis for consumptive use of wildlife[1] (e.g., subsistence and

[1] The Ministry of Environment and Tourism (MET) retains the right to grant permission to harvest 'specially protected game' (i.e., giraffe, elephant, rhinoceros, hippopotamus) and 'protected game' (i.e., roan, cheetah, leopard, tortoises, most bird species).

commercial hunting) (Corbett & Daniels, 1996); 3) 100% of economic benefits retained at the local level (e.g., no government tax on revenue, direct revenue sharing between conservancies and private sector) (Roe et al., 2009); and 4) codified wildlife damage management procedures (MET, 2009). In accordance with regulations governing conservancies in Namibia, each conservancy must engage in the sustainable management of their natural resources (Stuart-Hill et al., 2005); the rights to manage resources through a conservancy are conditional and can be revoked (Roe et al., 2009).

A change in predominantly negative local attitudes towards wildlife is often cited as one of the conservancies' greatest conservation successes (e.g. Weaver & Skyer, 2005). Whereas wildlife under state ownership was considered a liability to local livelihoods because residents were burdened with the economic costs of living with wildlife, conservancies created a situation in which wildlife could become an economic asset (Weaver & Skyer, 2005). The establishment of the conservancy system has been credited as a major contributing factor in the reduction of poaching, which was high in the 1980s and early 1990s and has recently declined (Nott & Jacobsohn, 2004; Vaughn & Long, 2007).

Human and wildlife populations are growing in Namibia, which has led to reports of increased frequencies and magnitudes of HWC both inside and outside of conservancies (Jones & Barnes, 2006; MET, 2009). In 2009, in response to increasing reports of HWC, the federal government established a nationwide policy for HWC management (MET, 2009). This legal framework mandated conservancies compensate farmers for livestock losses and crop damage under the Human Wildlife Self Reliance Scheme and devolved the authority to

destroy problem animals to regional MET staff members and conservancies (MET, 2009).[2] The policy put the onus of taking preventative measures to avoid HWC on all citizens and mandates that a portion of conservancy trophy hunting revenues, not governmental funds, be used to fund the compensation program (MET, 2009). This legislation further devolved not only rights over wildlife but also the responsibility of HWC management to conservancies.

1.3.3. The Caprivi Strip.

This research was conducted in East Caprivi, part of the Zambezian *Baikiaea* woodlands and flooded grasslands (Burgess, Hales, Underwood, Dinerstein, Olson, Itoua et al., 2004) (Figure 1.2), in an emerging (Dzoti) and established (Wuparo) conservancy (Figure 1.3). The Caprivi region has a mild climate (O'Connell-Rodwell et al., 2000), the highest rainfall in Namibia (Wardell-Johnson, 2000), and proximity to four major rivers (i.e., Okavango, Kwando, Chobe, Zambezi) and their tributaries. Local livelihoods in Caprivi are largely supported by natural resources, including agriculture, fisheries, forestry, livestock, and hunting and gathering activities (Jones & Barnes, 2006; Murphy & Mulonga, 2002). Despite Caprivi's rich natural resource base and favorable climate, the region remains one of Namibia's most impoverished and least developed (Suich, 2010). Additionally, Caprivians struggle with one of the nations' highest infection rates for HIV/AIDS and malaria, natural disasters that damage agriculture and spread disease, and poor access to health services (Jones & Barnes, 2006).

[2] Crop damage is compensated only if caused by elephant or hippopotamus. Livestock losses are compensated only if they meet the criteria related to the location of the incident (no national park or wildlife exclusive zone), reporting and verification and precautionary measures have been taken (MET, 2009).

Caprivi has many systems of conservation and land tenure, including communal areas supporting 11 conservancies, state land holdings supporting 6 national parks and game reserves (MET, 2009), private land holdings supporting game farms and tourist ventures (Jones & Barnes, 2006), and a transnational wildlife corridor shared with Angola, Zambia, and Botswana (WWF, 2008). Currently, Caprivi's registered conservancies cover 16% of the region; approximately 29% of the Caprivian population resides in a conservancy (NACSO, 2009).

There is nowhere in Namibia where the issue of HWC is more salient than Caprivi; indeed Caprivi has the highest estimated incident rates of HWC, including high livestock depredation and crop damage (Jones & Barnes, 2006; O'Connell-Rodwell et al., 2000). HWC in the region is estimated to cause an annual loss of US $770,000 (WWF, 2008). Numerous species are implicated in conflicts with people in Caprivi, however two species, elephants and lions, contribute to the greatest number of incidents reported and the highest economic losses (O'Connell-Rodwell et al., 2000). While the total annual per capita value of losses due to wildlife in Caprivi is $75 USD or approximately 7% of household income, these losses are unequally distributed among households and do not take into account agricultural products not sold at market but needed for subsistence (WWF, 2008). Jones and Barnes (2006) asserted that lethally removing problem animals did not appear to be threatening population levels. However, they (ibid) cautioned that increasing perceptions of threats from wildlife conflict could undermine positive local attitudes towards wildlife in Caprivi, potentially resulting in increased retaliation, problem animal removals, and ultimately affecting wildlife population levels in the long term.

The high levels of HWC in Caprivi are due in large part to its high human and wildlife population densities. Caprivi boasts the second most densely populated area in Namibia, with over 4 people per square kilometer (Jones & Barnes, 2006). It also supports high concentrations of wildlife, including one of the largest populations of free ranging elephants in Africa (O'Connell-Rodwell et al., 2000). The dependence of the majority of Caprivians on subsistence farming increases their vulnerability to HWC and exacerbates livelihood insecurity already affected by environmental risks (e.g., floods, drought) and socio-economic challenges (e.g., limited market access, HIV/AIDS) (Jones & Barnes, 2006).

1.4. RESEARCH STATEMENT AND OBJECTIVES

Deeper theoretical understanding about the factors that influence perceptions of HWC-related risk and vulnerability may inform local HWC management by facilitating greater integration of stakeholders' risk priorities into decision making. Practically, wildlife stakeholders have expressed a need for more effective HWC-related interventions, which requires understanding of both how stakeholders differentially prioritize risks as well as identifying those most vulnerable to risks. This research provided knowledge on risk perception, vulnerability, and HWC in Caprivi.

Objective 1: Characterize HWC-related risks and risk perceptions to and from people and wildlife.

Approach: I explored stakeholders' perceptions of HWC-related risks to and from people and wildlife. Risk perceptions were quantified and described by querying perceived severity of HWC-related risks in regard to other risks to livelihoods and wildlife, describing risk intensities in a spatially explicit way, and examining perceptions of HWC-related risk and vulnerability to livelihoods and conservancy wildlife. Risk perceptions and

vulnerability were queried using both local livelihoods and conservancy wildlife as a risk target (i.e., the subject toward which the risk is directed).

Objective 2: Evaluate factors influencing risk perception associated with HWC.

Approach: I adapted Gore et al.'s (2007) factors influencing risk perception to measure stakeholders' perceptions of risk associated with HWC. I used seven constructs to measure risk perception: dread, environment, frequency, control (Gore et al., 2007), risk fairness (McDaniels, Axelrod, Cavanagh & Slovic, 1997; Schmidt & Wei, 2006), acceptability and consequence (Slovic, 1987). Additionally, I assessed the extent to which conservancy establishment influenced perceptions of HWC-related risks. Five demographic factors (age, decision-making authority, education, gender, resource wealth) were assessed to determine their influence on stakeholders' perception of HWC-related risks (Cutter et al. 2003; Naughton-Treves, 1997; Ogra, 2008). I measured risk perception relative to two risk targets: local livelihoods and conservancy wildlife.

Objective 3: Evaluate factors influencing vulnerability to HWC.

Approach: I assessed the extent to which conservancy establishment and demographic factors influenced perceptions of vulnerability to HWC-related risks to livelihoods and wildlife. I considered perceived HWC-related vulnerability to be a function of the frequency and perceived consequences of exposure to HWC (see Nathan, 2008; Satterfield et al., 2004) and considered perceived vulnerability to be a factor influencing risk perception (Figure 1). Five demographic variables theoretically linked to HWC-related vulnerability were tested, based on Cutter et al. (2003), Naughton-Treves (1997) and Ogra (2008): age, decision-making authority, education, gender, and resource wealth. I also described perceptions of spatial vulnerability related to HWC within the conservancy and

stakeholders' perceptions of exposure of livelihoods and wildlife to multiple HWC-related and non-HWC related risks.

1.5. THESIS ORGANIZATION

Chapter two of this thesis examines local stakeholders' conceptualization of HWC-related risks relative to other risks affecting local livelihoods and conservancy wildlife, describes local perceptions of risks both to and from wildlife due to HWC, and examines the effect that conservancy establishment has on perceptions of risk and vulnerability to HWC-related risks. Chapter three explores local perceptions of poaching as a risk to conservancy wildlife and examines stakeholder motivations to poach. This chapter also demonstrates a participatory method for identifying HWC vulnerability hotspots in the landscape, which has implications for targeted enforcement and interventions meant to increase compliance. Chapter four summarizes the theoretical, methodological and practical implications of this research. Points for future research are discussed. Appendices provide information on research procedures and provide breadth and depth to research findings.

Table 1.1: Definitions of research concepts and terminology

Concept	Definition
Biophysical vulnerability	The likelihood of a system's exposure to and ability to adapt to a hazard based on the biological, physical and/or geographic characteristics of the system (*adapted*: Cutter et al., 2003; Hogan & Marandola, 2005).
Community-based natural resource management (CBNRM)	A system of management of natural resources, for commercial and/or subsistence uses, by collective, local institutions for local benefit (Roe et al., 2009).
Compliance	Behavior of people to conform to rules, which may be formal laws or informal norms that have been formulated to influence their actions (Hauck, 2008).
Hazard	Anything with a potential to harm, injure or damage (Kerns & Ager, 2007) human, environmental or wildlife systems.
Human-wildlife conflict (HWC)	An action by either humans or wildlife that results in a negative effect, realized or perceived, upon the other (Conover, 2002).
Management interventions	Methods used to mitigate human wildlife conflicts, which include direct methods that are designed to reduce the frequency and severity of encounters between people and wildlife and indirect methods that attempt to raise human tolerance for encounters (Treves et al., 2009).
Risk	An estimation of both the likelihood of a hazard and the magnitude and character of the negative consequences of that hazard given that it occurs (Sjöberg, 2000a)
Risk assessment	A technical estimation of the probability and magnitude of consequences related to a given hazard (Renn, 1992).
Risk perception	Intuitive judgments about a hazard made by stakeholders (Slovic, 1987)

Table 1.1(continued): Definitions of research concepts and terminology

Concept	Definition
Social vulnerability	The likelihood of a system's exposure to and ability to adapt to a hazard based on the demographic, social and/or cultural characteristics of the system (adapted: Cutter et al., 2003; Hogan & Marandola, 2005).
Vulnerability	A system's potential for a loss in response to exposure to a hazard (Cutter et al., 2003) and the ability to recover or adapt to losses (Schmidtlein et al., 2008).
Vulnerability perception	A judgment of likelihood and sensitivity to harm from exposure to a hazard, which may include beliefs about the system's fragility, social or physical vulnerability (adapted: Satterfield et al., 2004).
Wildlife stakeholder	Any person affected by or will affect decisions related to wildlife management; includes those that benefit or are negatively effected by wildlife and/or those that have a vested or latent interest in wildlife, wildlife conservation or wildlife management (Decker, Brown & Siemer, 2001).

Figure 1.1: Conceptual framework of stakeholders' risk perception associated with human-wildlife conflicts.

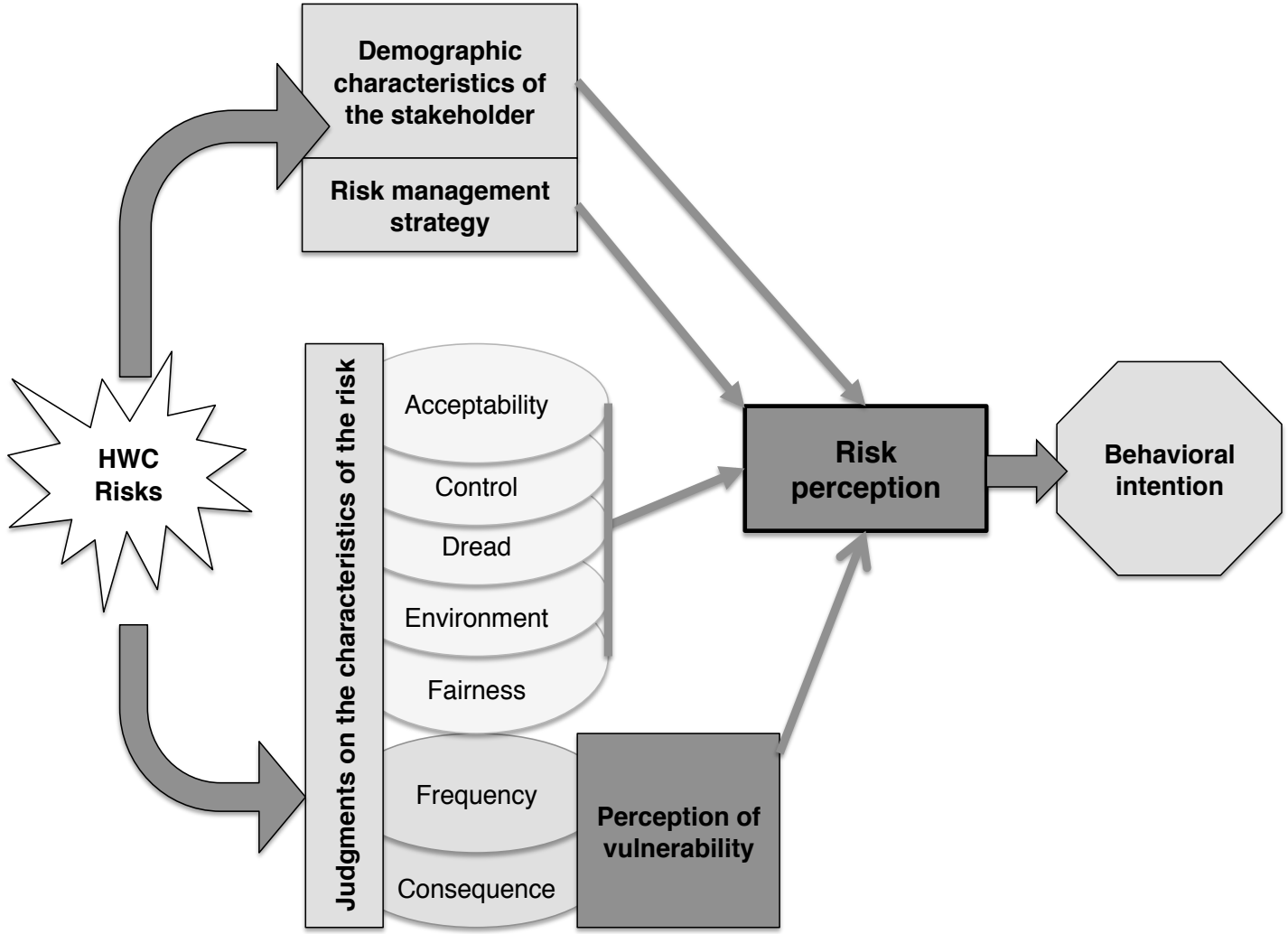


Figure 1.2: Map of the Study Area; Caprivi, Northeastern Namibia. For interpretation of the references to color in this and all other figures, the reader is referred to the electronic version of this thesis.

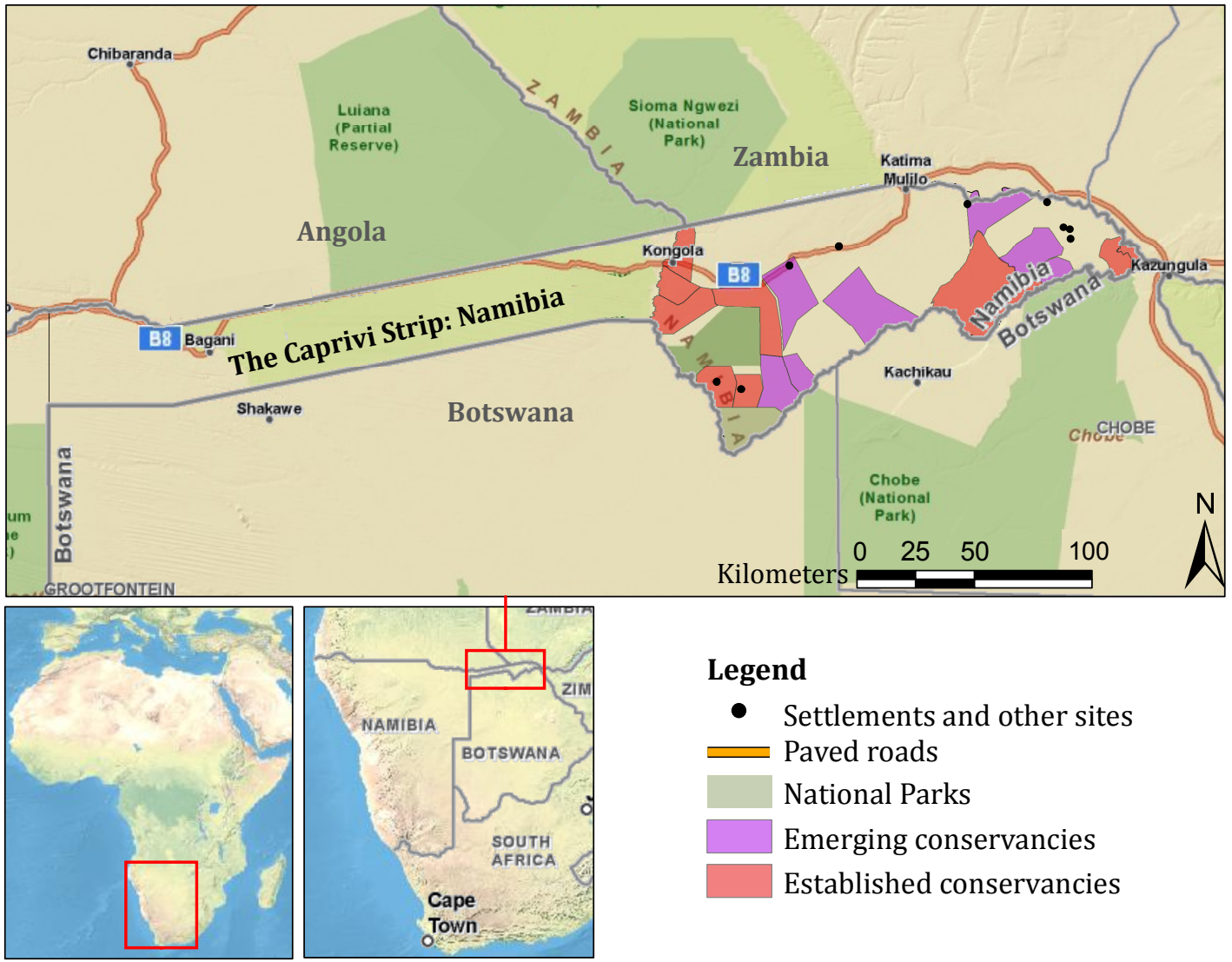
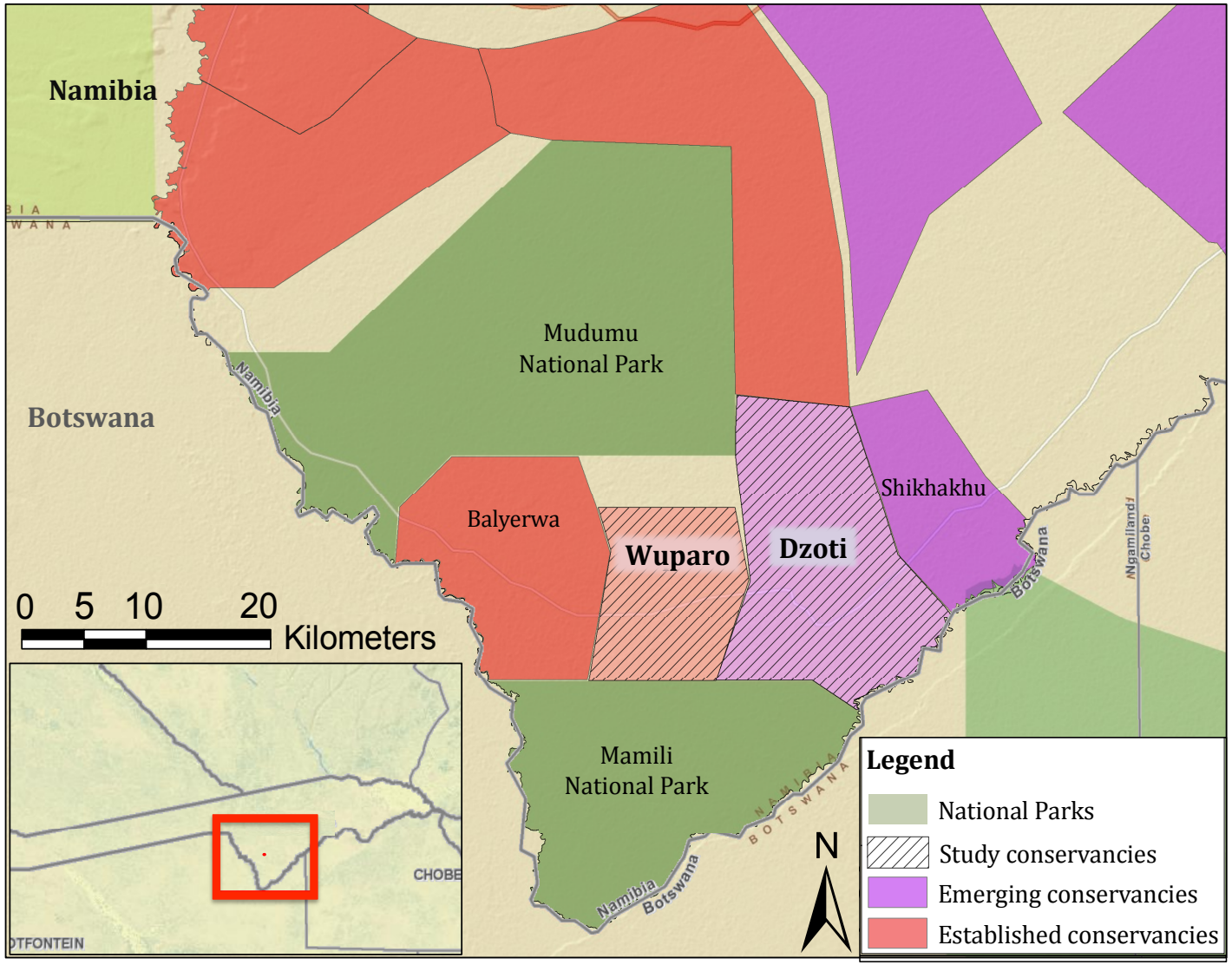


Figure 1.3: Map of Study Conservancies, Dzoti (emerging) and Wuparo (established), in Mudumu South Complex: Caprivi, Namibia.



CHAPTER 2: DOES CONSERVANCY ESTABLISHMENT AFFECT RESIDENTS' HUMAN-WILDLIFE CONFLICT RELATED RISK PERCEPTIONS? INSIGHTS FROM NAMIBIA.

2.1. INTRODUCTION

Negative human-wildlife interactions [i.e., human-wildlife conflicts (HWCs)] pose risks to human livelihoods and wildlife species globally and have been the subject of numerous studies within the context of livelihood development and wildlife conservation (see Hill, 2004; Kissui, 2008; Naughton-Treves, 1997; O'Connell-Rodwell, Rodwell, Rice & Hart, 2000). Practitioners have a large volume of best practices for managing HWCs in myriad contexts. Regardless of management strategy, species involved, or context, HWC management commonly aims to reduce risks to both people and wildlife. However, even with a substantial knowledge base, HWC persists and continues to be a high conservation and development priority for diverse stakeholders (Hill, 2004; O'Connell et al., 2000; Treves, Wallace & White, 2009). Management strategies that reduce HWC-related risks are of particular importance in landscapes managed under community-based approaches [i.e., community-based natural resource management (CBNRM)] as the success of economic development and wildlife conservation initiatives depend on coexistence of people and wildlife. Some scholars have suggested that because the outcomes of HWCs are ultimately rooted in human perceptions, actions, and reactions (Manfredo & Dayer, 2004) human dimensions insight about HWC-related risks is an essential but often overlooked part of the HWC management equation (Treves, Wallace, Naughton-Treves & Morales, 2006a). This research aims to contribute to the human dimensions knowledge base about HWC-related risks in CBNRM systems.

2.2. BACKGROUND

2.2.1. Community-based natural resource management.

CBNRM is the management of natural resource (e.g., wildlife, forest products) by collectives or local institutions to derive local benefits (e.g., commercial, subsistence use) (Roe, Nelson & Sandbrook, 2009). Theoretically, the primary incentive for locals to change unsustainable behaviors (e.g., poaching) hinges on the ability of CBNRM to develop and distribute benefits (Vaughan & Long, 2007). For example, using the case of wildlife, CBNRM should create benefits from the use of wildlife (e.g., selling trophy animals) that exceed the costs of living with wildlife (e.g., HWC-related risks) (Hoole, 2010). CBNRM systems may employ a suite of HWC management strategies, such as compensation schemes and preventative livestock husbandry practices, to reduce livelihood costs associated with living with wildlife. When benefits outweigh costs, CBNRM regimes may engender pro-conservation attitudes (i.e., greater tolerance, acceptance and conservation concern for wildlife) among stakeholders.

CBNRM has been used as a conservation tool for decades, however practitioners and scholars have extensively questioned its success in terms of providing either sustainable development or adequate biodiversity conservation (Shackleton, Willis, Brown & Polunin, 2010). Additionally, despite the fact that CBNRM approaches are theorized to positively influence local attitudes towards conservation initiatives, empirical evidence about the effects of CBNRM schemes on stakeholders' risk perception associated with HWC-related risks to and from wildlife is scant (see Schumann, Watson & Schumann, 2008). Although Schumann et al. (2008) found that farmers who were members of a commercial conservancy (e.g., type of CBNRM program in Namibia) reported greater tolerance for

carnivores regardless of their farming enterprise (e.g., livestock, mixed livestock/game), additional research is needed to evaluate whether CBNRM schemes can deliver similar results across diverse economic, environmental and social conditions, and stakes.

Ideally, CBNRM initiatives lower stakeholders' vulnerability to HWC-related risks and increase community members' ability to cope with the costs of living with wildlife through wildlife-derived benefits (Naughton-Treves, 1997). These benefits are thought to lower wildlife vulnerability to HWC by increasing stakeholder tolerance of wildlife when HWC occurs (Schumann et al., 2008) and reduce stakeholders' propensity to engage in unsustainable resource use (e.g., poaching) (Robertson & Lawes, 2005). Understanding vulnerability, an individual's sensitivity and ability to recover from losses when exposed to a hazard (e.g., HWC) (Cutter, Boruff & Shirley, 2003), requires, in part, knowledge about the multitude of risks that stakeholders and wildlife face that may aggravate sensitivity to a harmful event (Reid & Vogel, 2006) such as HWC. Research that incorporates local stakeholders' perceptions associated with multiple risks to livelihoods and wildlife can aid in understanding local vulnerability to specific risks (e.g., HWC) (Reid & Vogel, 2006; Smith, Barrett & Box, 2000; Tschakert, 2007).

2.2.2. Risk perceptions.

Risk perceptions are intuitive judgments made by stakeholders (Slovic, 1987); risk perceptions can influence stakeholders' risk-related decision-making (Gore, Wilson, Siemer, Hudenko, Clarke, Hart, Maguire & Muter, 2009) and may ultimately influence how individuals think and behave in response to risks (Baird, Leslie & McCabe, 2009). Stakeholder risk perceptions contribute to evaluating trade-offs between natural resource management alternatives (Gore et al., 2009) and may influence overall stakeholder support

for management actions (Gore, Knuth, Curtis & Shanahan, 2006; Knuth, Stout, Siemer, Decker & Stedman, 1992). The value of risk perception research in characterizing stakeholder attitudes towards wildlife, HWC and conservation initiatives has increasingly been demonstrated through empirical investigations in a variety of contexts (e.g., Baird et al., 2009; Gore et al., 2006; Hill, 2004; Knuth et al., 1992; LeBreton, Prosser, Tamoufe, Sateren, Mpoudi-Ngole et al., 2006; Muter, Gore & Riley, 2009).

Although we have a solid understanding of factors influencing stakeholders' risk perceptions associated with HWC, the target (i.e., the subject towards which the conflict consequences are directed) of those perceptions has always been people. There is a lack of understanding about factors influencing HWC risk perceptions with *wildlife* as the target (see McFarlane, 2005). Systematic investigations of local stakeholders' perceptions of HWC-related risk *to* wildlife, within a CBNRM context or otherwise, are largely absent from the literature. A question of interest to diverse stakeholders and practitioners is, "How do stakeholders perceive risks to wildlife from HWC?" Answering this question is important because perceptions of risk to wildlife could, much like livelihood-related HWC risk perceptions, influence stakeholders' responses to HWC incidents (Hill, 2004) and influence preferences for overall policy and management (McFarlane, 2005) of HWC; however, they may do so in different ways.

The literature about stakeholders' perceptions of HWC-related risks to livelihoods and wildlife relative to non-HWC related risks is nebulous and ill defined (see Baird et al., 2009). This is problematic because non-HWC related risks may increase both people's and wildlife's vulnerability to HWCs. Indeed, risks are not experienced as discrete entities (Baird et al., 2009) and exposure to one risk may aggravate sensitivity to or lessen one's

ability to adapt to another risk (Tschakert, 2007; Reid & Vogel, 2006). Increasing our understanding about the broader context in which HWC-related risks occur and the influence of CBNRM schemes on stakeholders' HWC-related risk perceptions can inform HWC theory and practice. Accordingly, I set two research objectives: 1) investigate the influence of CBNRM on perceptions of HWC-related risks and vulnerability; and 2) contextualize HWC-related risks relative to other livelihood and wildlife–related risks, according to the perceptions of HWC-vulnerable stakeholders.

2.2.3. Namibian conservancies.

In 1996, Namibia adopted a communal conservancy-based approach to natural resource management. Key features of the Namibian conservancy system include: 1) collaboration between government agencies, national non-governmental organizations and rural communities living on communal land (Stuart-Hill, Diggle, Munali, Tagg & Ward, 2005); 2) devolved rights over natural resources, including wildlife, to local communities (Barnes, MacGregor & Weaver, 2002); 3) a legislative basis for consumptive wildlife utilization (e.g., subsistence and commercial hunting); and 4) codified HWC management procedures (Ministry of Environment & Tourism (MET), 2009).

Namibia's conservancies are often considered successful CBNRM regimes in that they simultaneously conserve natural resources and preserve livelihoods (Hoole & Berkes, 2010). Residents of Namibian communal conservancies directly benefit from the sustainable use of, and decisions about, wildlife resources (Barnes et al., 2002). Literature on Namibia's conservancies often anecdotally assert that conservation success is, in large part, due to the positive effects of conservancies on local attitudes towards wildlife (e.g., Weaver & Skyer, 2005). While many Namibian conservancies report increased wildlife

populations (Nott & Jacobsohn, 2004), many also report increased frequencies and magnitudes of HWC (Jones & Barnes, 2006; MET, 2009). In 2009, in response to increasing reports of HWC across the country, the federal government established a legal framework for HWC management (MET, 2009). The legislation stipulated that HWC management and financial compensation to HWC-affected citizens residing in conservancies was the responsibility of the conservancies (MET, 2009).

2.3. METHODS

2.3.1. Study location

Two conservancies in East Caprivi, Wuparo (hereafter established [3]) and Dzoti (hereafter emerging), were selected for this research based on the: 1) recommendation of local and regional nongovernmental organizations with a long-term presence in the region; 2) permission of local and relevant traditional authorities; 3) willingness of conservancies to participate; 4) variation in conservancy management structure and function; and 5) comparability of conservancies based on similar habitat types, wildlife species composition, and presence of HWC (Table 2.1).

2.3.2. Data Collection

This research used a case study approach (Yin, 2009), focus groups, and semi-structured interviews to achieve the objectives. Both objectives were addressed using a multidirectional approach consistent with the notion that wildlife is both a source and recipient of the negative consequences of HWC-related risks. An identical research protocol was implemented in each conservancy. Six local research assistants were hired

[3] Wuparo was established in 1999 and Dzoti was established in 2009, after research concluded.

based on the following criteria: (1) fluent in English, Lozi, and/or Sheyeyi; (2) completed secondary school; (3) were not members of the conservancy committees or traditional authority; and (4) agreed to work the entire duration of research activities. All research assistants participated in a day-long training session before data collection commenced and in accordance with MSU Human Research Protection Program requirements.

Focus group and interview participants were solicited from each of the village zones (i.e., distinct residential areas) in proportion to the respective village's population using a random sampling technique (i.e., cluster sampling technique with probability proportionate to size) (Bernard, 2006). Given that there were no reliable lists (e.g., property tax records) of residents in the conservancies, this technique entailed identifying population clusters (i.e., village zones) and then assigning a given number of interviews to each cluster based on their population size relative to other clusters (Bernard, 2006). All village zones within each conservancy were sampled. Convenience sampling was used within each village zone (Bernard, 2006). This sampling protocol facilitated inferential statistical analysis that could be generalized to all residents of the study conservancies. However, results herein may not be generalized to the regional or national conservancy level.

Interview and focus group participants were all permanent residents of their respective conservancies and 18 years of age or older; ethnic affiliation, educational attainment, or socio-economic status were not prerequisites for participation. Gender parity was maintained by specifying an allotted number of participants to each gender within each cluster sampled. Only one participant per household was eligible to participate. Participation in one research activity (interview/focus group) did not exclude

participation in the other. However, interview and focus group participants were independently selected using the above-defined sampling protocols.

Focus Groups. In each conservancy, the lead researcher and six research assistants facilitated a two-day focus group (see Appendix A for protocol). Focus group participants were divided into three groups comprised of: 1) male residents; 2) female residents; and 3) local environmental decision-makers of either gender to promote a non-threatening and permissive environment for dialogue (Smith et al., 2000) and help diffuse power differentials between participants (Morgan, 1993).

The purpose of the focus group was to conduct participatory risk ranking and scoring (PRRS) activities (Quinn, Huby, Kiwasila & Lovett, 2003; Smith et al., 2000; Tschakert, 2007). During the four-step PRRS process, the participants first individually free-listed risks associated with a target. Second, participants assigned ordinal values to rank the importance of each risk. Third, participants rated the severity of each risk on a five-point Likert-type scale (1=not severe, 5=life threatening). Fourth, within their groups, participants shared and discussed their results, identifying what, if any, risks were related to HWC. The PRRS process was completed independently for two risk targets: local livelihoods and conservancy wildlife.

Semi-structured Interviews. Semi-structured interviews (Bernard, 2006) were conducted with conservancy residents concurrently with focus group activities. Interview questions elicited information related to non-demographic and demographic factors found to influence risk perception and vulnerability related to HWC (see Appendix B for interview guide). Most questions were measured using four-point visual Likert-type scales (0 = no risk, 1 = low, 2 = medium, 3 = high), which have been shown to lessen culturally-driven bias

towards neutral or extreme response categories (Reid, 1990; Roster, Albaum & Rogers, 2006) and are appropriate in situations of low literacy (Chachamovich, Fleck & Power, 2009). Likert-type scales were depicted visually to aid participant interpretation of scales in instances of low literacy (Appendix C).

I used seven constructs to measure non-demographic factors that influence risk perception: dread, environment, frequency, control (Gore, Knuth, Curtis & Shanahan, 2007), risk fairness (McDaniels, Axelrod, Cavanagh & Slovic, 1997; Schmidt & Wei, 2006), acceptability, and consequence (Slovic, 1987). Each construct was queried using at least one close-ended question designed to measure respondent's attitude and across three risk targets (i.e., general risk from HWC, risk to livelihoods, risk to wildlife). Risk perceptions to local livelihoods were defined as risks posed to individual livelihoods or immediate familial relations, while risks to wildlife were defined as risks posed to wildlife within the conservancy. Perceived HWC vulnerability was measured as a function of exposure risk (i.e., frequency of personal exposure to HWC) and perceived consequences (i.e., anticipated losses associated with exposure to a hazard) of HWC-related risks (see Nathan, 2008; Satterfield, Mertz & Slovic, 2004).

Five demographic variables were queried based on Cutter et al. (2003), Hill (2004), Naughton-Treves (1997) and Ogra (2008): age (years), decision-making authority (dichotomous), education (12 ordinal categories), gender (dichotomous), and resource wealth (agricultural, land and livestock holdings). Conservancy status (dichotomous) was recorded and two HWC deterrence behaviors, actively guarding crops and/or livestock against wildlife damage, were also queried.

Event Books. The Event Book system is the Namibian conservancy-based monitoring program used to monitor stochastic events (e.g., problem animal incidents, poaching) (Stuart-Hill et al., 2005). Event Book data represent reported HWC incident rates and were used to aid interpretation of conservancy effects on HWC-related risks and vulnerability perceptions. The date, species, location, incident type, specified damage and quantity of damages are recorded for each reported HWC incident. Event Book data between 2003 and 2008 were digitally photographed and transcribed with permission of relevant conservancy authorities.

2.3.3. Data Analysis

Focus Groups. An iterative process guided coding and analysis of individual participants' free-listed, ranked and scored risks generated during the PRRS activity (Bernard, 2006). First, I reviewed all text produced during the free-listing stage to generate a wide range of response categories (Saldaña, 2009). Next, I compared responses within categories and created a coding protocol to systematically transcribe each risk into an exclusive categorical variable (Bernard, 2006). Then, I coded all risks according to the protocol, revised protocol rules where appropriate, and conducted a final iteration of review coding to validate findings (Saldaña, 2009) (Appendix D). Three HWC risk themes were generated based on participant descriptions: direct, indirect and non-HWC. Direct HWCs included conflicts with unambiguous negative outcomes for humans or wildlife (e.g., crop damage, poaching), while indirect HWCs included conflicts with ambiguous outcomes (e.g., habitat alteration, increased human-wildlife interaction). Non-HWC related threats included risks not mediated through human-wildlife interactions (HWI) such as local climate (e.g., drought, flood).

I adapted statistical methods from Tschakert (2007) to analyze PRRS data. I calculated an incident index (I), importance index (P), joint risk index (R) and severity index (S) for each livelihood and wildlife-related risk. The incident index (I), ranging from 0 to 1, is the proportion of participants that identified a particular risk. The importance index (P), which also ranges from 0 to 1 (1=highest importance), reflects the ordinal rank that participants assigned to a particular risk in relation to the total number of risks listed, where r is the rank and n the total number of threats identified by that participant:

$$Pj = \left[\frac{(r-1)}{(n-1)}\right] \times (-1) + 1$$

The joint risk index (Rj) represents the most critical risk and is a function of a risk's average incident index score (Ij) and average importance index score (Pj); it ranges from 0 to 1 (1=most critical) and is calculated Rj= Ij/ (2-Pj). The severity index (S_j), represents the mean severity score assigned to each risk by participants that mentioned that risk and ranges from 0 to 5. Mean incidence (Ij), importance (Pj), joint risk (Rj), and severity (Sj) index scores were calculated for each conservancy.

Semi-structured Interview. Responses from four-point Likert-type scales (0=no risk; 1= low risk; 2= medium risk and; 3=high risk) were recoded as dichotomous variables (1=low risk; 2=high risk). All variables were cross-tabulated to assess the percentage of positive (yes or high) responses within each conservancy and Pearson chi-square tests were performed to test for statistically significant differences between the conservancies (Vaske, 2008). Binary logistic regression ($p \leq 0.05$) was used to calculate the odds of positive responses in the established conservancy compared to the emerging conservancy

(Schumann et al., 2008). Conservancy membership was set as the independent variable in all analysis and the emerging conservancy served as the reference group.

Summative scales were created using multiple questions in the survey conceptually related to dread (DREAD), frequency (FREQ), and consequences (CONSQ) of HWC for livelihood and wildlife risk targets. Cronbach's alpha was calculated as a measure of internal consistency for all summative scales related to concepts of dread, frequency and consequence; a value of 0.60 or higher was considered satisfactory (Vaske, 2008). Multiplicative scales were created for perceived vulnerability to livelihoods (VUL_{LH}) and wildlife (VUL_{WL}) by calculating a respondent's mean index scores for frequency and consequence question responses. Scales for perceived risk to livelihoods ($RISK_{LH}$) and wildlife ($RISK_{WL}$) were created by multiplying the mean index scores for dread and vulnerability. A wealth score, representing a per capita wealth measure, was developed based on Baird et al. (2009) and calculated as a function of a household's livestock assets and size of agricultural land holdings divided by the total number of people in the household [4].

Linear [Ordinary least squares (OLS)] regression [5] was used to: 1) assess how well conservancy status predicted the resulting dread, vulnerability and risk indices; and 2)

[4] Livestock and agricultural land values (price/hectare) were calculated using the Namibian Ministry of Environment and Tourism's (MET) payment scheme for livestock and 2009 crop damage estimates published in the Human Wildlife Self Reliance Scheme (MET, 2009). Price for fowl, not covered in compensation payments, was determined by local prices during field season, July-September 2009.

[5] To assess the appropriateness of OLS regression, I checked the distribution of variables for normality (skewness), examined residual plots to check for heteroscedasticity and

control for confounding predictors theoretically linked to risk perceptions (Vaske, 2008). Independent variables in the model included demographic factors: (1) conservancy status (1=established, 2 = emerging); (2) education (12 ordinal categories); (3) membership in local environmental decision-making body (0= no; 1= yes); (4) respondent's gender (0=male; 1=female); (5) respondents age (in years); and (6) respondent's wealth (index score). Pearson *r* tests were used to diagnose multicollinearity; values greater than 0.7 were considered correlated (Vaske, 2008). Independent variables were tested for entry into the model at $p \leq 0.05$ and removal from the model at $p \geq 0.10$ using a forward stepwise procedure (Vaske, 2008).

Event Book. Reported HWC incidents were analyzed using a series of two-sample independent *t*-tests for equality of the means between conservancies based on six years (2003-2008) of data collected on crop damage, livestock depredation and fatal human attacks. Additionally, *t*-tests were performed on the total HWC incidents, per capita HWC incidents and per area (km^2) HWC incidents. A Levene's test was used to test for the equality of variances (Vaske, 2008). All data was analyzed using PSAW 18 (SPSS Inc., 2009). The methods for this research were approved for the duration of the project by the Michigan State University (MSU) Committee on Human Subjects, Protocol ID# X09-443.

2.4. RESULTS

Fifty stakeholders (established conservancy = 30; emerging conservancy = 20) participated in PRRS activities related to livelihoods. Forty-eight stakeholders (established = 31; emerging = 17) participated in PRRS activities related to wildlife. Focus group participants

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performed a Durbin-Watson test for independence (Norušis, 2010). Non-normally distributed variables were log-transformed.

ranged in educational background from no formal schooling to college educated, age (18-60+ years), and all participated in some form of subsistence based activities or rural industries (e.g., artisanal fisheries, vegetable farming, thatch roof harvesting). A total of 76 local stakeholders (emerging= 41; established= 35) were interviewed. Demographic information was collected from interview participants (Appendix E). Interview participants ranged in formal education from no school to college educated, age (18-88), and all participated in some form of subsistence-based activity or rural industry.

2.4.1. Effect of conservancy status on risk and vulnerability perceptions.

Livelihoods. Emerging and established conservancy participants differed in their perceptions of which HWC-risks were the most critical and severe to livelihoods. Emerging conservancy participants rated crop damage and livestock loss as the most critical risks; socio-cultural insecurity and habitat modification were rated as the most severe (Table 2.3). Established conservancy participants rated poor human health and financial insecurity as the most critical; the most critical direct-HWC was crop damage (Table 2.3). Established conservancy participants rated poaching of conservancy wildlife and poor human health as the most severe (Table 2.3). However, poaching was reported by only 3% of established conservancy participants.

Emerging and established conservancies differed in their perception of acceptability of HWC-related risks to livelihoods. Established conservancy participants were nearly four times as likely to perceive risks to livelihoods as more acceptable than those in the emerging conservancy (Table 2.4). Overall worry about HWC-related risks to livelihoods was high in both conservancies, with 71% of established conservancy and 85% of emerging conservancy residents judging these risks as high (Table 2.4).

Conservancy status predicted the proportion of positive responses associated with the equality of benefit distribution in the conservancy (e.g., meat allocation from trophy hunts, problem animal removal); emerging conservancy participants reported higher perceived consequences of HWC in terms of losses to household food supply, income, labor and happiness (Table 2.4). Conservancy status did not influence beliefs about the level of personal control of experiencing a conflict with wildlife, the frequency of HWC in conservancy, or propensity of respondents reporting that they guard livestock (Table 2.4).

Conservancy status and education level predicted livelihood-related dread and consequences associated with HWC; residents of the established conservancy and those with higher educational attainment perceived HWC effects on livelihoods as less dreaded and of less consequence (Table 2.5). Conservancy status did not predict perceptions of vulnerability to HWC; participants with less education and those having local decision-making authority held higher perceptions of vulnerability (Table 2.5). Residents of the established conservancy, those with higher education and non-decision makers held lower HWC-related risk perceptions to livelihoods. These demographic factors explained 20% of the variance related to HWC-related risk perceptions to livelihoods (Table 2.5)

Wildlife. Emerging and established conservancy participants differed in their perceptions about relative severity and critical nature of risks to wildlife; they revealed more agreement about the criticalness of a variety of risks (e.g., agricultural activities, habitat modification) (Table 2.3). The emerging conservancy rated wildlife deterrence activities and agricultural activities as most critical; agricultural activities and legal hunting were considered most severe (Table 2.3). The established conservancy participants rated

poaching and agricultural activities as most critical risks to wildlife; ecological threats and poaching were viewed as most severe (Table 2.3).

Conservancy status did not influence the acceptability of HWC-related risks to wildlife (emerging = 51.4; established= 68.3), both conservancies judged these risks as more acceptable to wildlife than livelihoods (Table 2.4). Established conservancy participants rated risks to wildlife from HWC as being high 74% of the time whereas the emerging conservancy participants rated risks to wildlife as high 50% of the time (Table 2.4). There were no differences between conservancy participants in regard to their perceived consequences of HWC on wildlife. Both conservancies' participants rated the consequence of reduced resources for wildlife due to HWC as high concern (emerging= 92.7; established = 88.6) (Table 2.4).

Conservancy status did not enter into any model to predict wildlife-related risk perceptions (Table 2.5). Age of participants influenced their beliefs about the frequency of HWC incidents directed towards wildlife, vulnerability, and risk perceptions to wildlife. The older the participant, the more likely they were to perceive HWC incidents as being less frequent, wildlife as less HWC-vulnerable, and HWC as less risky to wildlife (Table 2.5). Overall risk perception to livelihoods (mean =11.41; SE=5.93, n=73) was over five times higher than risk perception to wildlife (mean =2.00; SE=2.19, n=76).

Assessed HWC. The mean number of total reported HWC incidents varied according to conservancy (emerging = 126.67; established = 71.83; t = 3.98; df =10; $p < 0.05$). The difference is largely driven by livestock depredation incidents (emerging= 56.33; established= 27.33; t = 2.81; df=10; $p < 0.05$) (Table 2.6). Although there was no difference in the mean number of total HWC incidents per area (km^2), the emerging conservancy

reported higher per capita rates of problem animal incidents than the established conservancy (emerging = 0.32; established = 0.03; t = 10.44; *df*=5.23; $p<0.05$) (Table 2.6).

2.4.2. HWC-related risks relative to other risks to livelihoods and wildlife.

Participants listed 165 risks to livelihoods (mean= 3.3, range 2-11) that were grouped into 15 risk categories. Participants also generated a total of 157 risks to wildlife (mean= 3.3, range 1-9) summarized by 14 risk categories. Nine risk categories were cross-listed as affecting both livelihoods and wildlife; 21 discrete risk categories were generated and included direct (n=8) and indirect (n=6) HWC and non-HWC related risks (n=7) (Table 2.2). Pooling data between conservancies, non-HWC risks (Rj=0.65) were considered the most threatening to livelihoods, followed by direct-HWC risks (Rj= 0.59) and indirect-HWC risks (Rj=0.24). Direct-HWC risks (Rj=0.65) and indirect-HWC risks (Rj= 0.60) were seen as the most critical to wildlife but non-HWC related risks (Rj=0.34) were also considered threatening to wildlife.

Livelihood risk categories were plotted using increasing incidents (Ij) against increasing importance (Pj) (Figure 2.1). No risk was rated as having low importance and high incidence. The risk to livelihoods with the highest incidence was crop damage; poaching was rated most important to livelihoods (Figure 2.1). Direct HWCs tended to have high importance (>0.4) and the largest range of incidence (0.02 to 0.52). Indirect HWCs were rated as having low incidence (<0.4) and increased in a linear fashion with increasing importance. The majority of non-HWC risks were rated as moderately important ($0.34 \geq 0.57$) with a wide range of incidence ($0.18 \geq 0.50$). The most severe risk was crop damage (Figure 2.1).

The distribution of plotted risks to wildlife was non-linear with the majority of risks rated as moderate to high importance (3.0 > 7.0) and ranging from low to high incidence (Figure 2.2). The wildlife risks with the highest incidence were agricultural activities and poaching. Human financial insecurity and legal hunting were ranked the highest in terms of importance. Poaching and wildlife deterrence activities were rated as high incidence (≥ 0.50), hunting was of moderate incidence (< 0.4) and retaliation was of low incidence (<0.2) (Figure 2.2). Indirect HWCs were widely dispersed in terms of incidence (I = 0.04 to 0.67) yet moderate in terms of importance (Pj= 0.32 to 0.56). Non-HWC related risks were rated as low incidence (<0.4); ecological threats, local climate and human financial insecurity were of moderate to high importance (Figure 2.2).

2.5. DISCUSSION

2.5.1. Conservancy effects on HWC-related risk perceptions.

Conservancy status affected overall perceptions of risk related to livelihoods and consequences of HWC-related risks to local livelihoods, but conservancy status it did not have the same effects on risk perceptions to wildlife. Conservancy status also influenced the prioritization of HWC-related risk to both livelihoods and wildlife and preferences for management. Residents of the established conservancy found the distribution of HWC-related benefits more equitable, risks to livelihoods less dreaded, and more acceptable than residents of the emerging conservancy. There was no effect of conservancy establishment on residents' feelings of control over experiencing HWC events. Nearly 60% of residents in the established conservancy and 40% in the emerging conservancy felt they had little control over experiencing HWC. This finding may be of high relevance to conservation practitioners. Perceptions that HWC are largely uncontrollable may lead to conservancy

residents failing to take preventative measures, even if risk management practices (e.g., chili bombs, lion proof fencing) exist and are promoted at the conservancy level (McDaniels et al., 1997). However, perceived control over experiencing HWC may not be the only factor influencing residents' participation in wildlife deterrence activities. For example, emerging conservancy residents ranked wildlife deterrence activities as the most critical risk to wildlife in their conservancy. This may indicate that managers need to evaluate the social acceptability of interventions designed to reduce conflict (Treves et al., 2009), as current methods may be deemed effective in terms of reducing risks to humans but too risky to wildlife.

Residents in the established conservancy may be displaying attitudes consistent with the notion that devolved rights over wildlife promote more positive attitudes towards wildlife conservation (Hoole, 2010). There was a higher propensity for residents in the established conservancy to report higher "overall worry" about HWC-effects on wildlife. Additionally, established conservancy residents ranked poaching as a threat to wildlife and local livelihoods, which may indicate that the devolution of wildlife ownership to local communities may be affecting local attitudes towards wildlife as a resource. However, conservancy status did not influence factors affecting risk perception to wildlife, such as acceptability, dread, consequences and vulnerability. This may indicate that changes in local attitudes towards wildlife may be more broadly tied to individual rights to use wildlife as an economic resource, and the perceived fairness of benefit distribution (Robertson & Lawes, 2005), rather than concerns over wildlife conservation or ecological sustainability.

Interpreting the effects of conservancy status on HWC-risk perceptions also necessitates understanding historical HWC incidents (realized risk) (Sjöberg, 2000b).

Although established conservancy residents had overall lower perceptions of HWC-related risks, they also experience significantly lower historical incidents of reported HWC (hereafter realized risk). Differences in realized risk between conservancies were largely influenced by livestock depredation rates in the emerging conservancy. Residents in the two conservancies did not differ in their perceptions of the frequency of HWC events and in their livestock guarding behavior, despite the emerging conservancies higher realized risk. This suggests that conservancy status may have a greater effect on the emotional, value-laden, factors that influence risk perception (dread, acceptability) rather than more calculated, analytical, cognitive factors (frequency, control) (Slovic, Fiucane, Peters & MacGregor, 2004).

Greater understanding about differences between realized and perceived HWC-risks could lead to effectively deconstructing the 'conservancy effect' into various components that may affect residents' perceptions and attitudes. Is it the resource tenure system (i.e., devolved resource rights) (Sutherland, Adams, Aronson, Aveling, Blackburn, Broad et al.,2009) that is affecting HWC-related attitudes in the conservancies? Is it the economic incentives (e.g., HWC compensation, trophy hunting revenues) (Sutherland et al., 2009) associated with conservancy establishment? What part does the provision of education, outreach or information (Sutherland et al., 2009) play in shaping HWC and conservation-related behavior? What role does realized risk (Sjöberg, 2000b) play in the affects of conservancy status on stakeholders' HWC risk perceptions? Ultimately, answering these questions may lead to improved HWC management in existing CBNRM areas and inform the appropriateness of using CBNRM to manage HWC in additional contexts.

2.5.2. Human-wildlife conflict relative to other risks.

A diversity of risks impact local livelihoods and wildlife. Both direct and indirect HWCs figured prominently into conservancy residents' conceptualization of threats to local livelihoods. However, when taken together, risks characterized as being unrelated to wildlife (non-HWC) were most threatening to livelihoods. Given that vulnerability may emerge or be exacerbated by multiple stressors (Reid & Vogel, 2006; Tschakert, 2007), understanding the larger risk context of an individual stakeholder or wildlife species could provide an indication of their overall vulnerability to HWC events. For example, participants often mentioned flooding increased human-wildlife interactions because flooding forced wildlife and people to compete for less space, resulting in increased frequency and sensitivity to crop raiding.

Examining HWC-related risk perceptions in a multidirectional manner is consistent with the evolution away from synonymous treatment of HWC as a wildlife damage event (Peterson, Birckhead, Leong, Peterson & Peterson, 2010) and gives a forum for local stakeholders to demonstrate their understanding of the negative consequences of HWC on not only their livelihoods but wildlife as well. For example, technical assessments of anthropogenic risks to wildlife, such as poaching (Waltert, Meyer & Kiffner, 2009), habitat alteration (Laurance, Croes, Guissouegou, Buij, Bethier & Alonso, 2008) and human socio-economic conditions (Dudley, Ginsberg, Plumptre, Hart & Campos, 2002), are common in the conservation literature. Results presented herein about the risk ranking exercise indicated that conservancy residents also perceive ties between human socio-economic conditions and wildlife conservation. For instance, stakeholders cited that high

unemployment, poverty, land and agricultural insecurities all exacerbated human and wildlife vulnerability to and decreased stakeholder tolerance of HWC.

What extent does conservancy residents' prioritization and quantification of HWC-related risks overlap with those of conservation agency and organizational professionals' risk assessments? Identifying overlapping concerns may aid in prioritization of risk management interventions and help further promote the role of conservancy stakeholders as influential in wildlife-related decision-making (Treves et al., 2006a), which aligns with the ideals of CBNRM. Identifying risk priorities of mutual concern to communities and managers may bolster community support for management and foster cooperation between conservancy residents and managers to more effectively address local risks to wildlife (Treves et al., 2006a).

Taken together, the results of conservancy residents' characterization of risks suggest that successful HWC management may necessitate addressing non-wildlife related risks (e.g., poor human health) as the social acceptability and tolerance of HWC appear to be closely tied to overall gains in human livelihood development and security. Further, conservationists interested in improving human welfare through sustainable development projects will need to consider the ramifications of such projects on relationships between local people and wildlife in order to avoid unintentionally exacerbating conflict or negatively affecting wildlife resources. Given that completely eliminating HWC-related risks is untenable (MET, 2009) and even undesirable in many circumstances, identifying non-HWC related risks that may be more efficiently managed could help reduce vulnerability to HWC-related risks.

3.5.3. Conclusion.

This research extends the current HWC literature by exploring stakeholder-perceptions of HWC-related risks *to* wildlife in addition to risk perceptions *from* wildlife, and includes empirical investigation of conservancy membership as a factor influencing HWC-related risk perceptions. Understanding local stakeholder perceptions of risks and vulnerability to livelihoods and wildlife may help managers better design HWC-interventions, prioritize threats for management and mitigation, and create vulnerability-reducing management plans that assist the most HWC-sensitive individuals and wildlife species in conservancies. Important questions remain. There is less understanding of the factors that influence the perceptions of HWC-related risks to wildlife versus those that influence perceptions of HWC-related risks to livelihoods. Further inquiry is also needed to understand the adaptive capacity of communities in the face of HWC-related risks and should incorporate community perceptions of risk and vulnerability (Flint & Luloff, 2005). Greater understanding of how HWC-related and non-HWC related risks interact to shape stakeholders' responses would have both theoretical and practical applications on understanding the effect that conservation initiatives (e.g., conservancies) have on attitudes and behaviors (Baird et al., 2009).

Table 2.1: Characteristics of study conservancies in East Caprivi, Namibia

	Dzoti & Wuparo Conservancies	
Climate	Semi-arid (Average annual rainfall ≥625 mm)	
Biome classification	Mosaic of mopane (*Colophospermum mopane*) woodland, Kalahari grassland with floodplains	
Major wildlife resources [a]	Buffalo, Duiker, Elephant, Impala, Kudu, Leopard, Lion, Reedbuck, Roan, Tsessebe, Warthog, Wildebeest	
	Dzoti	**Wuparo**
Registered	October 2009 [b]	December 1999
Management classification	Emerging [b]	Established
Size	245 km ^{2}	148 km ^{2}
Approximate population density	1.6 per km ^{2}	14.2 per km ^{2}
Village zones	5	3
HWC compensation scheme	No	Yes
Hunting concessions	No	Yes
Problem animal removal	Yes	Yes
Alternative income generation	No	Yes
Traditional authorities (kutas)	Chief Mbambo; Chief Sifu	Chief Sifu

[a] Based on Conservancy Profile (NASCO, 2009) for Wuparo; Conservancy information for Dzoti not available at this time yet Wuparo information is an appropriate proxy due to their continuity in the landscape

[b] Conservancy not established during research timeframe; table treats remaining characteristics as pre-registration condition.

Table 2.2: Risk categories, select category attributes, and risk themes (direct, indirect, non-HWC) generated during risk ranking activity in two conservancies (n=50): Caprivi, Namibia (July-September, 2009)

DIRECT HUMAN-WILDLIFE CONFLICT
Crop damage
Buffalo, elephants, porcupine
Human attack
Elephants, lions
Hunting
Commercial, local subsistence
Monetary utilization of wildlife
Human-wildlife conflict (general)
Buffalo, elephants, hippopotamus, lion
Livestock loss
Elephants, hyena, lion
Poaching
Firearms, snares and traps
Retaliation
Poisoning wildlife, retaliation
Wildlife deterrence activities
Chili, fence, shooting firearms

INDIRECT HUMAN-WILDLIFE CONFLICT
Agricultural activities
Farming, fire, livestock operations
Conservancy service & management
Insufficient benefits, compensation
Lack of infrastructure, zonation
Poor enforcement and patrolling
Development
Development in wildlife corridors
Pollution-waste
Roadways and transportation

INDIRECT HUMAN-WILDLIFE CONFLICT
Habitat modification
Deforestation
Environmental Damage
Increased human-wildlife interaction
Increased proximity, intimidation
Resource competition
Subsistence insecurity
Agriculture, food, land
Livestock disease

NON-HUMAN-WILDLIFE CONFLICT
Climate
Drought, flooding
Ecological threats
Insect pests, natural predation
Wildlife disease
Education and training
Lack of education, training
Financial insecurity
Lack of money, work, social security
Poverty
Poor human health
Bad Health, malaria
HIV/ AIDS
Rural services & infrastructure
Lack of potable water, infrastructure
Poor healthcare, living conditions
Socio-cultural insecurity
Alcohol, domestic violence
Social conflict, war

Table 2.3: Perceived ranking and severity of risks to local livelihoods and wildlife in two conservancies (emerging=20; established= 30) in East Caprivi, Namibia (July-September 2009).

Livelihood Risk Categories	Pooled (n=50)		Ranking of risks (Rj)		Severity of risks (Sj)	
	Ranking (Rj)	Severity (Sj)	Emerging	Established	Emerging	Established
Crop Damage	1 (0.37)	4.0	1 (0.58)	5 (0.23)	4.3	3.6
Poor human health	2 (0.34)	3.5	3 (0.29)	1 (0.37)	2.9	3.8
Financial insecurity	3 (0.26)	2.9	5 (0.20)	2 (0.29)	4.0	2.5
Education	4 (0.24)	3.2	6 (0.17)	2 (0.29)	3.8	3.0
Livestock loss	5 (0.22)	3.4	2 (0.32)	7 (0.16)	3.3	3.4
Conservancy services	6 (0.21)	2.8	6 (0.17)	5 (0.23)	3.3	2.6
Socio-cultural insecurity	7 (0.18)	3.1	10 (0.05)	3 (0.27)	5.0	3.0
Rural infrastructure	7 (0.18)	3.1	5 (0.20)	6 (0.17)	3.9	2.4
Human-wildlife conflict [a]	7 (0.18)	3.3	8 (0.09)	4 (0.24)	4.0	3.2
Subsistence insecurity	8 (0.15)	2.9	7 (0.16)	8 (0.15)	3.3	2.6
Human attack	9 (0.14)	3.0	4 (0.21)	10 (0.10)	3.3	2.5
Climate	10 (0.11)	3.4	9 (0.07)	9 (0.14)	2.5	3.7
Human Wildlife Interaction	11 (0.09)	3.1	8 (0.15)	12 (0.06)	3.8	2.3
Habitat modification	12 (0.06)	3.6	9 (0.06)	11 (0.06)	4.5	3.0
Poaching	13 (0.02)	4.0	na na	13 (0.02)	na	4.0
Ecological threats	14 (0.01)	2.0	11 (0.03)	na na	2.0	na

[a] Participant provided general designation of human-wildlife conflicts or multiple conflicts on one card.

Table 2.3 (continued): Perceived ranking and severity of risks to local livelihoods and wildlife in two conservancies (emerging= 17; established = 31) in East Caprivi, Namibia (July-September 2009).

Wildlife Risk Categories	Pooled (n=48)		Ranking of risks (Rj)		Severity of risks (Sj)	
	Ranking (Rj)	Severity (Sj)	Emerging	Established	Emerging	Established
Agricultural activities	1 (0.46)	3.2	2 (0.50)	2 (0.44)	4.0	2.8
Poaching	2 (0.37)	3.5	6 (0.14)	1 (0.50)	3.3	3.6
Wildlife deterrence	3 (0.34)	3.1	1 (0.51)	6 (0.25)	3.4	2.8
Development	4 (0.31)	3.2	5 (0.29)	4 (0.31)	3.3	3.1
Human Wildlife Interaction	5 (0.29)	2.9	3 (0.49)	7 (0.20)	3.1	2.6
Habitat modification	6 (0.28)	2.9	5 (0.29)	5 (0.27)	2.8	3.0
Hunting	7 (0.23)	3.4	4 (0.39)	8 (0.16)	3.7	3.0
Climate	7 (0.23)	3.3	na na	3 (0.37)	na	3.3
Retaliation	8 (0.07)	2.8	7 (0.12)	9 (0.05)	3.3	2.0
Ecological threats	9 (0.05)	2.7	9 (0.03)	11 (0.07)	2.0	4.0
Financial insecurity	9 (0.05)	2.8	8 (0.08)	10 (0.03)	2.0	3.0
Subsistence insecurity	10 (0.04)	2.0	8 (0.08)	12 (0.02)	2.0	2.0
Conservancy services	11 (0.03)	3.0	na na	9 (0.05)	na	3.0
Socio-cultural insecurity	12 (0.02)	1.5	9 (0.03)	12 (0.02)	1.0	2.0

Table 2.4: The effect of conservancy status (emerging=41; established=35) on attitudes towards human-wildlife conflict (HWC), as expressed by odds ratios: Caprivi, Namibia (2009)

	Percentage of positive responses [a]		Odds [b] of positive responses for established compared to emerging		
Variable	Emerging	Established	Coefficient	Odds ratio	
Benefits from wildlife dispersed	9.8	42.9 *	1.94	6.94	*
Risks from wildlife dispersed	73.2	55.9	-0.77	0.46	
HWC risks to livelihoods	19.5	48.6 *	1.36	3.90	*
HWC risks to wildlife acceptable	51.4	68.3	-0.71	0.49	
Household guards livestock	65.9	74.3	0.40	1.50	
Household guards crops	100.0	75.0 *	-20.1	•	[c]
	Percentage of high responses		Odds of high responses for established compared to emerging		
General HWC attitudes	Emerging	Established	Coefficient	Odds ratio	
Overall worry about risks to	85.4	71.4	-0.85	0.43	
Overall worry about risks to	50.0	74.3 *	1.06	2.89	*
Frequency in conservancy	78.0	82.8	0.31	1.36	
Control over exposure	60.0	41.5	0.75	2.12	
Increase due to natural factors	82.9	62.9 *	-1.05	0.35	
development	70.7	58.8	-0.53	0.59	
Perceived consequence of HWC to household					
Loss of household food supply	97.6	82.9 *	-2.11	0.12	
Loss in household income	97.6	77.1 *	-2.47	0.08	*
Loss of household labor	95.1	74.3 *	-1.91	0.15	*
Reduction in social status	92.7	88.6	-0.49	0.61	
Reduction in happiness	97.6	82.9 *	-2.11	0.12	
Perceived consequence of HWC to local wildlife					
Reduction in abundance	70.7	68.6	-0.10	0.93	
Reduction in diversity	75.0	71.4	-0.18	0.83	
Increase in local extinction	78.0	65.7	-0.62	0.54	
Reduction in health	77.5	74.3	-0.18	0.84	
Reduction in wildlife resources	92.7	88.6	-0.49	0.61	

[a] Pearson chi square

[b] Binary logistic regression

[c] Logistic regression invalid due to lack of

* Significant at P≤ 0.05

Table 2.5: Ordinary least squares (OLS) regression coefficients (± standard error) for estimated affects of conservancy status on HWC perception scores (n=73) for dread (DREAD), frequency (FREQ), consequence (CONSQ), vulnerability (VUL) and risk (RISK) to livelihoods (X_{LH}) and wildlife (X_{WL}) controling for age, decision-making authority, education, gender and wealth: Caprivi, Namibia (2009).

Risk Target: Familial livelihoods	**$DREAD_{LH}$**	**$FREQ_{LH}$**	**$CONSQ_{LH}$**	**VUL_{LH}**	**$RISK_{LH}$**
	Model 1	Model 1	Model 1	Model 1	Model 1
Constant	19.24 (0.45)	9.21 (0.46)	21.93 (0.60)	4.33 (0.36)	11.16 (0.77)
Conservancy (1=Established)	-2.15 (0.69)		-3.11 (0.89)		-2.89 (1.16)
Age (# of years)					
Authority (1=decision-maker)		2.32 (0.95)			
Education (ordinal scale)				-0.13 (0.06)	
Gender (1=female)					
LogWealth (index)					
R^2	*0.12*	*0.08*	*0.14*	*0.07*	*0.07*
	Model 2	Model 2	Model 2	Model 2	Model 2
Constant	20.62 (0.70)		24.21(0.90)	4.20 (0.34)	13.69 (1.19)
Conservancy (1=Established)	-2.26 (0.66)		-3.28 (0.84)		-3.08 (1.11)
Education (ordinal scale)	-0.26 (0.10)		-0.43 (0.13)	-0.16 (0.06)	-0.47 (0.18)
Authority (1=decision-maker)				1.19 (0.46)	
R^2	*0.19*		*0.25*	*0.16*	*0.14*
	Model 3	Model 3	Model 3	Model 3	Model 3
Constant					13.11 (1.18)
Conservancy (1=Established)					-2.66 (1.09)
Education (ordinal scale)					-0.54 (0.17)
Authority (1=decision-maker)					3.15 (1.30)
R^2					*0.20*

All reported values significant at $p \leq 0.05$

Table 2.5 (continued): Ordinary least squares (OLS) regression coefficients (± standard error) for estimated affects of conservancy status on HWC perception scores (n=73) for dread (DREAD), frequency (FREQ), consequence (CONSQ), vulnerability (VUL) and risk (RISK) to livelihoods (X_{LH}) and wildlife (X_{WL}) controling for age, decision-making authority, education, gender and wealth: Caprivi, Namibia (2009).

Risk Target: Conservancy Wildlife	**$DREAD_{WL}$**	**$FREQ_{WL}$**	**$CONSQ_{WL}$**	**VUL_{WL}**	**$RISK_{WL}$**
	Model 1	Model 1	Model 1	Model 1	Model 1
Constant		9.39 (1.12)		3.51 (0.44)	3.60 (0.69)
Conservancy (1=Established)					
Age (years)		-0.08 (0.02)		-0.04 (0.01)	-0.04 (0.02)
Authority (1=decision-maker)					
Education (ordinal scale)					
Gender (1=female)					
LogWealth (index)					
R^2		*0.14*		*0.18*	*0.09*

All reported values significant at $p \leq 0.05$

Table 2.6: Results of two-sample independent t-tests for equality of means[a] for total and mean annual incidents of wildlife damage in an emerging and established conservancy (Event Book Data, 2003-2008)

Incident type	Total incidents for years 2003-2008		Mean annual incidents (± std. error)		Test statistics		
	Emerging	Established	Emerging	Established	t	df	Sig.
Agriculture damage	419	260	69.83 (15.62)	43.33 (7.24)	1.54	10	
Livestock depredation	338	164	56.33 (15.33)	27.33 (5.31)	2.81	10	*
Humans attacked	3	7	0.5 (0.22)	1.17 (0.48)	-1.27	10	
Total HWC incidents	760	431	126.67 (10.73)	71.83 (8.65)	3.98	10	*
Total HWC per capita	1.94	0.21	0.32 (0.03)	0.03 (0.00)	10.4	5.2	**
Total HWC per km ^{2}	3.10	2.91	0.52 (0.04)	0.49 (0.06)	0.43	10	

[a] *Levene's test used to test for the equality of variances (α=0.05)*

** p<0.05 (equal variance - two-sample pooled t-test)*

***p<0.05 (unequal variance - two-sample un-pooled t-test)*

Figure 2.1: Conservancy residents' perceptions (n=50) about the incidence and importance of risks to livelihoods in two conservancies (n= 50) in East Caprivi, Namibia (Focus groups; July-September, 2009).

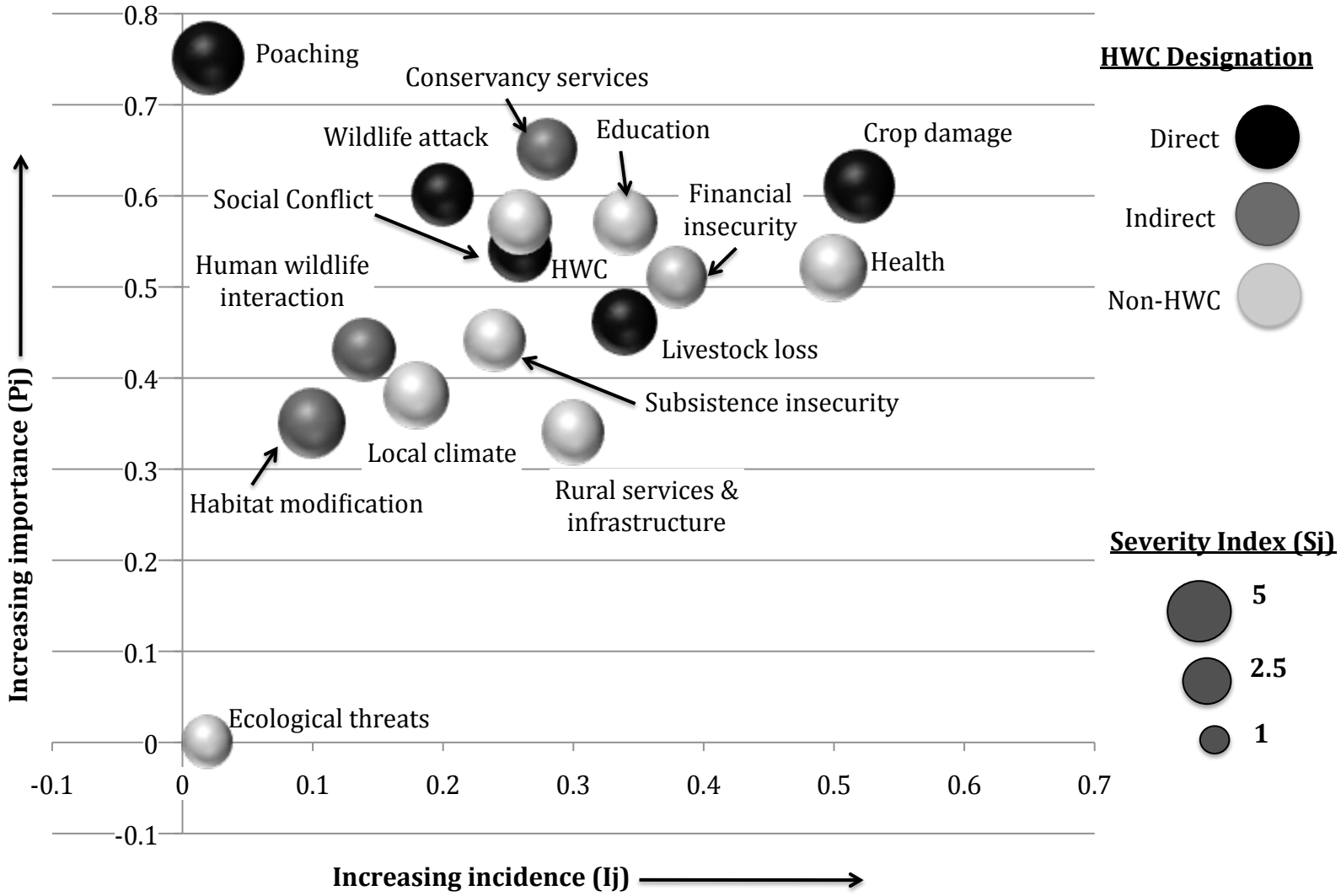
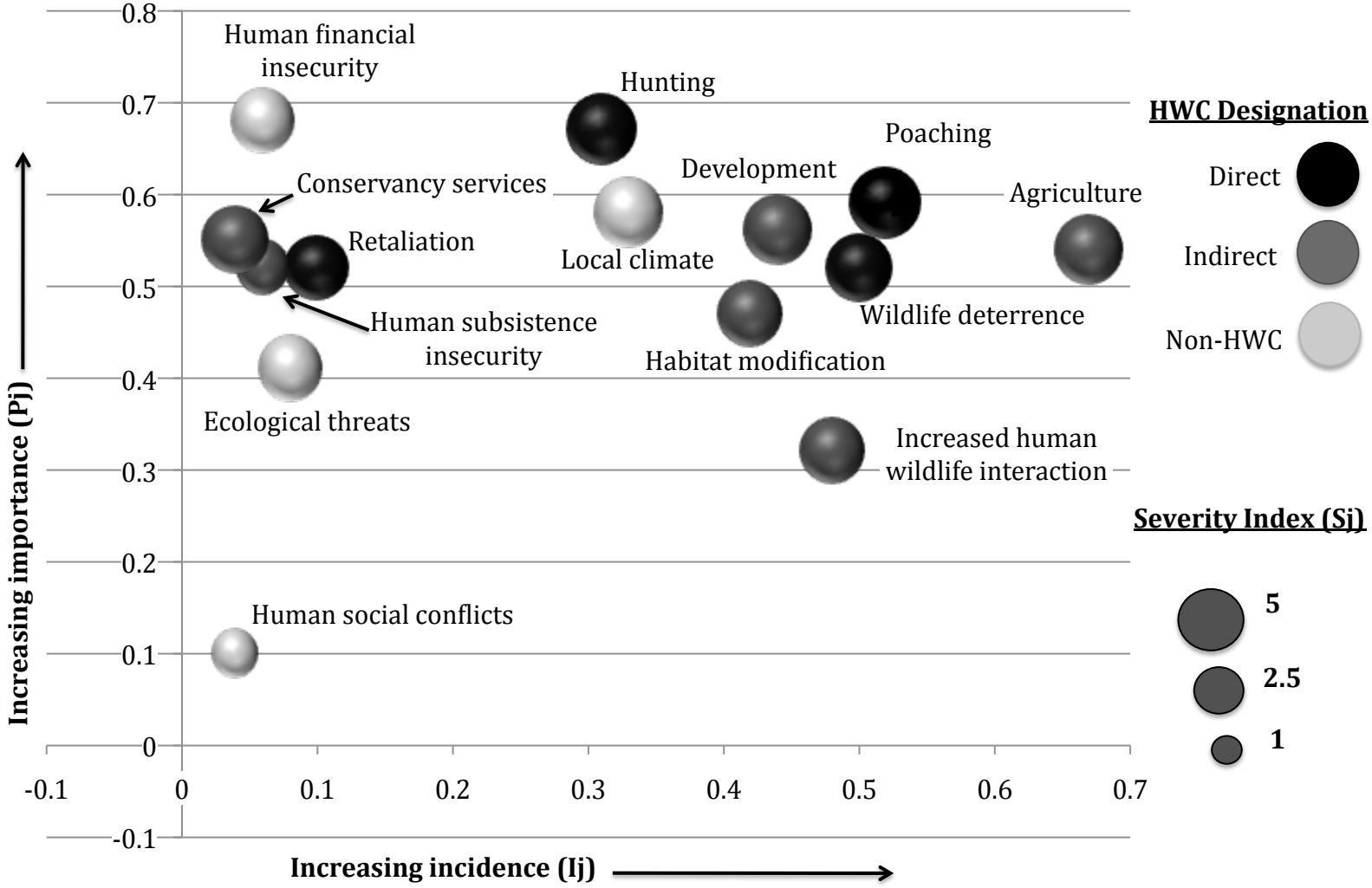


Figure 2.2: Conservancy residents' perceptions (n=48) about the incidence and importance of risks to wildlife in two conservancies in East Caprivi, Namibia (Focus groups; July-September, 2009).



CHAPTER 3: A CONSERVATION CRIMINOLOGY APPROACH TO ESTIMATING POACHING ACTIVITIES: CO-MAPPING RISKS AND CHARACTERIZING MOTIVATIONS IN NAMIBIAN CONSERVANCIES

3.1. INTRODUCTION

Poaching, the illegal harvest of wildlife, may have myriad biological, ecological and social consequences and implications for natural resource management. For example, wildlife species subjected to poaching can experience population suppression, range collapse and extinction (Woodroff, Thirgood & Rabinowitz, 2005). These outcomes may threaten ecosystem function (Waite, 2007; Wright, Stoner, Beckman, Corlett, Dirzo, Muller-Landau et al., 2007) and ecological services (e.g., pollination) (Bruno & Cardinale, 2008; Wright et al., 2007). The loss of wildlife-related resources may threaten rural livelihoods by decreasing food security (Bowen-Jones, Brown & Robinson, 2003; Robinson & Bennet, 2004) and disrupting human cultural practices that depend on wildlife (Basset, 2005; Bowen-Jones et al., 2003). In community-based natural resource management (CBNRM) systems, poaching may negatively affect stakeholders by reducing the capacity of CBNRM to deliver economic improvements through sustainable wildlife use (Sethi & Hilborn, 2008).

The illicit nature of poaching has long made monitoring, enforcement and deterrence cumbersome in terms of time, expenditure and reliability (Solomon, Jacobson, Wald & Gavin, 2007). Monitoring and deterrence activities require significant financial and human resources (Keane, Jones, Edwards-Jones & Milner-Gulland, 2008; Kuperan & Sutinen, 1998; Nielsen, 2003) and managers must prioritize monitoring and assessment activities relative to other natural resource issues (Sheil, 2001). Ultimately, the decision to

direct resources toward combating poaching is based, in part, on tradeoffs between the nature of the poaching risk relative to other risks and the relevance of reducing poaching for achieving conservation objectives (Sheil, 2001).

The goal of this research was to explore the conceptual and physical space between a technical assessment and local perceptions of poaching as a risk to wildlife in a CBNRM system with the hopes that such understanding can inform more effective wildlife decision-making, including monitoring and enforcement. I used conservation criminology, an interdisciplinary conceptual framework applying theories from the disciplines of criminology, natural resources management and risk and decision sciences (Gibbs, Gore, McGarrell & Rivers, 2010), to guide my research.

3.2. BACKGROUND

Conservation practitioners regularly face two challenges when attempting to manage risks to wildlife, including poaching: 1) a lack of adequate information about local stakeholders' attitudes about risks to wildlife, and; 2) a deficit of spatially explicit information about risks to wildlife (Treves, Andriamapianina, Didier, Gibson, Plumptre, Wilkie et al., 2006). Understanding stakeholders' perceptions about risks to wildlife is essential for encouraging compliance with anti-poaching regulations (Hampshire, Bell, Wallace & Stepukonis, 2004; McFarlane, 2005). Additionally, identifying the spatial distribution of poaching activities is essential because failing to delineate the extent and location of poaching may lead managers to expend limited resources combating poaching in areas where poaching activities are low at the expense of areas where poaching may be higher (Knapp, Rentsch, Schmitt, Lewis & Polasky, 2010).

3.2.1. Perception of poaching risks.

Different stakeholders, whether they are trained experts or experienced publics, will think about risks such as poaching differently (McFarlane, 2005). Experts' technical estimates about the probability and consequences of a risk are termed risk assessments and are based on objective measures (Renn, 1992). Alternatively, risk perceptions are intuitive judgments made by stakeholders (Slovic, 1987) and may be informed by subjective measures (e.g., outrage, trust, perceived control over exposure) (Slovic, 2000) in addition to experiences related to the risk. Risk perceptions are important for determining behavioral intentions (i.e., whether a stakeholder plans to engage in a behavior) and support for management actions (Gore, Knuth, Curtis & Shanahan, 2006; Knuth, Stout, Siemer, Decker & Stedman, 1992; McFarlane, 2005; Weber, 2006) and predicting compliance with natural resource laws (Kuperan & Sutinen, 1998).

Compliance is the behavior of people conforming to rules that were created to influence their actions (Hauck, 2008). Without compliance, rules may fail to achieve management objectives (Keane et al., 2008). Diverse management interventions, such as provision of alternative livelihood options (Kühl, Balinova, Bykova, Arylov, Esipov, Lushchekina et al., 2009), animal damage compensation programs (Bulte & Rondeau, 2007) and educational outreach programs (Eliason, 2003), can influence stakeholders' willingness and ability to comply. The effectiveness of these interventions are dependent, in part, on understanding stakeholders' motivations for engaging in an activity such as poaching (Kühl et al., 2009; Muth & Bowe, 2009) and their risk perceptions associated with the illegal activity (Bell, Hampshire & Topalidou, 2007). Spatial analysis of poaching risks has led to greater understanding of poachers' motivations and more effective interventions

(Sánchez-Mercado, Ferrer-Paris, García-Rangel & Rodríguez-Clark, 2008) yet there is a lack of integration between stakeholders' spatially-explicit risk perceptions and experts' assessments of illegal activities.

3.2.2. Stakeholder motivations to poach.

Stakeholders' decisions to comply with poaching rules are highly complex in large part because of the diverse economic, geographic, social, and psychological contexts within which poaching occurs (Kuperan & Sutinen, 1998). Poaching can manifest itself in a variety of ways, from an individual poaching for home consumption or trade in a local market (Bassett, 2005) to commercial poachers selling wildlife trophies in international, illegal markets (Leader-Williams & Milner-Gulland, 1993). Animal damage incidents, such as livestock depredation, may motivate retaliatory (Bulte & Rondeau, 2007) or preventative (e.g., setting snares, poison) (Naughton, 1997) poaching among affected stakeholders. Opportunistic poaching may occur due to chance encounters between humans and wildlife in the landscape (Sánchez-Mercado et al., 2008) or be related to unemployment (Knapp, 2007).

Poaching incidents may not always be the result of intentional violations of wildlife law, such as incidents where hunters are unaware of regulations (Sethi & Hilborn, 2008). Poaching is not always driven by economic necessity (Bell et al., 2007). For example, poaching may manifest as an act of social defiance or symbolic protest of local natural resource management practices (Bell et al., 2007) or as an act of rebellion towards specific laws or local authority (Muth & Bowe, 1998). Many poachers likely have multiple motivations for engaging in illegal behavior (Bassett, 2005). Characterizing stakeholders' motivations to comply with wildlife poaching rules can guide management decisions and

aid in designing responses aimed at reducing illegal activity (Hampshire et al., 2004; Kühl et al., 2009; Muth & Bowe, 1998).

3.2.3. Management interventions to increase compliance.

Risks to wildlife from poaching can be addressed through a variety of interventions intended to increase compliance and reduce poaching, such as formal legislative regulations (Leader-Williams & Milner-Gulland, 1993); informal, locally supported rules or agreements (Kuperan & Sutinen, 1998); provision of alternative livelihood options (Kühl et al., 2009); animal damage compensation programs (Bulte & Rondeau, 2007); or educational outreach programs (Eliason, 2003). Traditional law enforcement interventions, such as increasing detection through patrols and adjusting penalties to discourage offenders, can also reduce or prevent poaching (Leader-Williams & Milner-Gulland, 1993). For example, increasing the intensity of anti-poaching patrolling units, through community schemes (e.g. local game guards) (Vaughn & Long, 2007) or state-level authorities (e.g., wildlife officers), has shown to increase offenders' perceived risk of being detected and lower poaching rates in a variety of contexts (Leader-Williams & Milner-Gulland, 1993).

In addition to traditional law enforcement frameworks for combating poaching, normative approaches can be used to understand compliance and evaluate monitoring and enforcement interventions (Keane et al., 2008; Kuperan & Sutinen, 1998). Normative factors include moral obligations (e.g., standards of personal morality, ethics), social environmental influences (e.g., peer opinion, social influence) and perceived legitimacy of laws implemented by authorities (e.g., procedural fairness, perceptions of how just the laws are) (Kuperan & Sutinen, 1998). For example, Eliason (2003) proposed increasing the

discourse and content related to hunting ethics in hunters' education courses as a means to reduce poaching and increase the likelihood of poaching being treated as a serious offense by hunters.

The spatial vulnerability of wildlife to poaching is another key dimension for monitoring and enforcement efforts that can contribute to increased compliance with rules (Sánchez-Mercado et al., 2008). The spatial vulnerability of wildlife to poaching varies according to the distribution of human and wildlife populations, their overlap in the landscape (Jachmann, 2008; Knapp et al., 2010), and the distribution of limiting resources such as water (O'Connell-Rodwell, Rodwell, Rice & Hart, 2000). Poaching pressure may be lower for wildlife that occur in remote areas with difficult-to-access terrain because the landscape can increase the effort needed to successfully poach (Wilkie, Shaw, Rotberg, Morelli & Auzel, 2000). Conversely, deterrence activities (e.g., patrolling) and detection rates for poaching in remote areas is often lower than easy-to-access areas, which may result in increased poaching activity in those areas (Knapp et. al., 2010).

Ultimately, knowledge related to the diversity of local poachers' motivations (Sánchez-Mercado et al., 2008), the cultural context of poaching (Hampshire et al., 2004), local poaching-related economic conditions (e.g., market prices for poached species) (Leader-Williams & Milner-Gulland, 1993), law enforcement capacity (Robinson & Bennet, 2004), and the context of human-wildlife interactions (Sánchez-Mercado et al., 2008) should guide the choice between management interventions aimed at increasing compliance. Importantly, such choices between management interventions must be informed by empirical data about these local conditions (Eliason, 2003). Given the contextual and spatial complexity of poaching, it is unlikely that one approach (e.g., only

increasing patrolling or adjusting fines and penalties) will suffice to greatly alter local compliance rates.

3.2.4. Poaching in Namibia's conservancy system.

In 1996, the government of Namibia launched a CBNRM program, devolving rights over wildlife to local communities (Barnes, MacGregor & Weaver, 2002). Key features of the CBNRM-based conservancy system include: 1) collaboration between government agencies, national non-governmental organizations (NGOs) and rural communities living on communal land (Stuart-Hill, Diggle, Munali, Tagg & Ward, 2005); 2) a legislative basis for consumptive wildlife utilization (e.g., subsistence and commercial hunting), and; 3) wildlife damage management procedures (Ministry of Environment & Tourism (MET), 2009). Namibians residing in conservancies directly benefit from the consumptive use of wildlife and integrate wildlife into local economic development (Barnes et al., 2002); theoretically, conservancies and their residents have a vested interest to insure that wildlife use is sustainable.

Poaching in Namibia was unsustainably high in the 1980s and early 1990s (Nott & Jacobsohn, 2004). Exacerbated by drought and volatile periods of political instability (Bruchmann, 2002; Vaughan & Long, 2007), poaching threatened to virtually exterminate populations of Black rhino (*Diceros bicornis*) and African elephants (*Loxodonta africana*) in the northwestern regions (Nott & Jacobsohn, 2004), and wildlife numbers in the north central and eastern regions of Namibia declined as well (Jones, 2003). In Caprivi, northeast Namibia, South African Defense Force personnel poached heavily in previously declared reserves leaving wildlife populations in the region greatly reduced at the time Namibia achieved independence (Bruchmann, 2002). Poaching levels decreased after independence

in 1990 (Nott & Jacobsohn, 2004) and Namibia's expanding conservancy system has been credited with contributing to this reduction (Vaughn & Long, 2007). Each Namibian conservancy is charged with monitoring poaching incidents in their conservancies using a system developed for community-based monitoring called the "Event Book" (Stuart-Hill et al., 2005). Community game guards are hired, trained and deployed on regular patrols in each registered conservancy (Vaughn & Long, 2007). Game guards enter their findings into Event Books.

Jones and Barnes (2006) asserted poaching does not currently appear to threaten populations of the many commonly implicated problem species (e.g., elephant, lion) (see Appendix F for resident and Event book species-specific information). However, they also (ibid) cautioned that positive local attitudes toward wildlife could be undermined by increasing perceptions of risks from wildlife conflicts, particularly in the Caprivi region, potentially resulting in increased poaching. Indeed, Caprivi boasts high human (Jones & Barnes, 2006) and wildlife (O'Connell-Rodwell et al., 2000) population densities, is one of Namibia's poorest regions (Suich, 2010) and has the highest incident rates of human wildlife conflicts (Jones & Barnes, 2006; O'Connell-Rodwell et al., 2000) (refer to chapter 1 for more information on Caprivi).

3.3. METHODS

3.3.1. Study location.

Two conservancies in East Caprivi's Mudumu South Complex [6], Wuparo and Dzoti, were selected for this research based on the: 1) recommendation of local and regional

[6] Mudumu South Complex (MSC) is a geographically clustered group of conservancies with similar environmental, economic and cultural features. MSC can interact with agencies and

NGOs with a long-term presence in the region, 2) permission of relevant traditional authorities, 3) willingness of conservancies to participate, 4) comparability of conservancies based on similar habitat types and wildlife species composition, and 5) presence of poaching and animal damage records. These conservancies are contiguous in the landscape, located between two national parks, and share a boundary with the Kwando River (Table 3.1).

3.3.2. Data Collection.

This research used focus groups (Morgan, 1993) and secondary data analysis (Aust, Boyle, Fergusson & Coulson, 2009) from Event Books in two conservancies. Focus groups were used to elicit information about stakeholders' perceptions of poaching risks, motivations, and perceived location of poaching events (Bell et al., 2007) because direct questioning related to sensitive subjects (e.g., illegal activities) may generate mistrust and concealment from respondents (Solomon et al., 2007). Event Book data from 2003 to 2008 were acquired with permission from the Dzoti and Wuparo Conservancy offices and were used to assess poaching risks.

Focus groups. Focus group participants were all permanent residents of their respective conservancies and ≥18 years old. No person was excluded from participating based on ethnic affiliation, educational attainment, or socio-economic status. Only one person per household was eligible to participate. Participants were solicited from each of the village zones (i.e., distinct residential areas) in proportion to that village zone's population using a cluster sampling technique with probability proportionate to size

organizations as a larger management body, negotiate for translocation of wildlife into the area, resolve disputes and pursue economic development projects.

(Bernard, 2006) (see Chapter 2 for sampling protocol methodology). Each conservancy's staff provided census-type information (e.g., number of households, approximate population) about their village zones to facilitate sampling. Six research assistants were selected and trained to aid facilitation of focus group activities (see Chapter 2 for research assistant selection and training criteria).

Each conservancy completed an identical two-day focus group (see Appendix A for focus group protocol). Participants were divided into groups (e.g., men, women, and male and female decision-makers) to promote a non-threatening, permissive environment for dialogue (Morgan, 1993; Smith, Barrett & Box, 2000). Each group engaged in participatory risk ranking and scoring (PRRS) (Baird, Leslie & McCabe, 2009; Quinn, Huby, Kiwasila & Lovett, 2003; Smith et al., 2000; Tschakert, 2007) and participant risk mapping (PRM) (Treves et al., 2006) activities. PRRS is useful for documenting stakeholders' risk perceptions in a way that allows participants to self-generate and prioritize major risk themes while not constraining discussion about risks to researcher-defined concepts (Smith et al., 2000). Participants conducted the PRRS process for two risk targets: local livelihoods and conservancy wildlife.

After participants completed PRRS activities they began PRM activities. Participants mapped the perceived location and frequency of poaching activities onto transparent overlays secured over "basemaps" created by the lead researcher and assistants. During PRM participants: 1) identified important local features (e.g., community resources, rivers) on the map, 2) added any features absent on the basemap, and 3) mapped where and with what intensity risks identified from PRRS (e.g., poaching, crop damage) took place. Risks were ranked according to the intensity of occurrence (rarely (1-5 times a year); sometimes

(6-12 times a year); often (more than 12 times a year) (Treves et al., 2006). Finally, each group discussed motivations for poaching. Participants free-listed motivations and then rank-ordered them from the most to the least prevalent.

Event Book. Digital photographs for six years (2003 through 2008) of Problem Animal Incident (PAI) and Poaching Event (PE) cards were aquired from each conservancy and transcribed. PAI cards included information about the incident date, damage type (e.g., crops, livestock, human attack), specific crop or livestock type, number of livestock or humans attacked (if applicable), wildlife species implicated, descriptive notes and location within a 4 km^2 grid cell. PE cards included information about the date, species affected (if applicable), number of animals involved in the incident, type of incident (e.g., firearm, snare, traditional) [7], number of incidents, descriptive notes and location.

3.3.3. Data Analysis.

Participatory risk ranking and scoring. Coding of free-listed risks generated during the PRRS activity followed an iterative process (Bernard, 2006). First, I reviewed all risks to generate categories (Saldaña, 2009). Next, I assigned each risk into a category and coded each risk into an exclusive categorical variable (Bernard, 2006). I conducted a final iteration of coding to double-check findings (Saldaña, 2009) (see Appendix D for coding protocol).

Following Tschakert's (2007) methods for PRRS analysis, I calculated an incident index (I), importance index (Pj), joint risk index (Rj) and severity index (Sj) for each

[7] The conservancies define the designation of firearm, snare and traditional poaching incidents. Traditional incidents include poaching by means of traditional methods such as spears, bows and arrows, and traps.

livelihood and wildlife-related risk. The incident index (I), ranging from 0 to 1, is the proportion of participants that identified a particular risk. The importance index (Pj) also ranges from 0 to 1 (0=not important; 1=most important) and reflects the rank that participants assigned to a particular risk in relation to the total number of risks they listed, where r is the rank and n the total number of risks identified by that participant:

$$Pj = \left[\frac{(r-1)}{(n-1)}\right] \times (-1) + 1$$

The joint risk index (Rj) is a function of a risks' average incident index score (Ij) and average importance index score (Pj). The joint risk index ranges from 0 to 1 and is calculated as Rj= Ij/ (2-Pj). Finally, the severity index (Sj) represents the mean severity score assigned to each risk by participants that mentioned that risk and ranges from 0 to 5 (0=not severe; 5=most severe). An incident index (Ij), importance index (Pj) and joint risk index (Rj) were calculated for all the poaching motivations identified by participants during the PRRS activity.

Participatory risk mapping. Digital photographs of participants' maps were overlaid and rectified with georeferenced conservancy boundary layers (CONINFO, 2009) using ArcGIS 9.2 (Environmental Systems Research Institute, 2004). Participants' maps contained discrete locations (e.g., villages, schools), linear features (e.g., roads, rivers), and risk points, lines, and polygons. Risk features (e.g., poaching, crop damage) that were initially drawn as polygons by participants were converted to patches of points (10 m spacing). Line features were similarly converted to points. The risk points were combined to form a single risk point layer. Subsequently, the distance from each location (10 m spacing) within the conservancy boundaries to the closest risk point was measured. A

separate distance layer was generated for each intensity of occurrence score (ranging from 1-3). Distance layers were interpolated using an inverse distance weighted (IDW) method resulting in continuous surfaces (10 m resolution) of distance to nearest threat point by risk intensity (Childs, 2004). The interpolated surfaces were subsequently combined, weighted by perceived risk intensity (high, moderate, low), into a single risk surface.

Event Book. Event Book poaching data from each conservancy was pooled and analyzed by year and incident type using descriptive statistics. Locations (4 km^2) from the PAI and PE cards were overlaid on the interpolated participant maps in ArcGIS.

3.4. RESULTS

Fifty local stakeholders participated in PRRS and PRM activities with livelihoods as the risk target and 48 stakeholders completed the activities with wildlife as the risk target. Participants ranged in educational background from no formal schooling to college education, age (18-60+ years), and all participated in some form of subsistence based activities or rural industries (e.g., artisanal fisheries, vegetable farming, thatch roof harvesting).

3.4.1. Perceived poaching risk.

Participants generated a total of 157 risks to wildlife (3.3 threats per participant average; range 1-9) that were coded into 14 categories. Participants identified eight of 14 risks to wildlife as being anthropogenic (i.e., resulting from human activity). Three of these anthropogenic risks were direct forms of mortality: poaching (i.e., illegal hunting or trapping), legal hunting (i.e., commercial, trophy, subsistence) and retaliation (i.e., legal or illegal lethal removal for damage). Participants ranked poaching (Rj= 0.37; Sj= 3.5) as the most critical anthropological risk and the second most critical risk overall (Table 3.2). Over

half of all participants (Ij=0.52) cited poaching as a risk to conservancy wildlife and poaching ranked as the most severe threat to wildlife (Table 3.2).

3.4.2. Assessed poaching risk.

Fifty-three discrete poaching events were recorded between 2001-2008 in the Event Books, of which 62% were snares, 28% firearms, and 9% traditional methods (Figure 3.1). Game guards collected 147 snares in study conservancies during this time; there was a peak in snares collected in 2007 (n=67). More than 95% of documented poaching incidents have occured since 2006 (Figure 3.1); alone, these data suggest an increase in poaching, particularly in the use of illegal snares, since 2005.

3.4.3. Poaching motivations.

Participants identified 14 motivations to poach (Table 3.3). The top two poaching motivations were, income generation (Rj= 0.48) and food (Rj= 0.47). Income generation and food were perceived as nearly twice as prevalent a motivation to poach than protecting fields (Rj=0.24) (Table 3.3). Three motivations to poach were driven by retaliation (protecting fields, protecting human lives and protecting livestock) and were of particular importance to study participants. Retaliation was identified as being an important threat to wildlife (Table 3.2). Protecting livestock and human lives ranked low among all motivations to poach, yet protecting agricultural fields was important. Two poaching motivations provided by participants were related to conservancy management and services: protesting conservancy regulations or establishment and lack of conservancy benefits. Firearm training and entertainment were also cited as motivations for poaching in the conservancies (Table 3.3).

3.4.4. Co-mapping assessed and perceived poaching risks.

Participants created 6 maps for the wildlife-as-risk target. All mapped poaching as a risk to wildlife and livestock loss, crop damage and wildlife attack as threats to local livelihoods (see Appendix G for additional maps). There was little spatial overlap between the PRM-generated (hereafter perceived) and Event Book-generated (hereafter assessed) poaching maps (Figure 3.2). Assessed poaching risk maps indicated poaching events were primarily concentrated around residential areas and along main roads (Figure 3.2). Perceived poaching risk maps depicted the highest levels of poaching at the southern conservancy boundaries near Mamili NP, the northern boundary near Mudumu NP and east of Mudumu NP (Figure 3.2); those areas also had the highest perceived occurrence of wildlife. Participants in Dzoti conservancy (Figure 3.2) identified highest levels of poaching as occurring within the residential zones south of the main road. Perceived poaching risks were lowest near the southeastern boundary with the Kwando River (Figure 3.2).

Perceived risk maps for livestock loss, crop damage and humans attacked by wildlife were combined into a single map representing wildlife vulnerability to poaching motivated by retaliation (Figure 3.3). The perceived risk of wildlife attack on humans and livelihood damage (hereafter perceived retaliation risk) was highest near residential areas and along roads and trails with the exception of high-perceived retaliation risk along the southwest portion of the shared conservancy boundary (Figure 3.3). There was a high level of overlap between the assessed poaching risk and perceived retaliation risk (Figure 3.3). The majority of snares were found close to areas with higher levels of perceived retaliation risks and the majority of firearm incidents were clustered near the southern border with

Mamili NP and the Kwando River, and the northeastern region of the conservancy adjacent to Mudumu NP (Figure 3.3).

3.5. DISCUSSION

3.5.1. Estimating poaching risks.

Conservancy residents feel that poaching is adversely affecting conservancy wildlife. Participants rated poaching as the second most critical threat to wildlife and the highest in terms of severity. Beyond poaching, participants are aware of other risks affecting wildlife; these factors provide additional detail about the wildlife conservation climate within which poaching exists. For example, human financial insecurity, subsistence insecurity (Jachmann, 2008; Kühl et al., 2009), and socio-cultural insecurity (e.g., war) (de Merode, Smith, Homewood, Pettifor, Rowcliff & Cowlishaw, 2007) have been linked to increased poaching and illustrate that fluctuations in local poaching activities may be tied to dynamic economic, political and social conditions. Conservancy residents reported high perceptions of poaching risks. These perceptions may translate into high levels of local willingness to support poaching rules and sanctions and act against a behavior they have deemed an unacceptable risk to local wildlife resources (Bell et al., 2007; Hampshire et al., 2004). However, Kühl et al. (2009) warned that poaching behavior could continue despite stakeholders voicing concern for wildlife and support for management. Livelihood needs may override these sentiments.

According to the conservancy Event Books the assessed poaching risk over the last seven years is low and may not represent a technical threat to wildlife resources in the area. However, Event Book data also suggest an increase in documented poaching incidents with a greater number of snares confiscated and firearm and traditional incidents

since 2006. Deriving poaching trends from enforcement records, such as Event Books, however, may not wholly portray actual poaching incidence as such monitoring data depend on the surveillance effort exerted by anti-poaching staff over time (Kangwana & Mako, 2001). In addition to challenges associated with monitoring, Vaughan and Long (2007) reported community game guards, responsible for reporting poachers in conservancies, may not arrest an offender with whom they have strong social ties due to fear of being socially ostracized within the community. Combining Event Book data with the data gathered from community focus groups provides a more holistic portrayal of the potential extent of poaching activities in the conservancies. High perceptions of poaching risk among stakeholders coupled with an unexplained trend of increasing assessed poaching risk indicate a need for continued yet integrated approach to monitoring poaching.

3.5.2. Local motivations for poaching.

Conservancy participants identified diverse motivations for poaching. Muth and Bowe's (1998) typology of poaching motivations provides one method for interpreting these results; it is useful in guiding the transition between stated motivations and recommendations for management interventions. Participant-cited motivations for poaching fit into eight of Muth and Bowe's (1998) ten categories, although conceptually, many participant motivations fit into multiple categories (Table 3.4). The most often cited motivations related to commercial gain (e.g., income generation, lack of employment) and household consumption (e.g., meat) (Table 3.4). Although protecting fields was identified as the third most prevalent motivation for poaching, protecting human lives and livestock were low in terms of prevalence. This may be an artifact of Namibian's legal right to use

lethal force against wildlife found immediately threatening livestock or human lives; wildlife in agricultural fields are to be reported to local game guards, who initially remove them using non-lethal methods (MET, 2009).

Poaching acts motivated by rebellion or disagreements with regulations are related to negative local attitudes regarding the establishment, governance or benefit distribution scheme of the conservancy. The extent to which these motivations drive local poaching activities would be of particular interest to conservancy managers given that such motivations are rooted in public perceptions of regulations, local decision-makers, and effectiveness of the conservancy to provide benefits to stakeholders. No participant cited thrill killing (i.e., the psychological excitement of killing an animal) or gamesmanship (i.e., desire to outwit law enforcement) as motivations for poaching in their conservancies (Muth & Bowe, 1998).

The diversity of motivations for poaching may seem daunting in terms of generating management interventions. However, one management intervention may address multiple related motivations. For example, conservancy managers may focus on generating additional employment opportunities such as ecotourism to reduce poaching (Knapp, 2007). The increased income provided by employment could reduce poaching motivated by economic gains, lower dependency on poaching as a source of protein and decrease opportunities for recreational poaching. Increasing outreach activities to prevent animal damage events could reduce poaching motivated by crop damage, human attacks and livestock depredation in addition to addressing sentiments that there is a lack of benefits from the conservancy. However, reducing poaching incidents motivated by larger profits, such as those related to the illegal sale of skins, horns or ivory, will likely require more

traditional methods of increasing compliance such as increased patrolling and fines (Leader-Williams & Milner-Gulland, 1993).

3.5.3. Co-mapping poaching risks.

Co-mapping offers a multifaceted tool for conservation planning in CBNRM areas such as study conservancies. Examining the spatial patterns associated with risk to both local livelihoods and wildlife may assist in understanding poaching motivations and identifying more effective enforcement strategies (Sánchez-Mercado et al., 2008). There was a high degree of consistency between participant-generated and ranked motivations for poaching and the geographic depiction of said poaching risks. For instance, the stakeholder-identified areas of poaching near national park boundaries corresponded with areas perceived to have high densities of wildlife. This could represent poaching activities aimed at harvesting particular species prized for meat or trophies. Stakeholder-generated maps may prove to be a valuable monitoring tool to reduce poaching motivated by commercial gain or acquisition of trophies as this requires identification of areas where relevant species are concentrated (Sánchez-Mercado et al., 2008).

Considering the spatial relatedness of risks to livelihoods and wildlife may aid in identifying more appropriate enforcement and management strategies (Sánchez-Mercado et al., 2008) and aid in addressing the criminology of conservation. For example, there appeared to be a spatial relationship between participant-mapped retaliation risk and Event Book records for poaching events. Additionally, the prevalence of confiscated snares and traditional poaching methods within these perceived risk-retaliation zones is consistent with Muth and Bowe's (1998) protection of self and property (e.g., crops, livestock) motivation. Co-mapping risks to livelihoods from wildlife could aid in

identification of areas of the highest likelihood of retaliation-motivated events (legal or illegal) and better prioritize intervention efforts in those high-risk areas. Additionally, the use of spatially explicit risk maps may also improve risk communication between stakeholders and managers about interventions in the conservancy (Dransch, Rotzoll & Poser, 2010). For example, as managers approach individual farmers to discuss crop damage or livestock depredation preventative practices, maps can illustrate areas of high likelihood of risk exposure and aid individuals in contextualizing their risk perceptions (Dransch et al., 2010).

3.5.4. Conclusions.

Uncertainty surrounding the extent and intensity of local poaching can constrain managers and conservation practitioners' ability to set sustainable legal harvest quotas on wildlife (Sethi & Hilborn, 2008). This is a critical problem in CBNRM systems where financial and human resources for monitoring poaching may be limited yet economic development objectives are dependent on sustainable use of wildlife. Using conservation criminology as an analytical framework [i.e., applying notions of compliance (criminology), risk perception (risk and decision sciences) and wildlife management (natural resources management) (Gibbs et al., 2010)] , was advantageous in dealing with the contextual complexity surrounding poaching activities and their physical manifestation in the landscape. Integrated approaches that increase communication between local environmental decision-makers and local stakeholders in relation to poaching risks could help further prioritize monitoring efforts, target vulnerable wildlife habitats and stakeholders, influence local policies and management strategies and educate the local stakeholders about the biological, ecological and socio-cultural consequences of poaching.

Table 3.1: Characteristics of the Mudumu South Complex in East Caprivi, Namibia

Characteristic	Mudumu South Complex [a]
Adjacent conservation areas	Mudumu National Park (north); Mamili National Park (south)
Approximate population	Balyerwa (1500), Dzoti (391), Shikhakhu (unknown), Wuparo (2100)
Biome classification	Mosaic of mopane (*Colophospermum mopane*) woodland, Kalahari grassland with floodplains, riverine (Kwando River)
Climate	Semi-arid (Average annual rainfall ≥625 mm)
Conservancies (registered)	Balyerwa (2006), Dzoti (2009), Shikhakhu (stalled) [b], Wuparo (1999)
Major wildlife resources	Black-backed jackal, buffalo, bush pig, crocodile, duiker, elephant, hippopotamus, hyena, impala, kudu, leopard, lion, reedbuck, roan, tsessebe, warthog, wildebeest, zebra
Size (km ^{2})	Balyerwa (223), Dzoti (245), Shikhakhu (unknown), Wuparo (148)

[a] Information available on the Namibian Association of CBNRM Support Organizations' (NASCO) online database (http://www.nasco.org.na/)

[b] Establishment of conservancy has been stalled due to internal conflicts.

Table 3.2: Local perceptions (n=48) about the seriousness of risks to wildlife as identified by focus groups in two conservancies in Mudumu South Complex: Caprivi, Namibia (July-September, 2009).

Threat category	Overall Rank (Joint Risk Index)		Incidence Index	Importance index	Severity
Agricultural activities	1	(0.46)	0.67	0.54	3.2
Poaching	2	(0.37)	0.52	0.59	3.5
Wildlife deterrence activities	3	(0.34)	0.50	0.52	3.1
Development (e.g., roadways)	4	(0.31)	0.44	0.56	3.2
Increased human wildlife interactions	5	(0.29)	0.48	0.32	2.9
Habitat modification (e.g., deforestation)	6	(0.28)	0.42	0.47	2.9
Hunting	7	(0.23)	0.31	0.67	3.4
Climate (e.g., drought)			0.33	0.58	3.3
Retaliation [a]	8	(0.07)	0.10	0.52	2.8
Ecological threats (e.g., predation)	9	(0.05)	0.08	0.41	2.8
Financial insecurity			0.06	0.68	2.7
Subsistence insecurity (e.g., food insecurity)	10	(0.04)	0.06	0.52	2.0
Conservancy service and management	11	(0.03)	0.04	0.55	3.0
Socio-cultural insecurity (e.g., war)	12	(0.02)	0.04	0.10	1.5

[a] Legal or illegal removal of problem animals due to damage to crops, livestock, infrastructure or human.

Table 3.3: Participant-generated (n=48) and ranked motivations for poaching in two conservancies in Mudumu South Complex: Caprivi, Namibia (July-September, 2009).

Motivations for poaching	Overall Rank (Joint Risk Index)		Incidence Index	Importance Index
Income generation [a]	1	(0.48)	0.54	0.88
Food (Meat)	2	(0.47)	0.54	0.85
Protecting fields	3	(0.24)	0.38	0.41
Skins (pelts)	4	(0.19)	0.31	0.38
Trophies [b] (antlers)	5	(0.09)	0.15	0.38
Lack of employment			0.15	0.25
Protesting regulations/ conservancy			0.15	0.25
Medicine	6	(0.08)	0.15	0.00
Elephant ivory	7	(0.05)	0.08	0.50
Protecting human lives			0.08	0.50
Firearm training			0.08	0.13
Entertainment	8	(0.04)	0.08	0.00
Lack of benefits from conservancy			0.08	0.00
Protecting livestock			0.08	0.00

[a] Income generation was kept separate from skins, trophies, medicine and elephant ivory due to the fact that these wildlife products may be utilized by local people for non-economic purposes (e.g., subsistence based, cultural).

[b] Trophies refer to non-ivory, non-pelt based products (e.g., antlers, teeth and head mounts).

Table 3.4: Conservancy participants' (n=48) cited motivations for poaching conceptually sorted using Muth and Bowe's (1998) typology of the motivations for poaching (categories underlined): Mudumu South Complex, Namibia (2009)

<u>Poaching for commercial gain</u>

Elephant ivory [a]

Income generation

Lack of benefits from conservancy

Lack of employment

Medicine

Skins (pelts)

Trophies [b] *(antlers, mounts)*

<u>Poaching for household consumption</u>

Food (Meat)

Lack of benefits from conservancy

<u>Recreational poaching</u>

Entertainment

Firearm training

<u>Trophy poaching</u>

Elephant ivory

Skins (pelts)

Trophies [b] *(antlers, mounts)*

<u>Poaching to protect self and property</u>

Lack of benefits from conservancy

Protecting fields

Protecting human lives

Protecting livestock

<u>Poaching as rebellion</u>

Protesting regulations/ conservancy

Lack of benefits from conservancy

<u>Poaching as a traditional right of use</u>

Elephant ivory

Medicine

Skins (pelts)

Trophies [b] *(antlers, mounts)*

<u>Disagreement with specific regulations</u>

Lack of benefits from conservancy

Protesting regulations/ conservancy

[a] Italicized motivations cannot be exclusively designated under one category using Muth and Bowe's (1998) typology.

[b] Trophies refer to non-ivory, non-pelt based products (e.g., antlers, teeth and head mounts).

Figure 3.1: Recorded incidents of poaching (e.g., number of snares confiscated, firearm and traditional incidents) in two Mudumu South Complex conservancies: East Caprivi Namibia (Dzoti & Wuparo Event Books 2001; 2003-2008).

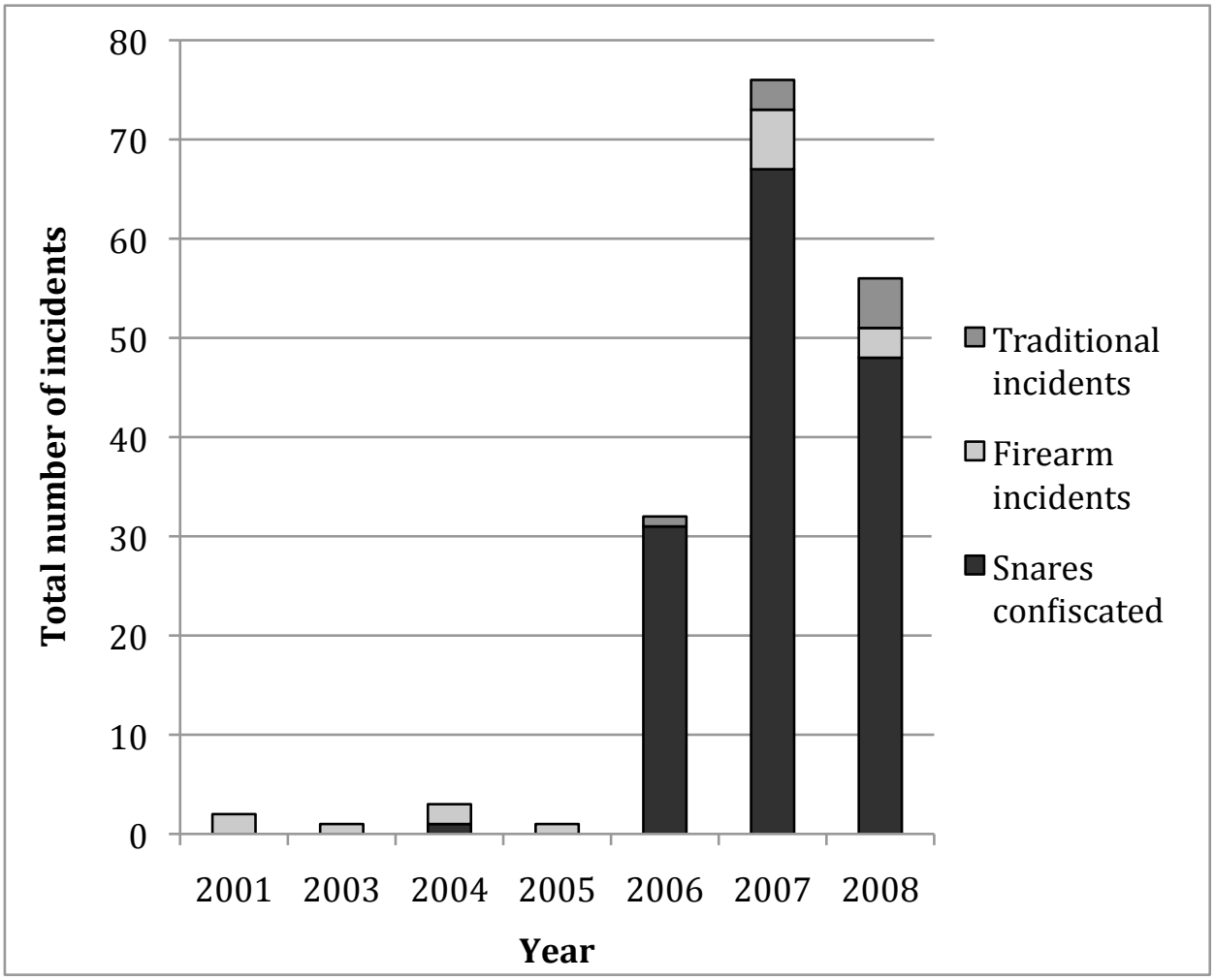


Figure 3.2: Perceived geographic incidents (Focus Group, 2009) of poaching and Event Book data for poaching incidents (2001-2008) in two Mudumu South Complex conservancies: Caprivi, Namibia.

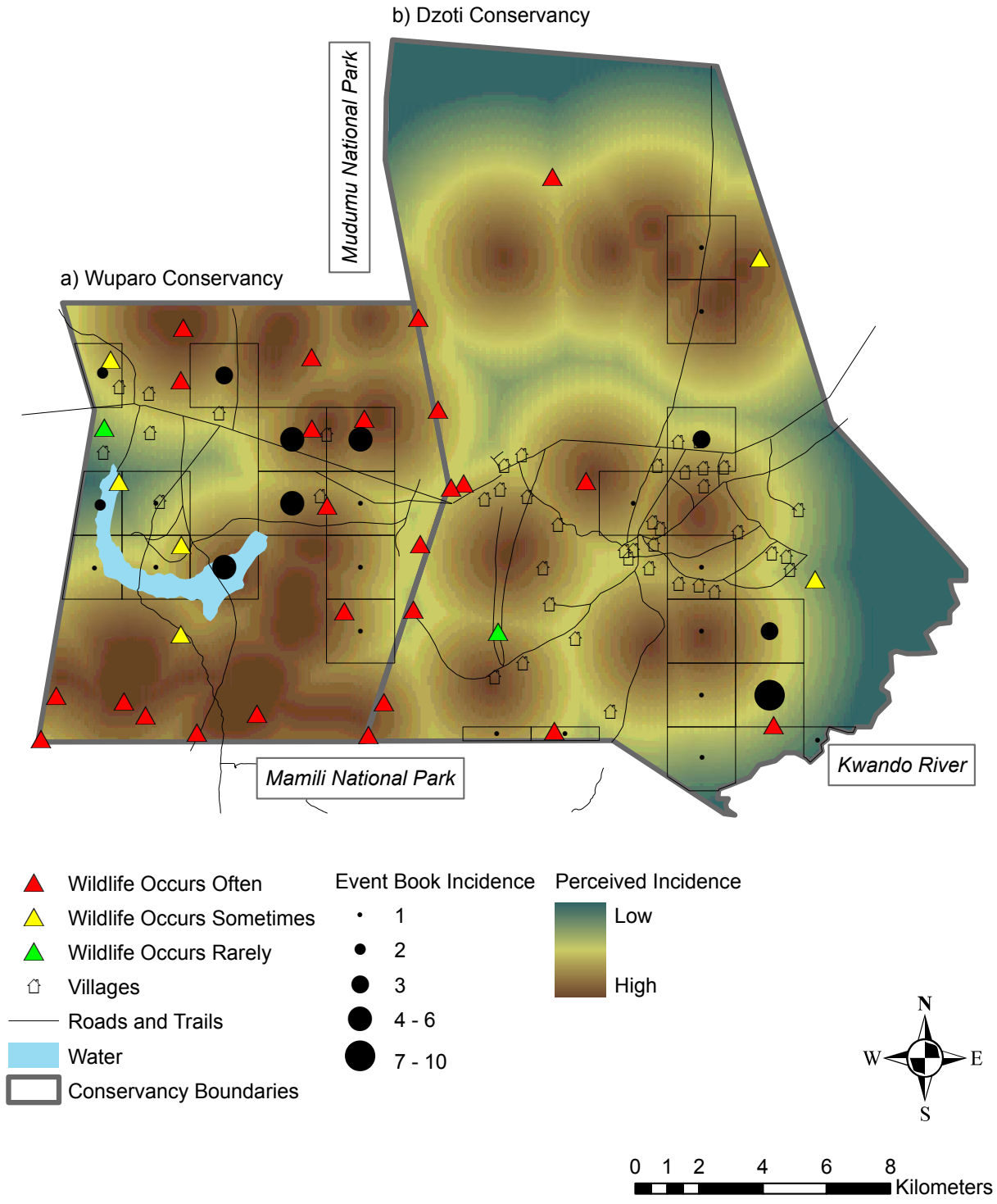
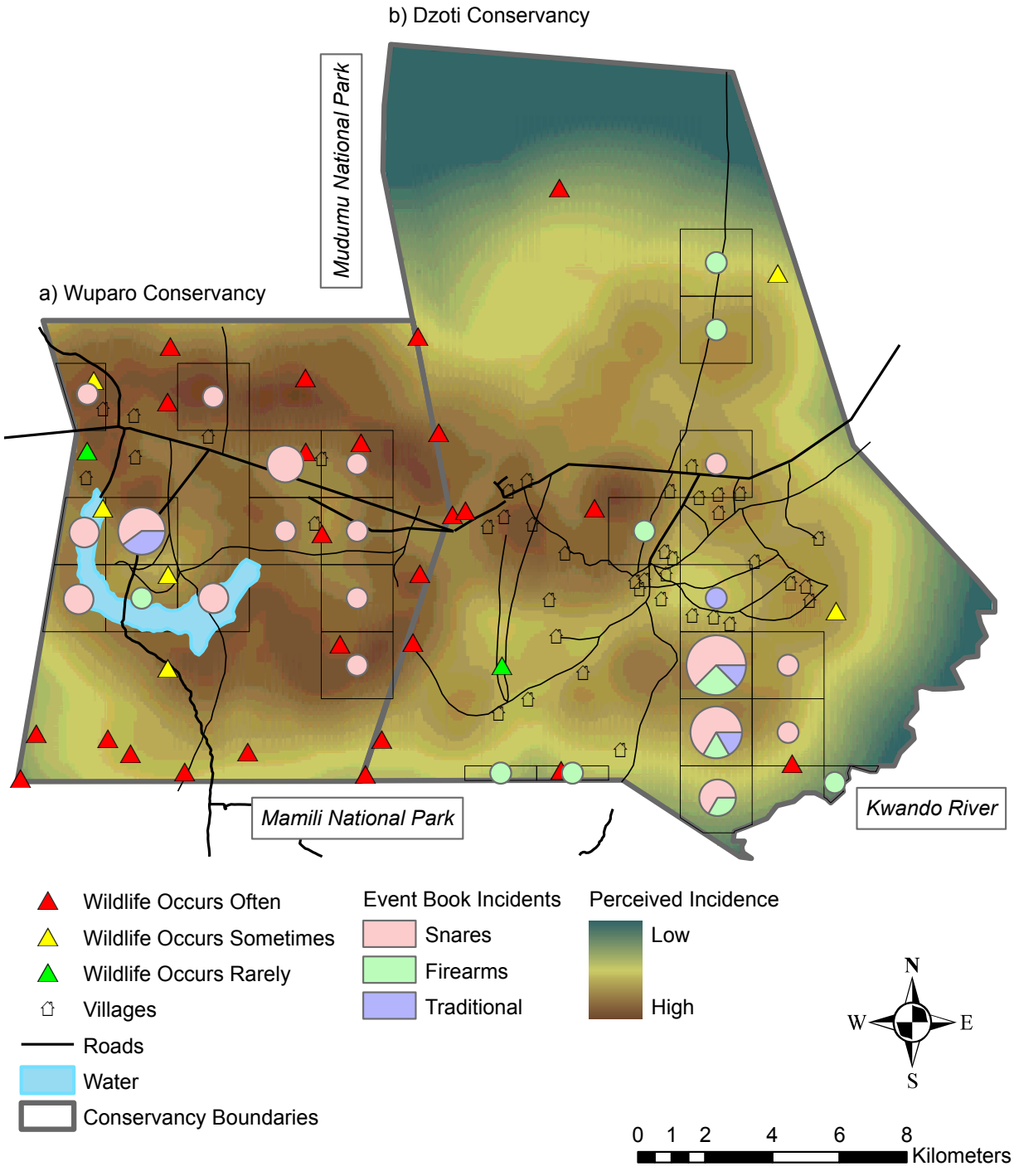


Figure 3.3: Perceived geographic incidents (Focus Group, 2009) of wildlife attack and livelihood damage that motivates retaliatory poaching and Event Book data for poaching incidents by incident type (2001-2008) in two Mudumu South Complex conservancies: Caprivi, Namibia.



CHAPTER 4: SUMMARY OF RESEARCH FINDINGS: IMPLICATIONS FOR THEORY, METHODS, AND PRACTICE

This thesis fills knowledge gaps related to the influence of conservancy status on perceptions of human-wildlife conflict (HWC) risks and vulnerability, local characterizations of HWC-related risks relative to non-HWC related risks (e.g., flooding) and differences between perceived and assessed risks. In producing new knowledge, this research makes theoretical, methodological, and practical contributions to the extant literature on risk perception, vulnerability, and HWC. Data herein provide novel understanding about local stakeholders' perceptions of wildlife-related risks and vulnerability, the influence of conservancy membership on HWC-related risk perceptions, and participatory approaches that enhance understanding of HWC-related risks both to and from wildlife. Below, I discuss key implications for theory, methods, and practice from this research.

4.1. THEORECTICAL IMPLICATIONS

4.1.1. Conservancy effects on risk perception and vulnerability.

Naughton-Treves (1997) and others suggested that decentralizing wildlife management [i.e., community-based natural resource management (CBNRM)] from state or federal levels to local communities reduces human vulnerability to HWCs by offsetting the costs of living with wildlife with economic benefits. There was previously a lack of empirical evidence surrounding the effects of such decentralized systems (e.g., communal conservancies) on stakeholders' livelihood and wildlife-related risk perceptions and vulnerability associated with HWC (Schumann, Watson & Schumann, 2008).

Research in chapter two highlights conservancy status effects on stakeholders' prioritization, characterization, and perceived severity of HWC-related risks and vulnerability. Although results provide evidence that the establishment of a conservancy may reduce risk perceptions to livelihoods from HWC, conservancy effects on HWC-related risk perceptions to wildlife are less clear. Established conservancy residents perceived more equitable distribution of benefits and less risks from living with wildlife; they failed, however, to differ from emerging conservancy residents regarding their sense of control over HWC and participation in anti-HWC related animal husbandry practices. Established conservancy membership, higher education level and not being a local environmental decision-maker strongly predicted lower stakeholder perceptions of risk to livelihoods from HWC. Age moderately predicted lower perceptions of risk to wildlife (i.e., older participants perceived lower risks to wildlife), while established conservancy membership marginally predicted higher risk perceptions to wildlife.

4.1.2. Multidirectional perceptions of risks.

We know multiple factors influence stakeholders' risk perceptions to livelihoods associated with wildlife such as dread, responsiveness of managers, and control over exposure (Gore, Knuth, Curtis, & Shanahan, 2007); factors influencing stakeholders' perceptions of risk to wildlife were previously less clear (McFarlane, 2005; Treves, Andriamampianina, Didier, Gibson, Plumptre, Wilkie, et al., 2006). Further, distinctions between stakeholders' risk perceptions associated with HWC to livelihoods and wildlife relative to non-HWC risks have largely been unevaluated (Baird, Leslie & McCabe, 2009). Stakeholders' risk perceptions to wildlife may influence, much like risk perceptions to livelihoods, their motivations to comply with HWC-related rules (Hampshire, Bell, Wallace

& Stepukonis, 2004; McFarlane, 2005). Research herein considers HWC-related risk perceptions with both human livelihoods and wildlife as risk targets.

Chapter two presents data about conservancy residents' perceptions and characterizations of multidirectional HWC-related risks. Residents characterized a variety of risks to livelihoods and wildlife related and unrelated to interactions between people and wildlife. Taken together, these risks influence the vulnerability of conservancy residents and wildlife. For example, residents stated that local climate conditions intensify crop damage, threatening local livelihoods, which can lead to retaliation towards wildlife. Participants noted that although risks to livelihoods are both related and unrelated to wildlife, the most critical risks are unrelated (e.g., anthropogenic). Risks to wildlife were also perceived as mostly anthropogenic in nature.

4.1.3. Similarities and differences between assessed and perceived HWC-related risks.

Research in chapter three: a) presents data about risk perceptions associated with specific types of HWC such as poaching, b) compares these perceptions to those associated with non-HWC related risks to wildlife (e.g., agriculture), c) explores stakeholder motivations for poaching, and d) co-maps risk assessments and perceptions associated with HWC. In comparing maps of conservancy residents' risk perceptions of conservancy poaching and animal damage records, I provide a unique picture of the relationship between risk perceptions and assessments, specifically differences in severity and the extent of poaching risk in the study conservancies (Knapp, Rentsch, Schmitt, Lewis & Polasky, 2010). Co-mapping risks in this way facilitates examining patterns (e.g., areas of overlap) associated with risk to local livelihoods and wildlife. Further, such examination can increase our understanding of the interrelatedness of HWC-related risks (e.g., crop

damage, poaching) and may aid in identifying appropriate management strategies (Sánchez-Mercado, Ferrer-Paris, García-Rangel & Rodríguez-Clark, 2008).

New questions emerge and warrant further inquiry. Factors that influence perceptions of HWC-related risks to wildlife remain more ambiguous than our understanding of factors that influence perceptions of HWC-related risks to livelihoods (McFarlane, 2005); more information is needed to elucidate what these factors may be. Deeper understanding about the relationships between risk perception and HWC-related behavior would be beneficial for theory and practice. For example, how do HWC-risk perceptions affect an individual's HWC-risk preventing behavior, such as adoption of best practices for reducing conflict? How do HWC-related risk beliefs towards wildlife affect compliance with wildlife management laws and conservation norms (e.g., not retaliating for animal damage)? Finally, it would be useful to explore how stakeholders conceptually map relationships between direct, indirect and non-HWC-related risks to livelihoods and wildlife.

4.2. METHODOLOGICAL IMPLICATIONS

4.2.1. Visual interview aids.

This research produced a novel method, a visual Likert-type scale, to maximize data collection in a cross-cultural, low literacy, English as a second language context. Visual Likert-type scales used multiple visual indicators (e.g., color, size, numeric and non-numerical quantitative measures) of increasing intensity (Appendix C). This approach proved useful and efficient for data collection in the field. Visual aids were also developed to supplement interview questions. Illustrations were provided to interview participants to insure construct validity. In providing line drawings of what I considered wildlife to be

(and not to be), I was able to minimize confusion between respondents and myself about the construct of wildlife. I was also able to maximize understanding among different participants about the construct of wildlife.

4.2.2. Focus group procedures.

This research adapted risk ranking (Tschakert, 2007; Smith, Barrett & Box, 2000) and threat mapping (Treves et al., 2006) techniques to capture local perceptions of HWC-related risks. Tschakert's (2007) risk ranking methodology, which allows for a participant-centered conceptualization and relative weighting of risks, was adapted to aid in the spatial depiction of risk perceptions (Appendix A). Treves' et al. (2006) spatially explicit methodology for capturing stakeholder perceptions of risks to wildlife was maintained; however, the unidirectional, researcher-constrained approach was modified to account for stakeholders' conceptualizations of HWC-related risks. While both methods were developed to investigate perceptions in a unidirectional manner (e.g., Tschakert's (2007) livelihood risk target; Treves' et al. (2006) biodiversity risk target), they were adapted to investigate HWC-related risks in a multidirectional manner in accordance with research objectives. Synthesizing both approaches proved useful for this research context; they proved effective and efficient for data collection.

Future research may employ or adapt these methods; with additional field-testing, visual aids may significantly improve a researcher's ability to collect valid data in the context of low literacy or English as a second language contexts. Comparative methodological research between the developed visual Likert-type scale and extant alphanumeric Likert-type scales could lead to further developments to improve scale validity in capturing attitudinal responses in a variety of demographic and cultural

contexts. Additional research employing the adapted focus group methodology is needed to assess its effectiveness not only as a data collection methodology but also as a participatory tool in risk management.

4.3. PRACTICAL IMPLICATIONS

4.3.1. HWC interventions.

Risk perceptions about HWC can inform the design, implementation, and evaluation of more effective interventions designed to reduce negative HWC consequences on livelihoods and wildlife. For example, practitioners may leverage information provided on combined risk perception and assessment maps to more accurately target HWC-related services to the areas that need it most (e.g., regions of greatest frequency of HWC, regions experiencing HWC but previously ignored). The use of spatially explicit and colorful risk maps could improve risk communication in the conservancy (Dransch, Rotzoll & Poser, 2010). For example, when communicating HWC mitigation strategies to stakeholders, maps can illustrate areas of high likelihood of risk exposure and aid individuals in contextualizing their risk perceptions based on their unique situation within the conservancy's landscape (Dransch et al., 2010).

Detailed insights about local livelihood and wildlife vulnerability to HWC may be used to guide prioritization of HWC management to focus on the most sensitive people and wildlife resources (Smith et al., 2000; Tschakert, 2007). For example, conservancy residents reported concerns about the negative consequences of retaliation on wildlife yet they did not prioritize managing that risk over other risks (e.g., agricultural activities, poaching). Characterizing HWC-related risk perception and vulnerability may provide new opportunities for mitigation and strategies for improved risk management (Smit & Wandel,

2006; Tschakert, 2007). For example, conservancy residents identified the agricultural interface between people and wildlife as highly problematic for managing HWC risks. The lack of land use zoning within the conservancy was cited as increasing vulnerability at this interface. Zoning areas for agriculture and wildlife could improve management of crop damage risk and reduce agricultural encroachment into wildlife habitat.

Vulnerability is an important concept for evaluating the efficacy of HWC management strategies; participatory evaluation strategies, especially those that involve the most vulnerable stakeholders in addition to experts and decision-makers, are considered to be more accurate than those that do not involve vulnerable stakeholders (Treves, Wallace & White, 2009). While residents in the two study conservancies failed to differ in their perceptions of the likelihood of their households experiencing an HWC-related risk, this research identified emerging (versus established) conservancy residents as having higher perceptions of vulnerability to the negative consequences of such risks. Emerging residents also viewed some HWC management strategies (e.g., conservancy-prescribed use of chili as a wildlife deterrent) as a significant threat to wildlife. Being aware of the existence and nature of vulnerability perceptions among conservancy residents can aid decision makers. Decision-makers may then opt to explicitly address, through communication, educational or other efforts, how different HWC management strategies will affect members' and wildlife's vulnerability. Such understanding may help decision-makers better anticipate the extent to which stakeholders will accept certain HWC interventions (Treves et al., 2009). If decision-makers are able to more aptly respond to local stakeholders, there is the potential for them to increase stakeholders' perceived legitimacy of management interventions (Kuperan & Sutinen, 1998).

Finally, characterizing stakeholder perceptions of multiple risks, both related and unrelated to human wildlife interactions, can foster understanding about how discrete wildlife-related risks may most effectively be managed (Baird et al., 2009). Data herein indicate that stakeholders' perceptions of risks from HWC are connected to and contingent upon a wide range of risks to livelihoods and wildlife. For example, stakeholders perceived risks such as human financial insecurity, local climate, inadequate conservancy services and socio-cultural insecurity (human-human conflict) as threats to livelihoods and wildlife within their conservancies. This information could be used to formulate interventions seemingly unrelated but very applicable to HWC, such as human-human conflict resolution or improved disaster planning, with the benefit of lessening human and wildlife vulnerability to HWC risks. Given the financial and social resources some HWC interventions require (e.g., compensation schemes), anticipating the intervention's social viability before it is implemented and employing indirect interventions when appropriate could be invaluable to decision-makers with limited resources.

4.3.2. Fostering compliance.

Illegal conservancy activities such as poaching are of concern to both conservancy residents and decision-makers. Unfortunately, there are significant logistical, economic, and sociopolitical constraints to measuring poaching activities in conservancies (Solomon, Jacobson, Wald & Gavin, 2007; Vaughan & Long, 2007). Equipped with an increased understanding of the local context of human-wildlife interactions, including locally relevant motivations for poaching, conservation practitioners could explore alternatives to financially costly deterrence measures. Combining Event Book data with residents' perceptions captured in focus groups can provide a rapid and cost effective way to

holistically and more accurately assess the conservation impact and geographical extent of illegal activity. Such information can prove essential for conservancy game guards who are tasked with monitoring and enforcing anti-poaching rules. Understanding the variety of motives to poach (Hampshire et al., 2004), the geographic extent and patterns of interactions between people and wildlife (Sánchez-Mercado et al., 2008) in the conservancy may allow conservation practitioners to more deliberately select optimal management strategies for reducing poaching.

A number of pragmatic questions were generated and necessitate further inquiry. More research is needed to understand the relationship between risk perceptions, vulnerability and the willingness of stakeholders to participate in specific HWC-related intervention programs. For instance, do high perceptions of risk influence stakeholders' willingness to adopt alternative agriculture or animal husbandry practices? What effects will high perceptions of risk to wildlife have on acceptability of wildlife deterrence programs such as the use of chili? Additionally, understanding how different interventions influence the behavior and attitudes of conservancy stakeholders could be of interest to practitioners. For example, do monetary compensation schemes decrease negative attitudes towards wildlife within conservancies? Do monetary compensation schemes influence stakeholder participation in HWC-related prevention activities within conservancies? Lastly, monitoring the effectiveness of research informed interventions in terms of decreased HWC vulnerability and increased compliance would be essential to evaluate such approaches in terms of their practical and theoretical significance in improving HWC-management.

APPENDICES

APPENDIX A

Focus Group Protocol

HWC FOCUS GROUP

Facilitator's Handbook

Research funded by Michigan State University's Department of Fisheries & Wildlife

1

HWC: Risk Perception, Vulnerability & Compliance

FOCUS GROUP ACTIVITY: COMMUNITY MAPPING (CM) & PARITICPATORY RISK RANKING (PRR)

Rationale

Community mapping (CM) is an effective way to spatially locate the areas within a community that are most vulnerable to human-wildlife conflict (HWC). CM is adaptable and can explore gender and age-stratified division of labor, which spatially influence the distribution of various people. These constructs may be a useful in exploring the interactions between spatial and socio-demographic vulnerability to HWC. CM can be used to explore people's perceptions, needs, and access to important resources within the community. Community maps may be left with a community to aid in the HWC planning, monitoring, and evaluation. CM also serves as a good community entry exercise.

Participatory risk ranking (PRR) is an effective way to quantify perceptions of risks to livelihoods and biodiversity. PRR has been used successfully in developing countries, where participants may have low literacy rates. PRR can explore similarities and differences between the risk perceptions of local men, women and decision makers. Results from PRR can be mapped conceptually or spatially and can inform discussions about solutions and response strategies, and evaluation metrics for intervention measures intended to reduce risks from HWC.

Activity Objectives

Conducting the community mapping and participatory risk ranking activities has the following objectives:

1. Identify risks to local biodiversity and livelihoods utilizing local perceptions.

2. Identify risks to regional biodiversity and livelihoods from HWC utilizing local perceptions.

3. Compare the perceived importance and severity of threats from HWC relative to threats unrelated to HWC.

4. Depict threats to biodiversity and livelihoods from HWC spatially in order to assess vulnerability.

Time

Workshop (two full-days; one day prep); each day- 6 hours of activity; 1-hour lunch and two 15-minute breaks

Session Outline

I. Introduction & Consent (day one); Question & Answers (day two)- (15-20 minutes*)*

II. Risk Ranking & Scoring- Livelihoods (day one); Biodiversity (day two)- (90-120 minutes*)*

BREAK (15 MINUTES)

III. Discussion- vulnerabilities – (30-40 minutes*)*

LUNCH (1 HOUR)

IV. Community Mapping- Part 1 (day 1); Part II (day 2) (60-90 minutes)

V. Discussions group (40-60 minutes)

BREAK (15 MINUTES)

VI. Debrief (25-30 minutes)

Participants

- All participants must be of 18 years of age.
- Participants will be chosen through consultation with leaders and opportunistically.
- Total number of participants will be 30: environmental decision makers (n <8-10), men (n< 8-10) and women (n< 8-10).
- Can be completed with up to 15 people in each group; men, women and key decision makers complete the activities separately
- Only one participant per household unit.

Materials

Risk Ranking Activities

- Large butcher paper or poster paper
- Large index cards of different colors
- Markers
- Pebbles or beans (several hundred)
- Tape or glue
- Stickers
- Post-it notes
- Digital camera (for both activities

Risk Mapping Activities

- Large aerial photograph, Arc View or other GIS reference base map of the community
- Grease pencils (assorted colors- 3 for severity ranking and additional for mapping features), markers of assorted colors
- Mylar or acetate transparent film (3 sheets large enough to cover maps)
- For relative HWC frequency, small colored stickers of 3 different colors
- For social vulnerability, 3 different shapes of colored stickers (same approximate size; in three different colors per shape-one shape needed for each group mapping)
- For species involved in HWC, 2 small sticky note pads
- For facilitator, small (11 x 8) print out of larger map

FACILITATOR'S NOTE: You will need at least two people to facilitate this workshop. All facilitators need to receive training on procedures before hand, receive a copy of this booklet and recording instruments. Decision-makers may be surveyed prior to general workshop. Materials should ultimately be left with the community or conservation area once facilitators have adequately recorded information. Lead facilitator should provide a final report of finding to the community/conservation area in an appropriate format.

Procedure

DAY ONE

I. INTRODUCTION & CONSENT (15-20 minutes)

You are being asked to participate in a research project related to understanding opinions of threats to local livelihoods and wildlife from human-wildlife conflicts. I am required to make sure that you understand that your participation in this workshop is voluntary, to explain the risks and benefits of participating and answer any questions you have at any time.

I am a graduate student from the United States and my name is Jessica Kahler. I attend Michigan State University and study human-wildlife interactions. By human-wildlife interactions I mean I study the benefits and risks to both people and wildlife that live and interact in an area. This research helps me complete requirements for my education, but more importantly may help improve management of conflicts or negative interactions between people and wildlife.

I am very interested in hearing what you think about this topic. There are no wrong answers to the questions and discussions that will take place at this workshop. I ask only for your honest opinion. Your participation will help regional and local decision-makers better understand what local people and communities think about conflicts between people and wildlife. Your responses are completely confidential, as I will not record the names of people attending the workshop and all posters and maps that are created will be created by the group, so no one person will be responsible for the information on the maps and posters. The entire workshop should take two full days. You will be provided with lunch, refreshments and all materials needed to complete the activities.

I would like to use my voice recorder and digital camera during the workshop. The voice recordings will not be available for any local person or group to review. My American advisor and I will be the only people to review the recording. I will take digital photographs of the maps and posters that the group creates and I may also take photographs of participants or the group. If you are uncomfortable with being photographed I will not photograph you.

These activities are voluntary, which means that you may choose not to participate in the workshop at any time. If you do not understand the questions or activities please ask me and I will explain in

greater detail. You have been given some materials in a folder for the workshop. The folder also has my contact information both here in Namibia and at my school in the US, if you should need to contact me later. You must be at least 18 years of age to participate in this workshop. By remaining here at the workshop you are telling me that you at least 18 years of age and want to participate.

Do you have any questions before we get started? Before we start I will go over the schedule for the day.

☐ SCHEDULE SHOULD BE POSTED AT THE FRONT OF THE ROOM

II. RISK RANKING & SCORING- LIVELIHOODS (90-120 minutes)

1. INTRODUCE THE ACTIVITY

"A person's livelihood is the way they come by or get the things they need to live. Many things can threaten people and the things they value or rely on to live. These threats, sometimes called worries, concerns, risks or dangers, may be of different importance to the community. Some worries may be very serious and threaten human life or health, while others cause only small problems or hassles. The reason we are going to do this activity is to find out what the worries or threats of the community are and how important you think these worries are in threatening local people's wellbeing. This should take about 2 hours."

2. FACILITATOR GIVES EACH PARTICIPANT A SET OF CARDS AND MARKERS AND GIVES THE FOLLOWING INSTRUCTIONS

- On these cards I want you to write or draw a threat or worry that affects the entire community.
- Each card should have only one worry or threat on it.
- You can write or draw as many threats to the community as you want.
- These worries can be big problems or small problems; whatever you think worries the community. The worries you list should be worries for the entire community not your individual worries.
- If you need to write in your local language please feel free or if you need help please ask. I will walk around the room to answer questions.
- Please take 20 minutes to write down as many worries as you can think of that threaten the community and the lives of people in the community. *Remember we are listing worries that affects the entire community not your individual worries.*

3. RANK THE LIVELIHOOD THREATS; USE A LARGE SHEET OF PAPER

- Now I want you to bring your cards with your worries, around this large piece of paper. The paper has most important written at the top and least important written at the bottom.
- I want you to rank your worries starting with the most important worry to the community, then the second most important and ending with the least important worry at the bottom.

- Everyone will get a chance to rank his/her worries and there is no wrong or right answer. Remember the most worrisome threat will be at the top and the least worrisome will be at the bottom.
- After you are happy with your ranking use this tape to attach your card to the paper.

4. FACILITATOR TURNS THE DISCUSSION TOWARDS HUMAN-WILDLIFE CONFLICT

"Human-wildlife conflicts are bad or negative interactions between people and wildlife. By wildlife I mean all animals in the area, including birds and reptiles (*i.e., such as snakes and lizards*) that are not domesticated animals or insects. Lets look at these pictures that show what animals are wildlife and what animals are not wildlife."

☐ FACILITATOR HAS PRE-PREPARED VISUAL WITH WILDLIFE, DOMESTICATED ANIMALS AND INVERTEBRATES.

- It is important to remember that not all interactions or relationships between people and wildlife are bad. Can you think of some benefits to living close to wildlife?
- However, bad interactions or negative relationships may threaten both people and the animals themselves. Can you think of different threats to people's livelihoods from bad interactions between people and wildlife? (i.e., *What about wildlife injuring people? How about threats from wildlife to gardens or livestock? Does wildlife ever make people in the community feel afraid or scared?)*
- Are human-wildlife conflicts a worry for the local community?
- Lets look at our worries and rankings again. Are any of the worries that you listed human-wildlife conflicts? If so, lets put a sticker on the cards that are or could be human-wildlife conflicts.
- Are there any worries from human-wildlife conflicts that are not on your lists? If there are, lets put them on a card and put them in your rankings where you feel they belong in relation to threats that are not related to wildlife conflict.

5. QUANTIFY THE THREAT SEVERITY

- Some worries or threats may be very harmful to people's wellbeing or livelihoods, while others may not be very harmful but are much smaller problems or hassles.
- I am going to give you five beans for each of the worries you listed. You are going to use these beans to give a score to the worries; giving five beans to a worry means that that worry is life threatening, while giving one bean to a worry means that the worry is very little problem or only a hassle. Giving a worry four beans would mean that the worry is less threatening than a five but more threatening than a three, while giving a worry two beans means it is more than a small hassle but less threatening than five, four and three beans.
- You can give your worries each a score of 1,2,3,4 or 5. Now you can score your worries; remember a score of 5 means it is life threatening while the lowest score of one the smallest problem or hassle.

- There are no right or wrong numbers of beans.

☞FACILITATOR ALLOWS PARTICIPANTS TO SCORE THEIR RISK RANKING; AFTER SCORING IS COMPLETED THE ASSISTANT NEEDS TO RECORD THE NUMBER OF BEANS ON EACH CARD OR RECORD SHEET

BREAK 15 MINUTES (REFRESHMENTS)

6. DESCRIBING AND QUANTIFYING THE THREATS

- Lastly, lets talk about the threats to your livelihood from human-wildlife conflict. I am going to list all the HWCs; that you listed and scored in your ranking as threats to local livelihoods on these large sheets of paper.
- We are going to discuss these threats and write down some important information regarding these threats.

THESE ARE GROUP DISCUSSIONS AND WILL BE RECORDED THROUGH A CONCENSUS. FACILITATOR WILL GUIDE PARTICIPANTS TO ANSWER EACH OF THE FOLLOWING QUESTIONS FOR EACH HWC THREAT (ANSWERING ALL QUESTIONS FOR ONE THREAT THEN MOVING TO THE NEXT THREAT. VISUAL SCALES WILL BE USED FOR QUESTIONS A, C AND D.

A. How often does this activity or threat happen? Lets use this scale to give this threat a number score.

0-NEVER, 1-RARELY, 2-SOMETIMES & 3- OFTEN

B. When during the year does this threat happen (i.e., *certain months or wet/dry seasons*)? Does it happen the same time every year?

C. Overall, how threatening is this human-wildlife conflict to community livelihoods?

0- NO THREAT, 1-LOW THREAT, 2-MEDIUM THREAT AND 3-HIGH THREAT

D. How important is it for the community to take steps to reduce this threat?

0-NOT IMPORTANT, 1-LOW IMPORTANCE, 2- MEDIUM IMPORTANCE, 3- HIGH IMPORTANCE

E. What animals (*i.e., species or types of animals*) are involved with this particular threat?

FACILITATOR HAS COMMON SPECIES CARDS AVAILABLE AND AS DISCUSSION PROCEEDS THE SPECIES ARE PRESENTED.

- Now, that you have chosen the animals please rank them from the most important animal involved in this threat to the least important. Feel free to talk among yourselves and come to a decision.
- Once you have a decision, please attach your animals to the sheet in the order from the most important to the least important.

III. DISCUSSION-VULNERABILITITES (30-40 minutes)

1. FACILITATOR INTRODUCES IDEA OF VULNERABILITY AND LEADS DISCUSSION OF HWC VULNERABILITY

🗣THIS IS A GROUP DISCUSSION AND FACILITATOR MODERATES THE DISCUSSION AND TAKES NOTES; VULNERABILITY FACTORS THAT HAVE STRONG SUPPORT ARE LISTED ON THE THREAT DESCRIPTION POSTERS WITH BRIEF DISCRIPTIONS

"Lets look at each of the threats and discuss who in the community faces the most threat from this conflict. People in your community may have different chances of experiencing a conflict with wildlife. People in your community may also be different in their ability to cope or recover from a conflict with wildlife after a conflict has happened."

- Are there different traits that make people more likely to have a conflict with wildlife in your community (e*.g., where their land is located, how large their land may be, if they take measures to scare away wildlife*)?
- Are there different traits that make some people suffer more than others once a conflict with wildlife has happened (*e.g., how many people live in the household, gender, wealth, landholding size*)?

🍽LUNCH (1 HOUR)

IV. COMMUNITY MAPPING PART 1 (60-90 minutes)

1. INTRODUCTION TO COMMUNITY MAPPING

"Community maps can be important to show where in the area many of the conflicts with wildlife happen and who lives and works in those areas. This is a map of your community and the surrounding area. The purpose of this activity is for you to show where the important areas and resources are in your community, where there have been conflicts with wildlife, which animals are involved in those conflicts, how often these conflicts occur and where in the community particular community members spend time to work and live. Once we are done with this activity we will have a good picture of where in the community conflicts with wildlife occur. This activity should take less than two hours. "

- Lets gather around and look at this map. Has anyone ever seen a map before? On this map let's locate some important areas for the community.

FACILITATOR WILL USE A GOREFERENCED BASE MAP WITH PRE-MAPPING OF KEY AREAS IN THE COMMUNITY BY CONSULTING LOCAL LEADERS.

Lets quickly locate some important features on the map that are found in the community:

a. Locate rivers, lakes, ponds and community water sources.

b. Locate important community areas, places to gather for meetings, schools, clinics, roads, businesses, guest areas and community projects.

c. Locate houses, village boundaries, fences, gardens and livestock areas.

- Are there any important community areas are not on the map? If so, lets take this pencil and add the important areas to the map.

2. MAPPING SOCIAL SPACES

1. Next, I am going to give each of you a set of stickers and we are going to discuss where you spend the most time completing tasks and activities.

- The blue stickers indicate areas where you spend the least amount of time, such as an area visited only a few times a year.
- The yellow sticker indicates an area that you visit more often, such as an area you may visit nearly monthly.
- Finally, the red sticker indicates and area that you spend a great deal of time completing tasks and activities, an area that you visit almost weekly or more than once a week.
- Lets discuss which places you and other women in your community spend their time and when you have decided please put your stickers on the map.
- *Remember, blue stickers are places you spend the least amount of time, yellow stickers are areas you more time and the red are areas you are in almost every day*.

📽 THIS ACIVITY IS COMPLETED ON TRANSPARENT SHEETS SECURED TO THE ORIGNAL BASEMAP OF COMMUNITY RESOURCES AND ACTIVITIES. ALL LAYLERS NEED TO BE PHOTOGRAPHED USING A DIGITAL CAMERA FOR LATER ANALYSIS.

3. MAPPING HWC

"We are now going to use the HWC threat posters that we created and map these threats onto the community map. First lets number the threats from human wildlife conflict to your livelihoods starting with number one. Write the number on each poster."

- I am going to give you each a set of three different markers. Lets look at the posters and the numbers related to how threatening this threat is to community livelihoods.
- We are going to draw where these threats occur on the map. This may be a circle, a line or a dot depending on how large of an area this threat happens in.
- The blue marker is for the low threat worries; an area where wildlife conflict occurs yet has little impact on the community or families, as the damage from the conflict is minimal. These are threats that were ranked as a one.

- The yellow marker will represent medium threat or an area where the wildlife conflict occurs and has some impact on the community or families, as the damage from the conflict is moderate or more severe. These threats are those that were ranked as a number two on our number scale.
- The red marker is for areas where the wildlife damage is the most severe, area of high threat, and has a great impact on the community or families. These are threats listed scored as a three on our number scale.
- *Make sure to write the number of the conflict in the circle or next to the line or point.*
- You can talk with each other about the map and share your ideas. However, remember that each have your individual knowledge of where wildlife conflict occurs. Please be respectful of everybody's thoughts. You may have some areas where you share conflict and others that are different from your peers.
- After you have made your final comments and collected your thoughts you may draw the threat areas on the map with the color that corresponds to the level of threat on its poster.

FACILITATOR WILL, AT A LATER TIME TRANSFER INFORMATION FROM THE HWC THREAT POSTERS (FREQUENCY, IMPORTANT SPECIES INVOLVED) ONTO THE THREAT MAP IN THE CORRECT POLYGON OR ON THE CORRECT LINE OR POINT.

V. GROUP DISCUSSIONS (40-60 minutes)

1. GROUP DISCUSSION ABOUT RESULTS OF MAPPING ACTIVITY

- Are there any surprising things that you see from looking at the maps?
- What are some ways that the community has tried to lessen the threat from human-wildlife conflict or solve human wildlife conflicts?
- For each worry related to a human wildlife conflict, the posters we have created, lets write a few common ways that the community or individuals cope or deal with the conflict.
- For each strategy or way the community has tried to solve or lessen the conflict lets talk about how good this strategy is at helping the community or individuals deal with the conflict.
- Sometimes there are people who benefit from certain solutions (*i.e. winners, gain a benefit*) and others that do not or are actually harmed even more (*i.e. losers, do not benefit*). For each solution lets discuss who benefits and who does not benefit.
- What do you think are the best things the community could do to help reduce or solve the most worrisome problems related to human-wildlife conflict?

Thank you for completing this activity. I will work to make one list with total scores for each worry and present it to community before I leave the village.

We need a couple volunteers to present our posters and maps to the large group after break. Select a reporter from the group to discuss the final map with the entire group. Now lets take a short break and we will come back in one large group to close the day's activities.

BREAK 15 MINUTES

VI. DEBRIEF (25-30 minutes)

1. GROUP DISCUSSIONS OF RISK RANKING AND MAPPING ACTIVITY

- Now lets look at the maps created. Each group's reporters please briefly discuss your maps and posters with the entire group. Please describe the map to the group.
- Are there areas within the community that have more severe conflicts with wildlife?
- Are there areas within the community that have conflicts more often than others?
- Do any areas overlap with areas often used in completing daily tasks and activities?
- Are there concerns about conflicts with particular animals?

IF THE ACTIVITY WAS CONGRUENTLY COMPLETED BY MEN AND WOMEN:

Now that we have looked at both group's maps, discuss the similarities and differences between these two maps.

- What do you think are the reasons for the differences and the similarities?
- Are the areas that men and women use the same in terms of frequency and severity of conflicts with wildlife? If not, why might that be?
- What do you think are the best things the community could do to help reduce or solve the most threatening problems for wildlife related to human-wildlife conflict?

Thank you for completing that activity. I will work to complete one community map based on the two maps that you completed and make one list with total scores for each threat and present it to community before I leave the village.

Are there any questions?

CLOSING DAY ACTIVITIES, REMARKS AND ANNOUNCEMENTS

NOTE: FACILITATOR MUST TAKE EXTENSIVE DIGITAL PHOTOGRAPHS OF THE MAPS, POSTERS AND OTHER OUTPUTS CREATED FOR TRANSPORTATION AND ANALYSIS. OUTPUTS ARE LEFT WITH THE COMMUNITY TO HELP AID LOCAL PLANNING.

I. ICEBREAKER, QUESTIONS & ANSWERS (15-20 minutes)

FACILITATOR MAY CHOOSE APPROPRIATE ICEBREAKER ACTIVITY OR ASK SOMEONE TO OPEN WITH PRAYER IN ACCORDANCE WITH LOCAL CUSTOM

- Does anyone have any questions from yesterday's activities?
- Does anyone have any comments from yesterday's activities?

FACILITATOR PRESENTS THE SCHEDULE FOR DAY TWO'S ACTIVITIES AND SPLITS THE GROUPS INTO TWO.

II. RISK RANKING & SCORING-BIODIVERSITY (90-120 minutes)

1. INTRODUCE THE ACTIVITY

"Today we are going to discuss threats to local wildlife in your area. By wildlife I mean all animals in the area, including birds and reptiles (*e.g., such as snakes and lizards*) that are not domesticated animals or insects. Lets look again at these pictures that show what animals are wildlife and what animals are not wildlife. Many things can threaten wildlife and the things they rely on to live. These threats, sometimes called concerns, risks or dangers, may be of different importance to the wildlife. Some threats may be very serious and threaten to reduce wildlife numbers, reduce the types or diversity of wildlife found in the area or make them go extinct, while others cause only small problems for wildlife. The reason we are going to do this activity is to find out what the threats to wildlife are and how important you think these threats are in reducing healthy wildlife numbers and types of wildlife found in the area. This should take about 2 hours."

2. FACILITATOR GIVES EACH PARTICIPATN A SET OF CARDS AND MARKERS AND GIVES THE FOLLOWING INSTRUCTIONS

- On these cards I want you to write or draw a threat that affects or threatens <u>wildlife</u> in this area.
- Each card should have only one threat on it.
- You can write or draw as many threats to the wildlife as you want. These threats can be big problems or small problems; whatever you think threatens the local wildlife.
- If you need to write in your local language please feel free or if you need help please ask. I will walk around the room to answer questions.
- Please take 20 minutes to write down as many threats as you can think of that endanger or threaten local wildlife.
- *Remember we are listing threats from people or not from people that affects wildlife.*
- *If you write down an activity that people do that threatens wildlife this does NOT mean that you do this activity.*
- *Try to think about regional or local threats, not just large global threats, such as global warming, but threats that are manageable by local people.*

3. RANK THE LIVELIHOOD THREATS; USE A LARGE SHEET OF PAPER AND TAPE

- Now I want you to bring your cards, the threats, around this large piece of paper. The paper has most important written at the top and least important written at the bottom.

- I want you to rank your threats starting with the most important, the most threatening to wildlife on top, then the second most important and ending with the least important threat at the bottom.
- Everyone will get a chance to rank his/her threats and there is no wrong or right answer. Remember the most worrisome threat will be at the top and the least worrisome will be at the bottom.
- After you are happy with your ranking use this tape to attach your card to the paper.

4. FACILITATOR TURNS THE DISCUSSION TOWARDS HUMAN-WILDLIFE CONFLICT

Human-wildlife conflicts are bad or negative interactions between people and wildlife. It is important to remember that not all interactions or relationships between people and wildlife are bad, as we discussed yesterday.

However, bad interactions or negative relationships may threaten both people and the animals themselves.

- Can you think of different threats to wildlife that result from a conflict with people? (i.e. *What about people killing wildlife because of threats to gardens or livestock? How about threats from people to the places wildlife depend on to live? What about poisoning or pollution? What about disease from livestock?)*
- Are human-wildlife conflicts a threat to local wildlife?
- Lets look at our threats and rankings again. Are any of the threats that you listed human-wildlife conflicts or are these threats on wildlife because of a bad interaction with people? If so, lets put a sticker on the cards that are human-wildlife conflicts.
- Are there any threats to wildlife from human-wildlife conflicts that are not on your lists? If there are, lets put them on a card and put them in your rankings where you feel they belong.

5. QUANTIFY THE THREAT SEVERITY

- Some threats may be very harmful to wildlife, while others may not be very harmful but are much smaller problems that wildlife may easily recover from. I am going to give you five beans for each of the threats you listed. You are going to use these beans to give a score to the threats.
- Giving five beans to a threat means that that threat is very serious and may result in the loss of a species or type of animal in the area, while giving one bean to a worry means that the worry is very little problem and does not affect overall wildlife numbers or types of wildlife in the area.
- Giving a threat four beans would mean that the threat is less threatening than a five but more threatening than a three, while giving a threat two beans means it is more than a small problem but less threatening than five, four and three beans.
- You can give your threats to wildlife each a score of 1,2,3,4 or 5.

- Now you can score your worries; remember a score of 5 means it is very threatening while the lowest score of one the smallest problem.

☞FACILITATOR ALLOWS PARTICIPANTS TO SCORE THEIR RISK RANKING; AFTER SCORING IS COMPLETED THE ASSISTANT NEEDS TO RECORD THE NUMBER OF BEANS ON EACH CARD OR RECORD SHEET

☺BREAK 15 MINUTES (REFRESHMENTS)

6. DESCRIBING AND QUANTIFYING THE THREATS

- Lastly, lets talk about the threats to wildlife from human-wildlife conflict. I am going to list all the HWCs that you listed and scored in your ranking as threats to local wildlife on these large sheets of paper.
- We are going to discuss these threats and write down some important information regarding these threats.

🗣THESE ARE GROUP DISCUSSIONS AND WILL BE RECORDED THROUGH A CONCENSUS. FACILITATOR WILL GUIDE PARTICIPANTS TO ANSWER EACH OF THE FOLLOWING QUESTIONS FOR EACH HWC THREAT (ANSWERING ALL QUESTIONS FOR ONE THREAT THEN MOVING TO THE NEXT THREAT. VISUAL SCALES WILL BE USED FOR QUESTIONS A, C AND D.

A. How often does this activity or threat happen? Lets use this scale to give this threat a number score.

0-NEVER, 1- RARELY, 2-SOMETIMES, 3- OFTEN

B. When during the year does this threat happen (i.e., *certain months or wet/dry seasons*)? Does it happen the same time every year?

C. Overall, how threatening is this human-wildlife conflict to wildlife?

1-LOW THREAT, 2-MEDIUM THREAT AND 3-HIGH THREAT

D. How important is it for the community to take steps to reduce this threat to local wildlife?

0-NOT IMPORTANT, 1-LOW IMPORTANCE, 2-MEDIUM IMPORTANCE, 4- HIGH IMPORTANCE

E. What animals (*i.e. species or types of animals*) are threatened the most by these conflicts?

FACILITATOR HAS COMMON SPECIES CARDS AVAILABLE AND AS DESCUSSION PROCEEDS THE SPECIES ARE PRESENTED.

- Now, that you have chosen the animals please rank them from the most threatened animal involved to the least important. Feel free to talk among yourselves and come to a decision.
- Once you have a decision, please attach your animals to the sheet in the order from the most threatened to the least threatened.

III. DISCUSSION-VULNERABILITITES (30-40 minutes)

1. FACILITATOR INTRODUCES IDEA OF VULNERABILITY AND LEADS DISCUSSION OF HWC VULNERABILITY

🗣THIS IS A GROUP DISCUSSION AND FACILITATOR MODERATES THE DISCUSSION AND TAKES NOTES; VULNERABILITY FACTORS THAT HAVE STRONG SUPPORT ARE LISTED ON THE THREAT DESCRIPTION POSTERS WITH BRIEF DISCRIPTIONS

"Lets look at each of the threats and discuss which animals face the most threat from this conflict. Different species or kinds of animals may have different chances of experiencing a conflict with people. Different species in your area may also be different in their ability to cope or recover from a conflict with people after a conflict has happened."

- Are there different traits that make certain animals more likely to have a conflict with people in your community (*e.g., where these animals forage or drink water, how large their territory needs to be, migration patterns, cultural factors, hunting or foraging patterns*)?
- Are there different traits that make some animals suffer more than others once a conflict with wildlife has happened (*e.g., how long it takes to reproduce, other threats they face, behavioral factors*)?

🍽LUNCH (1 HOUR)

IV. COMMUNITY MAPPING PART 2 (60-90 minutes)

FACILITATOR IS TO CLEAN OR REMOVE THE MYLAR SHEET FROM DAY ONE ACTIVITIES AND REPLACE WITH A CLEAN SHEET

1. MAPPING THREATS TO WILDLIFE

We are now going to use the threat posters that we created and map these threats onto the community map.

- First lets number the threats from human wildlife conflict to wildlife starting with number one. Write the number on each poster.
- I am going to give you each a set of three different markers. Lets look at the posters and the numbers related to how threatening this threat is to wildlife.
- We are going to draw where these threats occur on the map. This may be a circle, a line or a dot depending on how large of an area this threat happens in.
- The blue marker is for the low threat worries; an area where wildlife conflict occurs yet has little impact on local wildlife, as the damage from the conflict is minimal. These are threats to wildlife that we gave a score of one.
- The yellow marker will represent medium threat or an area where the wildlife conflict occurs and has some impact on the wildlife, as the damage from the conflict is moderate or more severe. These threats had a score of two.

- The red marker is for areas where the damage or threat to wildlife is the most severe, area of high threat, and has a great impact on the local wildlife numbers or variety. These threats are the ones that you gave a score of three.
- Make sure to write the number of the conflict in the circle or next to the line or point.
- You can talk with each other about the map and share your ideas. *However, remember that each have your different knowledge of where these threats occur. Please be respectful of everybody's thoughts*.
- After you have made your final comments and collected your thoughts you may draw the threat areas on the map with the color that corresponds to the level of threat on its poster.

V. GROUP DISCUSSION (40-60 minutes)

1. GROUP DISCUSSION ABOUT RESULTS OF MAPPING ACTIVITY

- Are there any surprising things that you see from looking at the maps?
- What are some ways that the community has tried to lessen the threat from human-wildlife conflict or solve human wildlife conflicts?
- For each worry related to a human wildlife conflict, the posters we have created, lets write a few common ways that the community or individuals cope or deal with the conflict.
- For each strategy or way the community has tried to solve or lessen the conflict lets talk about how good this strategy is at helping the community or individuals deal with the conflict.
- Sometimes there are people who benefit from certain solutions (*i.e. winners, gain a benefit*) and others that do not or are actually harmed even more (*i.e. losers, do not benefit*). For each solution lets discuss who benefits and who does not benefit.

FACILITATOR WILL RETURN TO THE THREAT MAPS AND RECORD GROUP RESPONSES IN TERMS OF STRATEGY EFFICIENCY AND WHO IS BENEFITING FROM THE STRATEGY. THIS IS A GROUP DISCUSSION.

- What do you think are the best things the community could do to help reduce or solve the most worrisome problems related to human-wildlife conflict?

Thank you for completing this activity. I will work to make one list with total scores for each worry and present it to community before I leave the village.

We need a couple volunteers to present our posters and maps to the large group after break. Select a reporter from the group to discuss the final map with the entire group. Now lets take a short break and we will come back in one large group to close the day's activities.

BREAK 15 MINUTES

16

VI. DEBRIEF (25-30 minutes)

1. GROUP DISCUSSIONS OF RISK RANKING AND MAPPING ACTIVITY

Now lets look at the maps created. Each group's reporters please briefly discuss your maps and posters with the entire group. Please describe the map to the group.

- Are there areas within the community that have more severe conflicts with wildlife?
- Are there areas within the community that have conflicts more often than others?
- Do any areas overlap with areas often used in completing daily tasks and activities?
- Are there concerns about conflicts with particular animals?

If the activity was congruently completed by men and women:

- Now that we have looked at both group's maps, discuss the similarities and differences between these two maps. What do you think are the reasons for the differences and the similarities?
- Are the areas that men and women use the same in terms of frequency and severity of conflicts with wildlife? If not, why might that be?
- What do you think are the best things the community could do to help reduce or solve the most threatening problems for wildlife related to human-wildlife conflict?

Thank you for completing that activity. I will work to complete one community map based on the two maps that you completed and make one list with total scores for each threat and present it to community before I leave the village.

- Are there any questions?

CLOSING DAY ACTIVITIES, REMARKS AND ANNOUNCEMENTS

NOTE: FACILITATOR MUST TAKE EXTENSIVE DIGITAL PHOTOGRAPHS OF THE MAPS, POSTERS AND OTHER OUTPUTS CREATED FOR TRANSPORTATION AND ANALYSIS. OUTPUTS ARE LEFT WITH THE COMMUNITY TO HELP AID LOCAL PLANNING.

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APPENDIX B

Interview Guide

Opinions of Risks to Local Livelihoods & Wildlife from Human-Wildlife Conflict

Research funded by Michigan State University's Department of Fisheries & Wildlife

INTERVIEW GUIDE- VERBAL CONSENT SCRIPT

I am a graduate student from the United States and my name is Jessica Kahler. I attend Michigan State University and study human-wildlife conflicts. By human-wildlife conflicts I mean a bad or negative interactions between people and wildlife. This research helps me complete requirements for my education, but more importantly may help improve management of conflicts between people and wildlife.

I am very interested in hearing what you think about this topic. There are no wrong answers to the questions that will be asked. I ask only for your honest opinion. Your participation will help researchers, regional and local decision-makers better understand the threats to local people, communities and wildlife from conflicts between people and wildlife. Your responses are completely confidential, as I will not record your name in association with your answers. I will only give your interview a number. The entire interview should take about 1 hour - 1.5 hours.

This interview is voluntary, which means that you may choose not to participate in interview at any time. You may also chose not answer a particular question of the interview. If you do not understand the questions please ask me and I will be happy explain in greater detail. You must be at least 18 years of age to participate in this interview. By saying "Yes I understand," you are telling me that you at least 18 years of age and want to participate.

Do you have any questions before we get started?

HWC INTERVIEW: Risk Perception, Vulnerability & Compliance

Case Study Code: _03- _____Language: _____ Date:_____

Interview #: _____ Time Start: _____ Time End: _____

Setting (circle one): Residential Outdoors Commercial Community

Introduction & Ice-Breakers

Many of the questions that I am going to have you answer will have a number as an answer. This picture illustrates the numbers (SHOW IMAGE). Larger numbers indicate more or greater, which can mean that you have more concern, you think there is more threat or you think it always happens. Lower numbers indicate you have less concern, you think there is a little threat or you think it never happens. First you get a chance to practice using the number scale. **[INTERPRETERS EXPLAIN SCALE]**

1. How often did you eat porridge last year?

0	1	2	3
Never	Rarely	Sometimes	Often

2. Please tell me how concerned you are that South Africa's football team will beat Namibia's football team during the world cup in 2010.

0	1	2	3
No concern	Low concern	Medium concern	High concern

Section 1: Factors influence HWC

Human-wildlife conflicts (HWC[1]) are bad or negative interactions between people and wildlife. [INTERPRETER AND RESEARCHER SHOW VISUAL AID THAT CLARIFIES WILDLIFE]. HWCs can threaten the health and safety of either people or wildlife. I am going to ask you how you feel about human-wildlife conflicts**.**

3. How often does HWCs happen in your community?

0	1	2	3
Never	Rarely	Sometimes	Often

4. Do you think that the current threat from conflicts with wildlife to your community is low enough (i.e., is the risk of HWC to your community okay)?

YES or NO

IF NO: Are the threats from wildlife to your community?

1	2	3
Low	Medium	High

[1] HWC will be used as shorthand through the remainder of the document. Investigator will say "human-wildlife conflict" throughout interview.

5. Do you think that the current threat from people to local wildlife populations is low enough (i.e., is the risk of HWC to local wildlife populations okay)?

YES or NO

If NO, are the threats to local wildlife populations from people?

1	2	3
Low	Medium	High

6. How much do you think that natural factors (*i.e., drought, or floods*) increase conflicts with wildlife in your area?

0	1	2	3
No increase	Low increase	Medium increase	High increase

7. How much do you think that your community's development (*i.e., where people build housing or plant crops*) increases conflicts with wildlife in your area?

0	1	2	3
No increase	Low increase	Medium increase	High increase

8. How much control do you think you have over whether your family has a conflict with wildlife?

0	1	2	3
No control	Low control	Medium control	High control

9. Does everyone in your community have the same chance to benefit from local wildlife?

YES or NO

IF NO: *In your community, how much are the benefits from wildlife shared?*

0	1	2	3
No sharing	Low sharing	Medium sharing	High sharing

10. Does everyone in your community have the same risk of experiencing a conflict with wildlife?

YES or NO

IF NO: *In your community, how much are the risks (threats) from conflicts with wildlife shared?*

0	1	2	3
No sharing	Low sharing	Medium sharing	High sharing

Section 2: Perception of risks to livelihoods from HWC

I am now going to ask you questions about the threats from wildlife to your livelihood. By livelihood I mean your way of life and your quality of life. Seeing a wild animal is not necessarily a conflict unless you feel bad or threatened.

11. People have different levels of concern about living with wildlife. How concerned are you <u>personally</u> about:

	No concern	**Low concern**	**Medium concern**	**High concern**
Being injured by wildlife	0	1	2	3
Damage to agricultural products caused by wildlife (*e.g., crops, fisheries*)	0	1	2	3
How concerned are you <u>personally</u> about:				
Loss of livestock to wildlife	0	1	2	3
Damage to your property caused by wildlife (*e.g., equipment, fence, house*)	0	1	2	3
How concerned are you <u>personally</u> about:				
The work needed to keep wildlife away from your agricultural property (e.g., crops, livestock, fisheries)	0	1	2	3

How concerned are you <u>personally</u> about:

Feeling threatened by wildlife	0	1	2	3
Conflicts with other people in your community over wildlife issues	0	1	2	3
Livestock getting a disease from wildlife	0	1	2	3

12. People have different levels of concern about loss that may result from human-wildlife conflict. How concerned are you that a conflict with wildlife that would:

	No concern	**Low concern**	**Medium concern**	**High concern**
Reduce your household food supply	0	1	2	3
Reduce family income (i.e. lost marketable products)	0	1	2	3

How concerned are you that a conflict with wildlife that would:

Reduce household labor available due to injury caused by wildlife	0	1	2	3
Increase labor needs due to agricultural damage by wildlife	0	1	2	3

How concerned are you that a conflict with wildlife that would:

Reduce your family's ability to meet cultural obligations (*e.g., festivals, weddings, pay fines)*	0	1	2	3
Reduce your family's social status (*e.g., reduction in livestock #'s or wealth*)	0	1	2	3

How concerned are you about losses from conflict with wildlife that may:

Reduce your family's happiness due to worry	0	1	2	3
Reduce future wildlife resources to benefit your grandchildren (*i.e., future generations*)	0	1	2	3

13. Now I am going to ask you about how often you come up against certain types of threats from conflicts with wildlife. We are going to use this scale [SHOW SCALE AND GO THROUGH CATEGORIES]. How <u>often</u> has your family come up against:

	Never	**Rarely**	**Sometimes**	**Often**
Agricultural crop loss to wildlife	0	1	2	3
Livestock predation by wildlife	0	1	2	3
How often has your family come up against:				
Damage to your property by wildlife (*e.g., equipment, fences, house*)	0	1	2	3
Injury due to wildlife	0	1	2	3
How often has your family come up against:	**Never**	**Rarely**	**Sometimes**	**Often**
Feeling threatened by wildlife	0	1	2	3
Conflicts with other people in the community over wildlife issues	0	1	2	3
Livestock getting a disease from wildlife	0	1	2	3

14. Overall, please rate how often you worry about threats from wildlife to your livelihood.

0	1	2	3
Never	Rarely	Sometimes	Often

15. Can you give me an example of something that you or your family does to reduce the threats to your livelihoods from conflicts with wildlife (i.e. can you give me an example of ways you protect yourselves against wildlife)?

_____
_____
_____
_____
_____
_____
_____

Section 3: Perceptions of risk to wildlife from HWC

I am now going to ask you questions about threats that people cause to wildlife. By threats to wildlife I mean that things that people do have a negative effect on the overall numbers of wildlife, the diversity of wildlife (i.e., different types of wildlife) or harm the environment wildlife needs for survival.

16. People have different levels of concern about the negative effects on wildlife due to conflicts that wildlife has with people. Using this scale [SCALE CHANGE SHOW IMAGE], how much threat to local wildlife in this area is:

	No threat at all	Low threat	Medium threat	High threat
People killing wildlife for food	0	1	2	3
People killing wildlife because of conflicts with people (*i.e., agriculture, injury, water*)	0	1	2	3
In your area, how threatening to wildlife is:				
People killing wildlife because of cultural beliefs (*i.e., taboos, trophies, rites of passage*)	0	1	2	3
People killing wildlife for money (*i.e., tourism, meat*)	0	1	2	3

	No threat at all	Low threat	Medium threat	High threat
In your area, how threatening to wildlife is:				
People using the resources wildlife need for survival (*i.e., water, pasture*)	0	1	2	3
Wildlife getting a disease from domestic animals	0	1	2	3
In your area, how threatening to wildlife is:				
People changing wildlife areas to support their livelihoods (*i.e., agriculture, fuel wood*)	0	1	2	3
People changing wildlife areas to exclude wildlife (*i.e., putting up fences, clearing brush*)	0	1	2	3
Poaching	0	1	2	3

17. OMITTED QUESTION

18. People have different levels of concern about losses that wildlife may face as a result of conflict with people. How concerned are you about that the following types of losses are happening to wildlife in your area:

	No concern	Low concern	Medium concern	High concern
Reduce overall wildlife numbers	0	1	2	3
Reduce the number of different wildlife species in the area (*i.e., losing diversity*)	0	1	2	3
Loss of a certain wildlife species (*i.e., losing one kind of animal in the area*)	0	1	2	3

How concerned are you about wildlife losses from conflict with people that may:

Reduce wildlife health	0	1	2	3
Reduce resources to support future wildlife populations	0	1	2	3

19. Now I am going to ask you about how <u>often</u> you think wildlife comes up against certain types of threats from HWC. [SHOW SCALE AND GO THROUGH CATEGORIES]. How often does the following happen in your area:

	Never	**Rarely**	**Sometimes**	**Often**
People killing wildlife due to damage to agricultural products (*i.e., crops, livestock*)	0	1	2	3
People killing wildlife due to damage to property (*i.e., housing, fences, water tanks*)	0	1	2	3
People killing wildlife that threaten to injure people	0	1	2	3

How often do you think the following threatens wildlife in your area:

Wildlife getting a disease from domestic animals	0	1	2	3
People using resources wildlife needs for survival (*e.g., water, pasture*)	0	1	2	3

How often do you think the following threatens wildlife in your area:

People changing wildlife areas to support their livelihoods (*e.g., clearing land for agriculture, removing fire wood*)	0	1	2	3
People changing wildlife areas to exclude wildlife (*e.g., putting up fences, clearing bush*)	0	1	2	3
Poaching	0	1	2	3

20. Overall, how often you do you worry about threats to wildlife from people in your area?

0	1	2	3
Never	Rarely	Sometimes	Often

21. Can you give me an example of something that your community or conservancy does to reduce the threats to wildlife from conflicts with people (*i.e., Can you give me an example of something your community is doing to protect wildlife)?*

_____
_____
_____
_____
_____
_____

Section 4: Compliance and Legitimacy

Now I am going to talk to you about your feelings about wildlife rules. The rules I am interested in tell you how you should and can interact with wildlife populations and include both laws and community rules. I will ask you about how good you think wildlife rules are at reducing threats to people and to wildlife. I will also ask you about your opinion on how these rules and laws are created but I will not ask you about whether you break wildlife rules.

22. Are you aware there are rules in relation to wildlife?

YES or NO

IF YES: Can you give me an example of a wildlife law (*i.e., enforced by government or local decision-makers that you are aware of*)?

_____
_____

Can you give me an example of a local rule (*i.e., enforced by community or culture*)?

_____
_____

23. I am now going to ask you to use this scale to measure importance [SHOW SCALE]. People may choose to follow wildlife rules for different reasons. How important do you think the following reasons are in relation to why <u>people in your community</u> may follow rules regarding wildlife?

	Not important	Low importance	Medium importance	High importance
Because the rule is doing the right thing	0	1	2	3
Because following rules is the right thing to do	0	1	2	3
Respect for authority	0	1	2	3
When people decide to follow wildlife rules how important is:				
Fear of getting caught	0	1	2	3
How severe the punishment is (*i.e., the punishment is serious*)	0	1	2	3
Shame if caught	0	1	2	3

24. Do you think that decision makers are doing the right thing by creating rules in relation to wildlife?

YES or NO

25. How good do you think decision makers are at enforcing the rules about wildlife?

0	1	2	3
Not at all good	Low good	Medium good	High good

26. How good do you think decision makers are at enforcing the rules about wildlife in a fair way?

0	1	2	3
Not at all good	Low good	Medium good	High good

27. How good do you think the rules are now at lowering the threats from conflicts with wildlife to :

	Not at all good	Low good	Medium good	High good
All people in your community	0	1	2	3
People like yourself	0	1	2	3
***How good are these wildlife rules at lowering the threats to*:**				
All wildlife species in the area	0	1	2	3
Wildlife species at high risk (i.e., wildlife of conservation concern, endangered animals)	0	1	2	3

28. Some people may feel they are not able to participate in decision-making about wildlife rules as much as they want to. In your opinion, how important are the following factors in deciding whether people in your community are able to participate in decision making related to wildlife rules:

	Not at all important	**Low important**	**Medium important**	**High important**
Their desire to participate	0	1	2	3
Being male (*i.e., being a man, gender*)	0	1	2	3
Being a community elder	0	1	2	3

In deciding whether people are able to participate in decision making related to wildlife how important is:

Having a formal education	0	1	2	3
Whether their family lived in area for a long time	0	1	2	3
What tribe they belong to	0	1	2	3

29. How good are local decision makers at taking the views of <u>people like you</u> into account when making wildlife rules (i.e., how good are the decision makers now at listening to opinions of people like yourself)?

0	1	2	3
Not at all good	Low good	Medium good	High good

30. How good are decision makers not at considering threats to your livelihood when making wildlife rules?

0	1	2	3
Not at all good	Low good	Medium good	High good

31. How good are decision makers now at considering threats to wildlife populations when making wildlife rules?

0	1	2	3
Not at all good	Low good	Medium good	High good

Section 4: Vulnerability

I am now going to ask some questions that are personal in nature. This is a very important part of the interview. Remember, I will not ask for your name or any questions that would indicate who you are.

32. Respondent's gender [OBSERVED]: Male or Female

33. Ethnic affiliation:

[ ] Kavango	[ ] Kwanyama	[ ] Lozi	[ ] Mafwe	[ ] Mbukushu	[ ] Ndonga	[ ] Subiya
[ ] Totela	[ ] Twana	[ ] Yeyi	Other: _____			

34. What would you say is the primary way that you make a living: (*check no more than two)*

[ ] Agriculture	[ ] Livestock	[ ] Fishing	[ ] Hunting	[ ] Trading/ vending	[ ] Rural industry (beer brewing, handicraft)

Wage or salary work [ ]; If wage or salary check one below:

[ ] Agricultural/ livestock	[ ] Tourism industry	[ ] Childcare/ homecare	[ ] Business	[ ] Government	[ ] Service/ NGO

[ ] Other (specify): _____

35. How old are you? _____ (IF UNSURE): What year were you born? _____(IF UNSURE CONSULT THE CAPRIVI HISTORICAL CHRONOLOGY FOR GROSS GENERATIONAL ESTIMATES):

I was born before: _____

36. What is your highest level of formal education that you completed? _____ (check one)

Did not complete lower primary	[ ]	Completed lower primary	[ ]
Some upper primary	[ ]	Completed upper primary	[ ]
Some junior secondary	[ ]	Completed junior secondary	[ ]
Some senior secondary	[ ]	Completed senior secondary	[ ]
Some college	[ ]	Completed college	[ ]
Adult vocational training (adult education courses)	[ ]		

37. How long has your family been living in this community? (UTILIZE THE CAPRIVI HISTORICAL CHRONOLOGY FOR GROSS GENERATIONAL ESTIMATES)

Have lived here since: _____

38. Are you a member of any decision-making body such as a committee, council or elected position (e.g., Village development committees (VDC), Farmer's committees, health committees, parent-teacher associations, women's group, water committee, conservation committee)?

YES or NO (IF NO → SKIP TO NEXT QUESTION; IF YES ANSWER FOLLOWING TWO QUESTIONS)

IF YES: What decision making group do you belong to:

_____

What is your position in that group? _____

39. What is your current marital status?

[ ] Never Married [ ] Married [ ] Divorced [ ] Widowed

IF MARRIED: How many spouses do you have? _____

40. How many people are currently living in your household? _____

41. Of the people living in your household how many are under 18 years of age? _____

42. Do you own any land? YES or NO

IF NO LAND OWNERSHIP OR NO AGRICULTURAL/ GRAZING LAND →SKIP TO QUESTION 44

IF YES: Is the land that belongs to you: (check all that apply)

[ ] Residential	[ ] Arable/ agriculture	[ ] Grazing	[ ] Business sites	[ ] Other (hunting, collecting)

43. How large is your agricultural and/or grazing land? _____

[ ] Small [ ] Medium [ ] Large
Less than 5 hectares 5-10 hectares Greater than 10 hectares

44. Is any of your agricultural/ grazing land fenced, including bush fence?
YES or NO

IF YES, is the fence: [ ] Bush (Acacia, thorn) [ ] Barbed Wire [ ] Electric
[ ] Other:_____

45. Do you rent or lease land for agriculture? YES or NO

46. Does your household currently grow agricultural crops? YES or NO
IF NO → SKIP TO QUESTION 48

47. Are your agricultural crops regularly guarded? YES or NO
IF NO → SKIP TO QUESTION 48

IF YES: Of the following, who in the household is responsible for guarding the crops (check all that apply):

[ ] Everyone/ anyone	[ ] Household men	[ ] Household women	[ ] Children-boys	[ ] Children-girls
[ ] Paid labor	[ ] Guard animal	[ ] Other: _____		

48. Do you have livestock? YES or NO
IF NO→SKIP TO QUESTION 50

IF YES: Can you tell me what kind of livestock you have and approximately how many head of each?

[ ] Cattle: Estimation of #: _____ [ ] Goats: Estimation of #: _____
[ ] Donkeys: Estimation of #:_____ [ ] Horses: Estimation of #:_____
[ ] Pigs: Estimation of #: _____ [ ] Fowl (chickens, ducks): #: _____
[ ] Other: _____: Estimation of #: _____

49. Does anyone or anything, such as a guard animal, in your household guard your livestock? YES or NO

IF NO →SKIP TO QUESTION 50

IF YES: Who in the household is responsible for guarding the livestock and what livestock do they guard (CHECK ALL THAT APPLY AND INDICATE LIVESTOCK GUARDED-LG):

[ ] Household men LG: _____	[ ] Household women LG: _____	[ ] Children-boys LG: _____
[ ] Children-girls LG: _____	[ ] Paid labor LG: _____	[ ] Guard animal (specify): LG: _____
[ ] Other: _____	LG: _____	

50. Do you have any other comments you would like to share with me related to HWC?

_____

_____

_____

_____

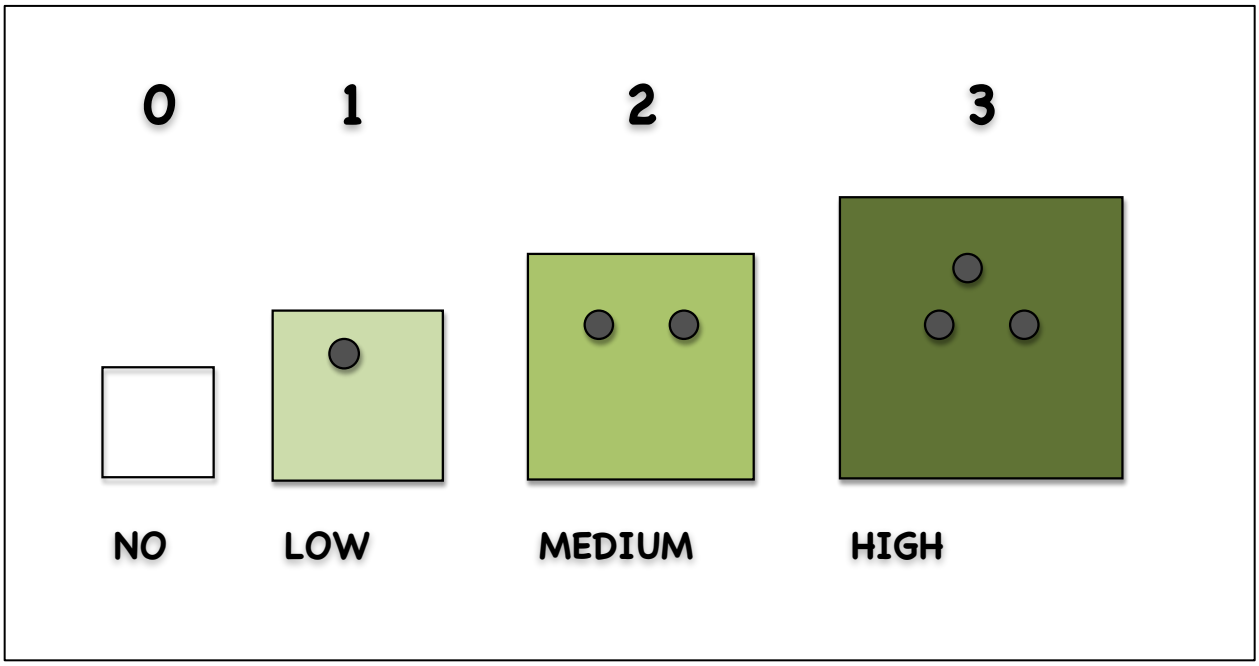
Thank you for your time. That concludes the interview related to human wildlife conflict. Please feel free to contact me later if you think of anything else you would like to add. If you would like to contact the researcher I can provide you with contact information including a Namibian cell phone number. If you are interested in learning about the results of this research the researcher will be happy to share them with you when she is finished in August 2010. (Time End: _____)

APPENDIX C

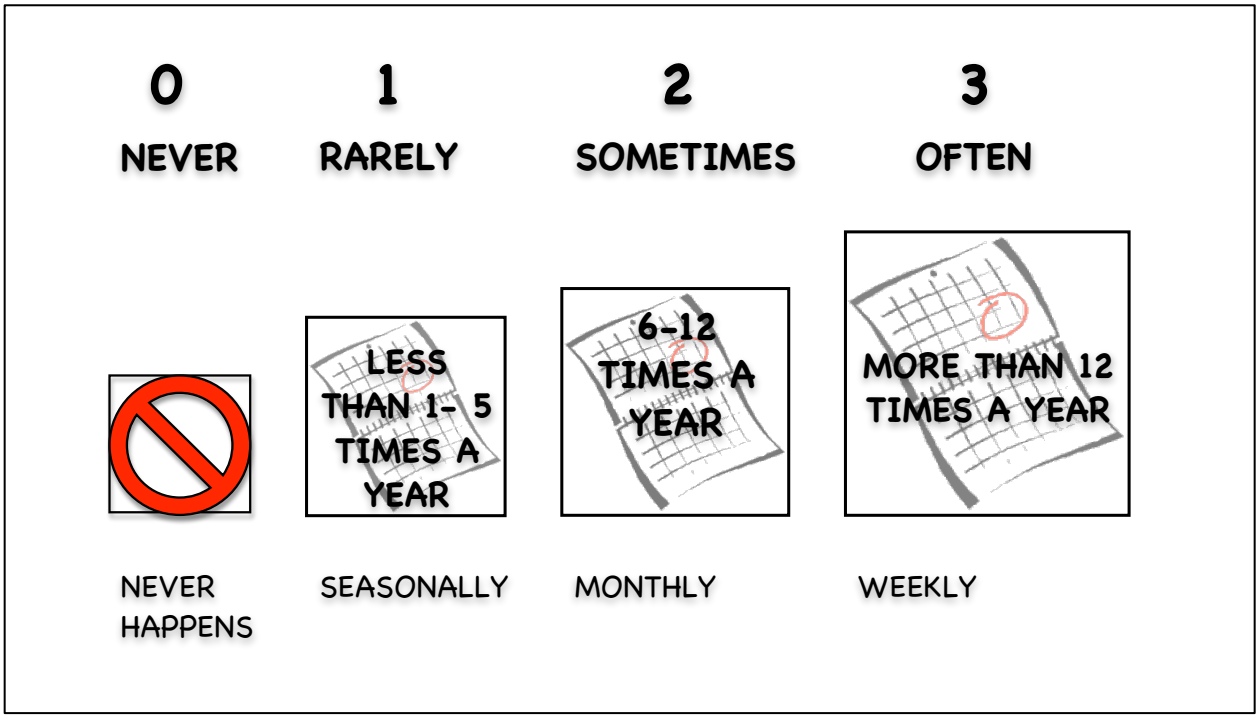
Visual aids

Figure C1: Developed visual Likert-type scales (a. intensity or amount; b. frequency) for use with semi-structured interviews and focus groups in Mudumu South Complex: Caprivi Namibia (July-September, 2009)

a.



b.



APPENDIX D

Coding Protocol

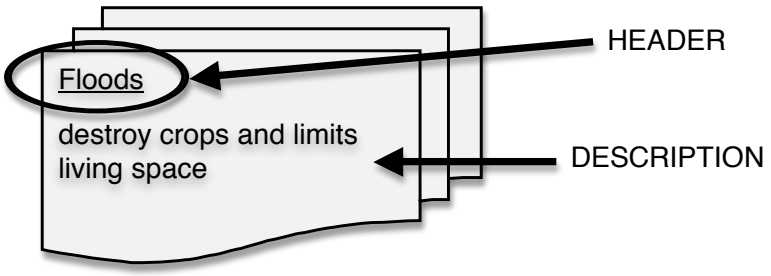
Focus Group Data - Coding Protocol

Human dimensions of HWC Research
East Caprivi, Namibia (July-September, 2009)
Author: Jessica Kahler
Revised: February 21, 2010

A. IDENTIFYING HEADERS & DESCRIPTIONS

Participants recorded their opinions about risks onto index cards (hereafter cards). For the purpose of coding text on the cards it is necessary to break each card into its component parts. Every card had at least one risk, depicted as a single word, phrase or sentence (header); some cards had additional information (descriptions) related to the risk.

Sample Index Card:



Header → The lone text on the index card or the subject of the text to follow; often written at the top of the card or above accompanying text below and may be distinguished by being underlined, written in capital letters or other.

Description→ Text written in addition to the header; text elaborates on the header, may list additional risks that are perceived to be causally related to the header risk or give examples or additional explanation.

B. RULES REGULATING THE TREATMENT OF HEADER AND DESCRIPTIONS:

A) Priority is given to the participants' header on the index card when assigning a primary category; if the card contains additional risk categories in the description the header risk will remain as the primary category.

Example: (Header) *Flooding* (Description) *destroys crops and limits living space*

Primary category → Flooding

B) If description text is present and it contains additional keywords and concepts related to risk categories (Table 1), it should be coded for a secondary categorical variable. Secondary categories must be distinct from the primary category assignment.

Example: (Header) *Bridges* (Description) *During construction of bridges large machines can scare [wildlife][sic].*

Primary category → Development

Secondary category → Increased human-wildlife interaction

C) If the description contains multiple examples of additional risk categories related to the header risk category (primary category), the first example given will become the second category.

Example: (Header) *Cash benefits* (Description) *Cash benefits [are] not enough to feed the family OR take [children] to school [sic].*

Primary category → Insufficient benefits from conservancy

Secondary category → Subsistence insecurity

2

D) If a participant has listed the same risk category as a header on more than one of their cards (replicating risk headers), the description (if available) on the second, replicated card will be used to reassign a primary category and the header on the replicated card will become the secondary category.

Example: (1st Header) *Flooding* (1st Description) *decreases food security*

(2nd Header) *Flooding* (2nd Description) *brings wildlife closer to people*

(1st Primary category) → Flooding (1ST Secondary category) → Food insecurity

(2nd Primary category) → Increased wildlife proximity (2nd Secondary category) → Flooding

C. RISK CATEGORY CODING RULES

Individual cards with text generated during the risk ranking and scoring activity must be coded into categories for analysis. Below are yes or no question for coding "text" on cards into categories generated during the initial, iterative review of text (see Table 1 for list of categories). "Text" refers to headers in the first round of coding in which the primary category is assigned. If there are descriptions available on cards (text in addition to the header), then the card is subjected to a second round of coding in which the secondary category is assigned from the description. Therefore, "text" in the second round of coding refers to descriptions on cards.

1) Does the text mention a wildlife species, a problem animal damage incident, activities to control wildlife or human-induced wildlife death?

IF YES → NEXT QUESTION

IF NO → ***SKIP TO QUESTION #8***

2) Does the text mention more than one type of human-wildlife conflict (HWC) (e.g., crop damage and livestock depredation) or HWC in general?

IF YES → Card will be coded as a generalized designation of HWC

IF NO → NEXT QUESTION

3) Does the header-text mention a specific wildlife species or wildlife in general?

IF YES → Card will be coded using the description (secondary category). If the description contains more than one type of conflict, refer to rule #2. If the description contains one risk category in the text, that category becomes the primary category (refer to next question).

IF NO → NEXT QUESTION

4) Does the text mention a specific type of wildlife damage incident (e.g., crop damage, livestock depredation, people injured or killed by wildlife)?

IF YES → Card will be coded as the specific category of wildlife damage type as generated by the initial review of all text (crop damage, human attack, livestock loss).

IF NO → NEXT QUESTION

5) Does the text mention illegal harvest of wildlife or use of illegal harvest methods (e.g., snares, poison)?

IF YES → If the text mentions the illegal act in terms the context of a problem animal incident, card is coded as "retaliation." If text does not mention the illegal act in the context of a problem animal incident, card will be coded as "poaching."

IF NO → NEXT QUESTION

6) Does the text mention hunting or wildlife harvest sanctioned by the conservancy?

IF YES → Card will be coded as “hunting.”

IF NO → NEXT QUESTION

7) Does the text mention preventative activities meant to avoid conflict with wildlife or scare wildlife away from property?

IF YES → Card will be coded as “wildlife deterrence activities.”

IF NO → ***STOP***. Coding should be complete for all cards for which the answer to question #1 was ‘yes.’ For coding of secondary categories (descriptions), return to question #1 and follow all rules accordingly.

8) Does the text mention services or management activities that are related to conservancy function or fall under conservancy management duties or authority (e.g., translocation of wildlife, compensation)?

IF YES → Card will be coded as “conservancy services and management”

IF NO → NEXT QUESTION

9) Does the text mention human activities within the conservancy related farming, animal husbandry, or anthropogenic use of fire?

IF YES → Card will be coded as “agricultural activities”

IF NO → NEXT QUESTION

10) Does the text mention anything that results in changes in the interaction between, the proximity of or the competition between people and wildlife for space or resources?

IF YES → Card will be coded as “increased human-wildlife interactions”

IF NO → NEXT QUESTION

11) Does the text mention the development of infrastructure (e.g., housing, roads) within the conservancy or the negative consequences of development activities?

IF YES → Card will be coded as “development”

IF NO → NEXT QUESTION

12) Does the text mention human or wildlife activities (e.g., deforestation) that modify or change the environment not related to development of infrastructure (question #11)?

IF YES → Card will be coded as “habitat modification”

IF NO → NEXT QUESTION

13) Does the text mention a lack of subsistence-based resources (e.g., land, food, skills, livestock) or conditions that reduce subsistence-based resources?

IF YES → Card will be coded “subsistence insecurity”

IF NO → NEXT QUESTION

14) Does the text mention lack of economic development, financial resources, employment opportunities or chronic deficiencies in monetary resources?

IF YES → Card will be coded “Financial insecurity”

IF NO → NEXT QUESTION

15) Does the text mention a lack of education opportunities, educational-related infrastructure or adult training in job-related skills?

IF YES → Card will coded “education and training”

IF NO → NEXT QUESTION

16) Does the text mention a lack of non-education related services (e.g., health care), inadequate infrastructure or unsatisfactory living conditions?

IF YES → Card will be coded “rural services and infrastructure”

IF NO → NEXT QUESTION

17) Does the text mention poor human health related to disease, chronic conditions or reduced physiological health conditions?

IF YES → Card will be coded "poor human health"

IF NO → NEXT QUESTION

18) Does the text mention conditions related to social welfare (e.g., alcoholism), social or cultural conflicts or concerns about cultural or theological deterioration?

IF YES → Card will be coded "socio-cultural insecurity"

IF NO → NEXT QUESTION

19) Does the mention text mention climatic conditions, natural climate-related disasters or changes in weather patterns?

IF YES → Card will be coded "climate"

IF NO → NEXT QUESTION

20) Does the text mention non-anthropogenic competition between or among wildlife species for resources (e.g., predation) or biotic (non-climatic) related environmental risks (e.g., wildlife disease outbreak)?

IF YES → Card will be coded "ecological risks"

IF NO → **STOP: ALL CARDS SHOULD BE CODED FOR A PRIMARY CATEGORY.**

IF CARDS REMAINS UNCODED, REVISIT CODING RULES FOR VERIFICATION. RULES MUST BE REVISED IF ANY TEXT REMAINS UNCODED FOR A PRIMARY CATEGORY AFTER FINAL VERIFICATION. FAILURE TO CODE FOR SECONDARY CATEGORIES IN THE DESCRIPTION DOES NOT WARRANT REVISION OF CODING RULES (ENTER "OTHER" AS SECONDARY CATEGORY).

Table 1: Risk categories generated by reviewing participant generated text during risk ranking and scoring activities; Caprivi HWC research (July-September, 2009)

Risk Category	Coding
Agricultural activities	01
Climate	02
Conservancy service and management	03
Crop damage	04
Development	05
Ecological risks	06
Education and training	07
Financial insecurity	08
Habitat modification	09
Human attack	10
Human-wildlife conflict	11
Hunting	12
Increased human-wildlife interaction	13
Livestock loss	14
Poaching	15
Poor human health	16
Retaliation	17
Rural services and infrastructure	18
Socio-cultural insecurity	19
Subsistence insecurity	20
Wildlife deterrence activities	21
Other- description (does not fit categories)	22

APPENDIX E

Interview respondent demographic information by conservancy

Table E1: Demographic information from interviews in two conservancies (emerging = 41; established = 35) in Mudumu South Complex: Caprivi, Namibia (July-September, 2009)

Characteristic	Emerging	Established
Educational attainment	Percent of participants (%)	
No schooling	12	23
Some primary	5	6
Completed primary	20	6
Some secondary	44	40
Completed secondary	12	25
Some college education	5	0
Adult vocational training	2	0
Ethnic group		
Kwanyama	0	3
Mafwe	0	3
Mayeyi	100	86
Totela	0	8
Gender		
Female	49	49
Male	51	51
Language (used in interview)		
English [a]	24	34
Lozi	12	6
Shiyeyi	59	51
Subiya	0	3
Totela	0	3
Missing (unknown)	5	3
Local environmental decision-maker [b]		
No	71	86
Yes	29	14

[a] Includes English and English with Sheyeyi or Lozi.

[b] Members of conservancy staff or traditional authority.

Table E1 (continued): Demographic information from interviews in two conservancies (emerging = 41; established = 35) in Mudumu South Complex: Caprivi, Namibia (July-September, 2009)

Characteristic	Emerging	Established
Marital status	Percent of participants (%)	
Never married	20	20
Married	68	60
Divorced	2	3
Widowed	10	17
Primary livelihood strategy		
Agriculture	98	89
Livestock	2	0
Rural industry	0	6
Wage (Service/NGO)	0	3
Other	0	2
Age (years)	People (#)	
Mean	43	43
Minimum	18	18
Maximum	84	88
Household size		
Mean	6	6
Minimum	1	1
Maximum	10	15
Wealth index [c]	Household ($NAD/capita)	
Mean	5024	3513
Minimum	50	0
Maximum	85160	43900

[c] The wealth index was calculated using a household's livestock assets, size of agricultural land holdings divided by the total number of people in the household.

APPENDIX F

Data on species-specific vulnerability

Table F1: Perceived and reported species implicated in crop damage, livestock loss and human attack in two conservancies in Mudumu South Complex (n=50): Caprivi, Namibia (July-September, 2009)

Perceived (Focus Group, 2009)				Reported (Event Book, 2001-2008)		
	Rank	Incidence index	Importance index		Total # incidents	Percent
Crop damage [a]		**0.52**	**0.61**	**Crop damage**	**678**	**56.8**
Elephant	1	1.00	1.00	Elephant	290	42.8
Hippopotamus	2	1.00	0.79	Hippopotamus	176	26.0
Baboons	3	1.00	0.49	Buffalo	79	11.7
Porcupine	3	1.00	0.49	Porcupine	41	6.0
Buffalo	4	0.83	0.73	Bush pig	32	4.7
Monkeys	5	0.83	0.23	Monkey	18	2.7
Bush pig	6	0.67	0.37	Baboon	18	2.7
Kudu	7	0.50	0.47	Duiker	9	1.3
Jackal	8	0.50	0.07	Spring hare	6	0.9
Fox	9	0.33	0.11	Kudu	4	0.6
Duiker	9	0.33	0.06	Jackal	4	0.6
Impala	10	0.17	0.11	Reed Buck	1	0.1

[a] Incidence and importance index scores for crop damage, livestock loss and injury or death based on participants overall ranking and scoring for all threats to livelihoods.

Table F1 (continued): Perceived and reported species implicated in crop damage, livestock loss and human attack in two conservancies in Mudumu South Complex (n=50): Caprivi, Namibia (July-September, 2009)

	Perceived (Focus Group, 2009)			Reported (Event Book, 2001-2008)		
	Rank	Incidence index	Importance index	Total # incidents		Percent
Livestock loss		**0.34**	**0.46**	**Livestock loss**	**504**	**42.2**
Hyena	1	1.00	0.91	Hyena	352	69.8
Lion	2	1.00	0.87	Lion	137	27.2
African wild dog	3	1.00	0.34	Elephant	5	1.0
Crocodile	4	0.67	0.41	Crocodile	3	0.6
Snakes	4	0.67	0.40	Leopard	3	0.6
Leopard	5	0.50	0.19	Cheetah	1	0.2
Jackal	6	0.33	0.27	Hippopotamus	1	0.2
Birds of prey	7	0.17	0.71	Jackal	1	0.2
Cheetah	8	0.17	0.60	Snake	1	0.2
Genet	9	0.17	0.13			
African wild cat	9	0.17	0.00			
Caracal	9	0.17	0.00			
Fox	9	0.17	0.00			

[a] Incidence and importance index scores for crop damage, livestock loss and injury or death based on participants overall ranking and scoring for all threats to livelihoods.

Table F1 (continued): Perceived and reported species implicated in crop damage, livestock loss and human attack in two conservancies in Mudumu South Complex (n=50): Caprivi, Namibia (July-September, 2009)

	Perceived (Focus Group, 2009)			Reported (Event Book, 2001-2008)		
	Rank	Incidence index	Importance index		Total # incidents	Percent
Human attack		**0.20**	**0.60**	**Human attack**	**10**	**0.8**
Elephant	1	1.00	1.00	Elephant	8	80.0
Lion	2	1.00	0.33	Hippopotamus	2	20.0
Hippopotamus	3	0.80	0.65			
Snakes	3	1.00	0.30			
Crocodile	4	1.00	0.26			
Buffalo	5	0.80	0.48			
Leopard	6	0.20	0.50			

[a] Incidence and importance index scores for crop damage, livestock loss and injury or death based on participants overall ranking and scoring for all threats to livelihoods.

Table F2: Wildlife species vulnerability to poaching according to conservancy incident reports (Event Book, 2001-2008) and local perceptions from a risk ranking activity (Focus Group, 2009; n=50) in two conservancies in Mudumu South Complex: Caprivi, Namibia.

Perceived (Focus Group, 2009)				Reported (Event Book, 2001-2008)		
Species	**Incidence index**	**Importance index**	**Overall rank [b]**	**Species**	**Incident type(s)**	**Total # Incidences**
Buffalo	0.88	0.84	1	***Hippopotamus***	Firearm	4
Kudu	1.00	0.45	2	***Duiker*** [a]	Firearm	3
Elephant	0.88	0.60	3	Wildebeest	Firearm	3
Hippopotamus	0.88	0.56	4	***Buffalo***	Firearm	2
Warthog	0.75	0.50	5	***Elephant***	Firearm	2
Guinea fowl [a]	0.63	0.63	6	Partridge [a]	Snares	2
Zebra	0.50	0.37	7	***Warthog***	Traditional	2
Spring hare	0.25	1.00	8	Bird [a]	Firearm	1
Duiker [a]	0.38	0.44	9	Quail [a]	Snares	1
Hyena	0.38	0.38	10	Snake [a]	Snares	1
Lion	0.25	0.56	11	***Pangolin***	Traditional	1
Pangolin	0.25	0.50	11			
Porcupine	0.25	0.44	12			

[a] Wildlife taxa not reported to species-specific level (i.e., genus, family or order level classification). Genus level reporting may not represent the lone species found in Caprivi.

[b] Overall rank is based on the joint risk score; calculated from the importance and incidence index scores.

Figure F1: Top fifteen most threatening wildlife species to local livelihoods as perceived by residents in two conservancies (n= 50) in Mudumu South Complex: Caprivi, Namibia (Focus Groups; July-September, 2009)

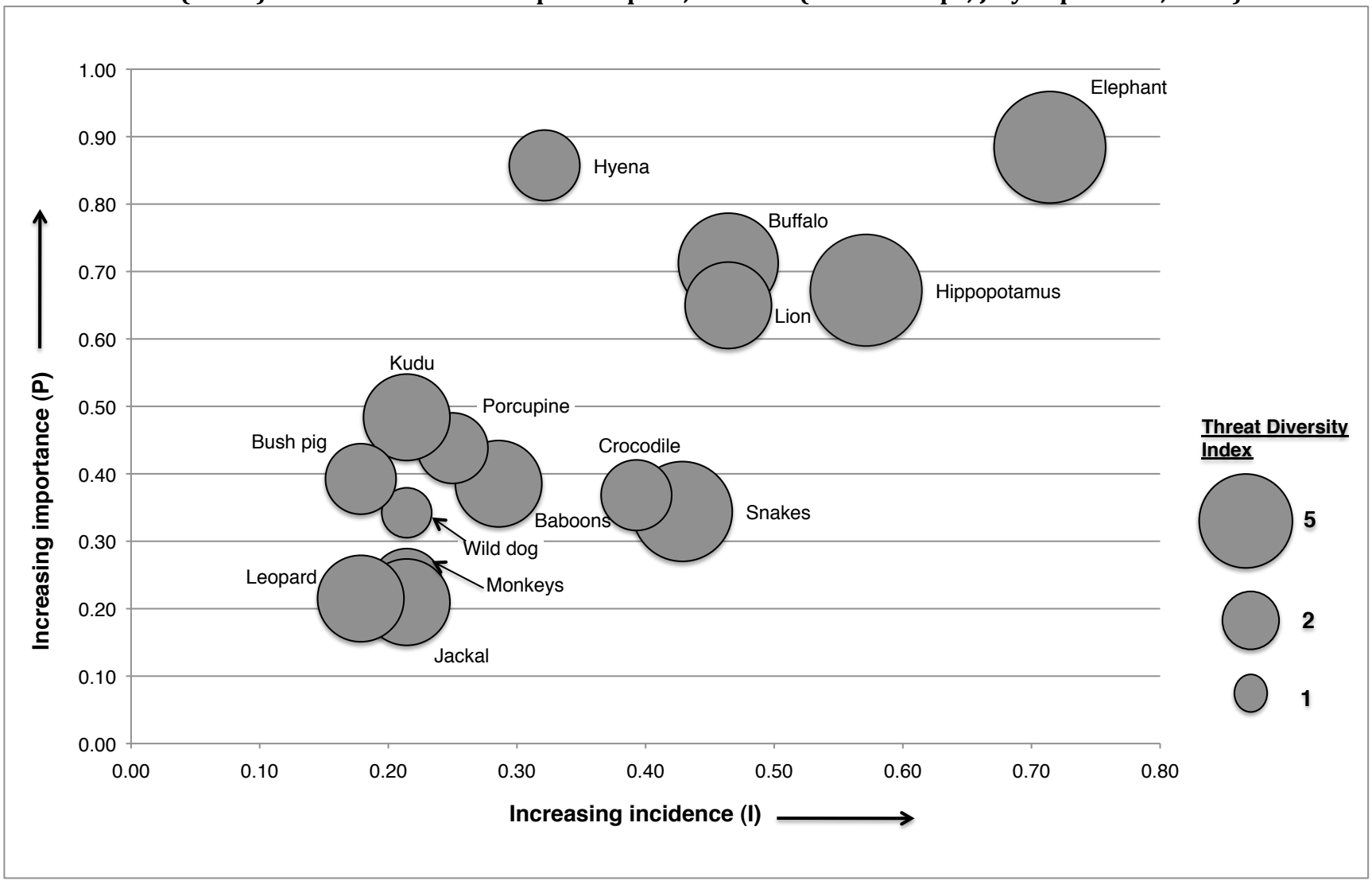
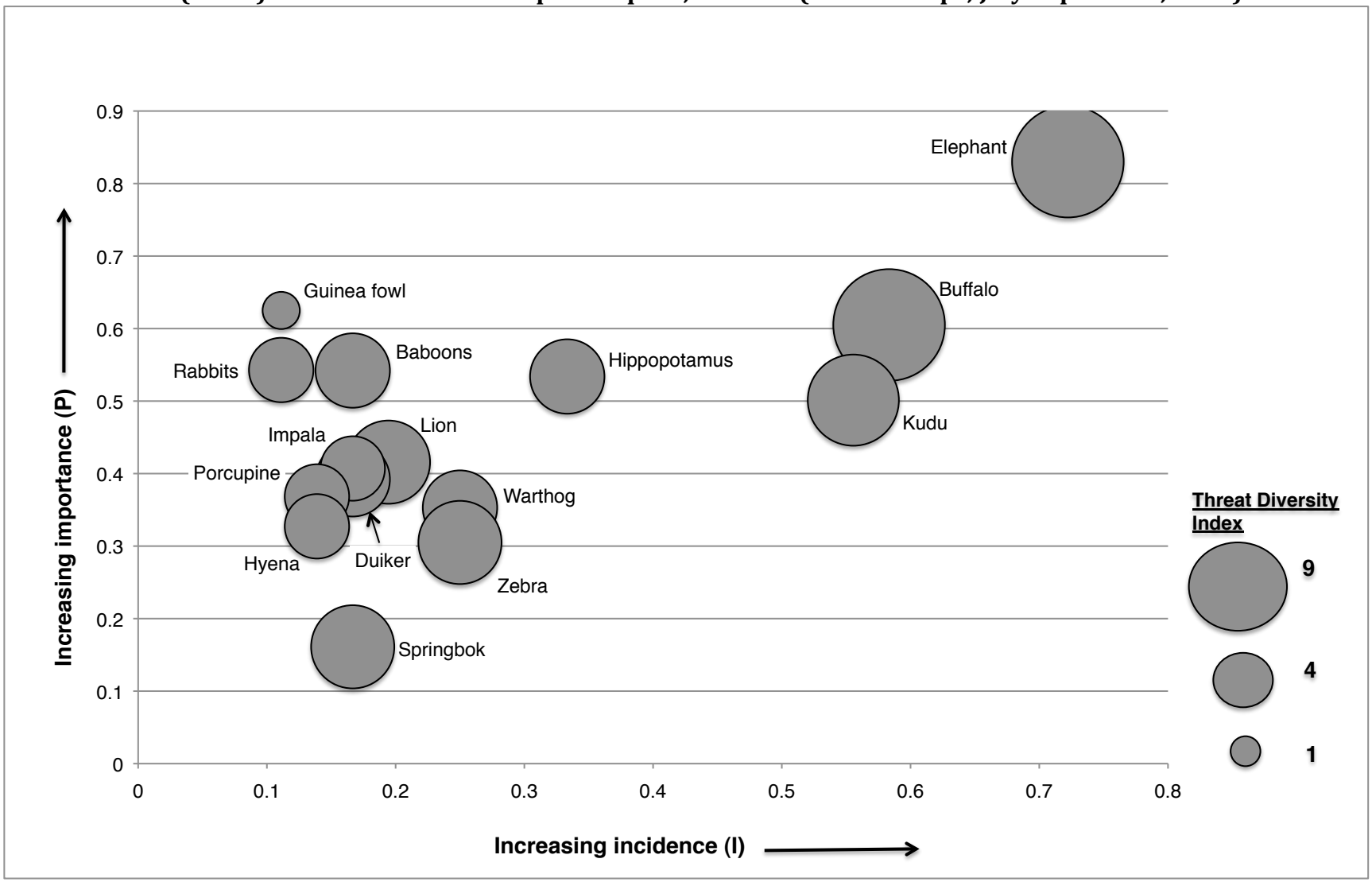


Figure F2: Top fifteen most threatened wildlife species from conflicts with people as perceived by residents in two conservancies (n= 48) in Mudumu South Complex: Caprivi, Namibia (Focus Groups; July-September, 2009)



APPENDIX G

Additional co-mapping risk maps

Figure G1: Perceived geographic incidents (Focus Group, 2009) of crop damage incidents and location of Event Book (2003-2008) crop damage incidents in Wuparo (a) and Dzoti (b) conservancies: Mudumu South Complex, Caprivi, Namibia.

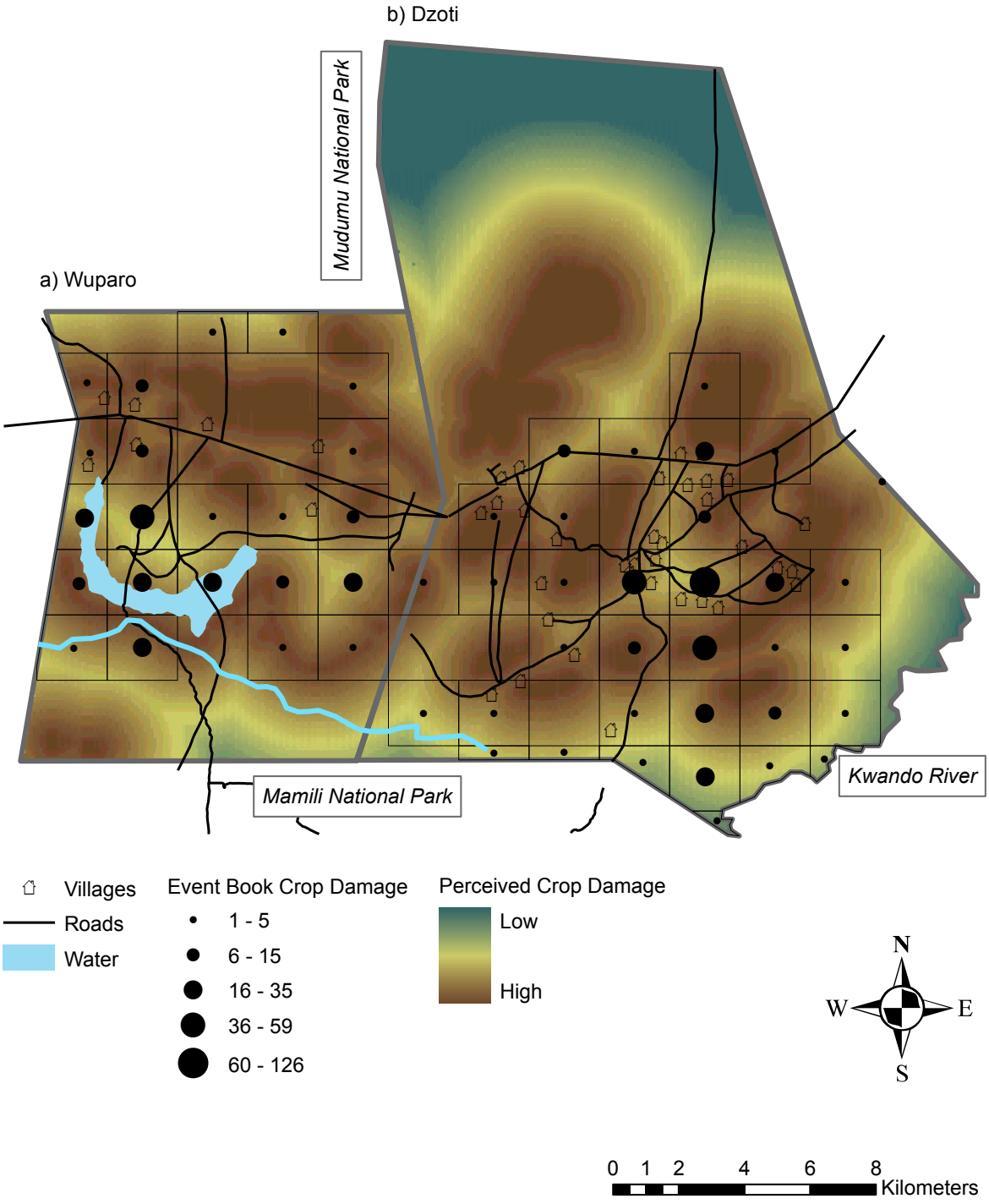


Figure G2: Perceived geographic incidents (Focus Group, 2009) of human-attack incidents and location of Event Book (2003-2008) human-attack incidents in Wuparo (a) and Dzoti (b) conservancies: Mudumu South Complex, Caprivi, Namibia.

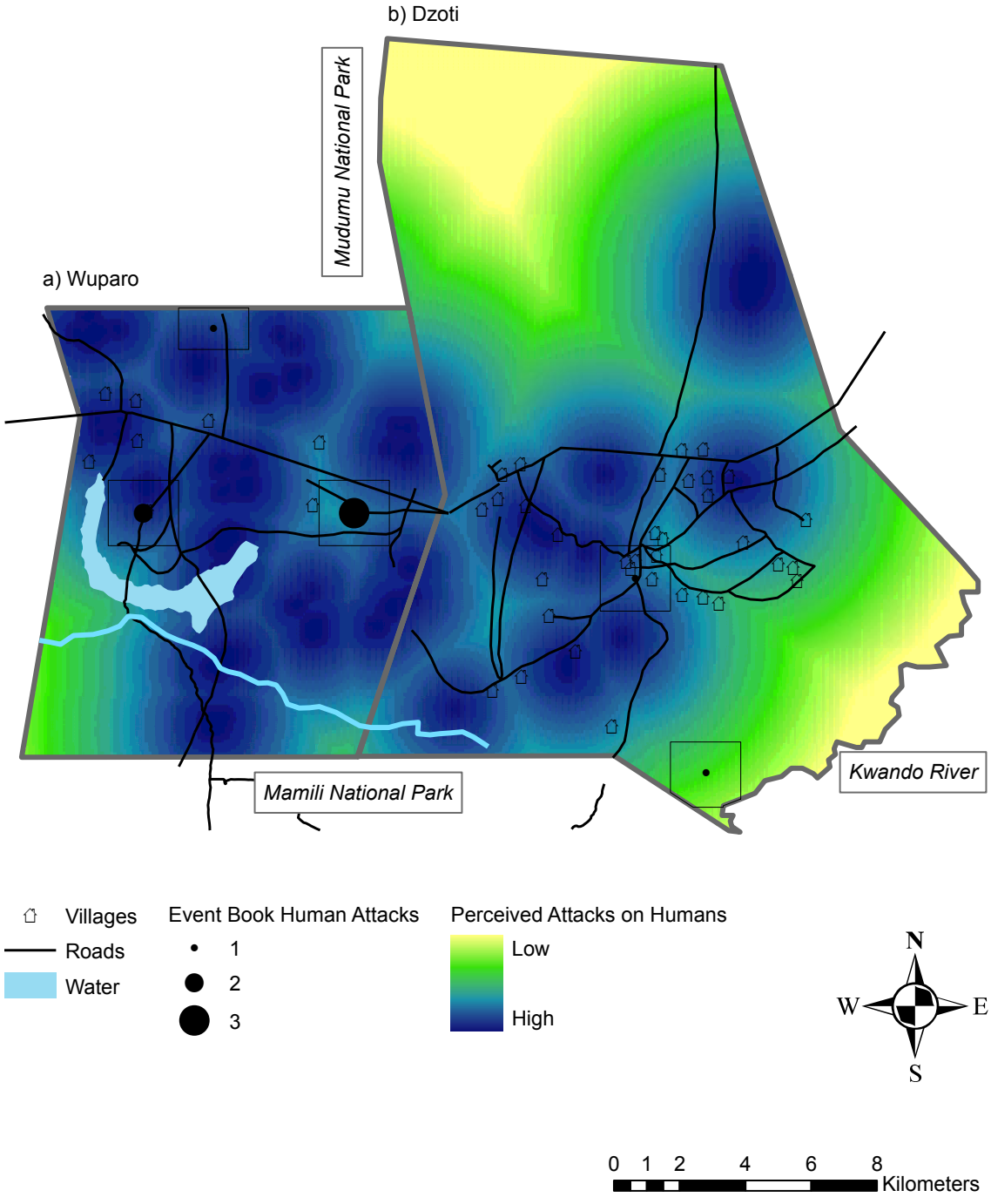


Figure G3: Perceived geographic incidents (Focus Group, 2009) of livestock depredation incidents and location of Event Book (2003-2008) livestock depredation incidents in Wuparo (a) and Dzoti (b) conservancies: Mudumu South Complex, Caprivi, Namibia.

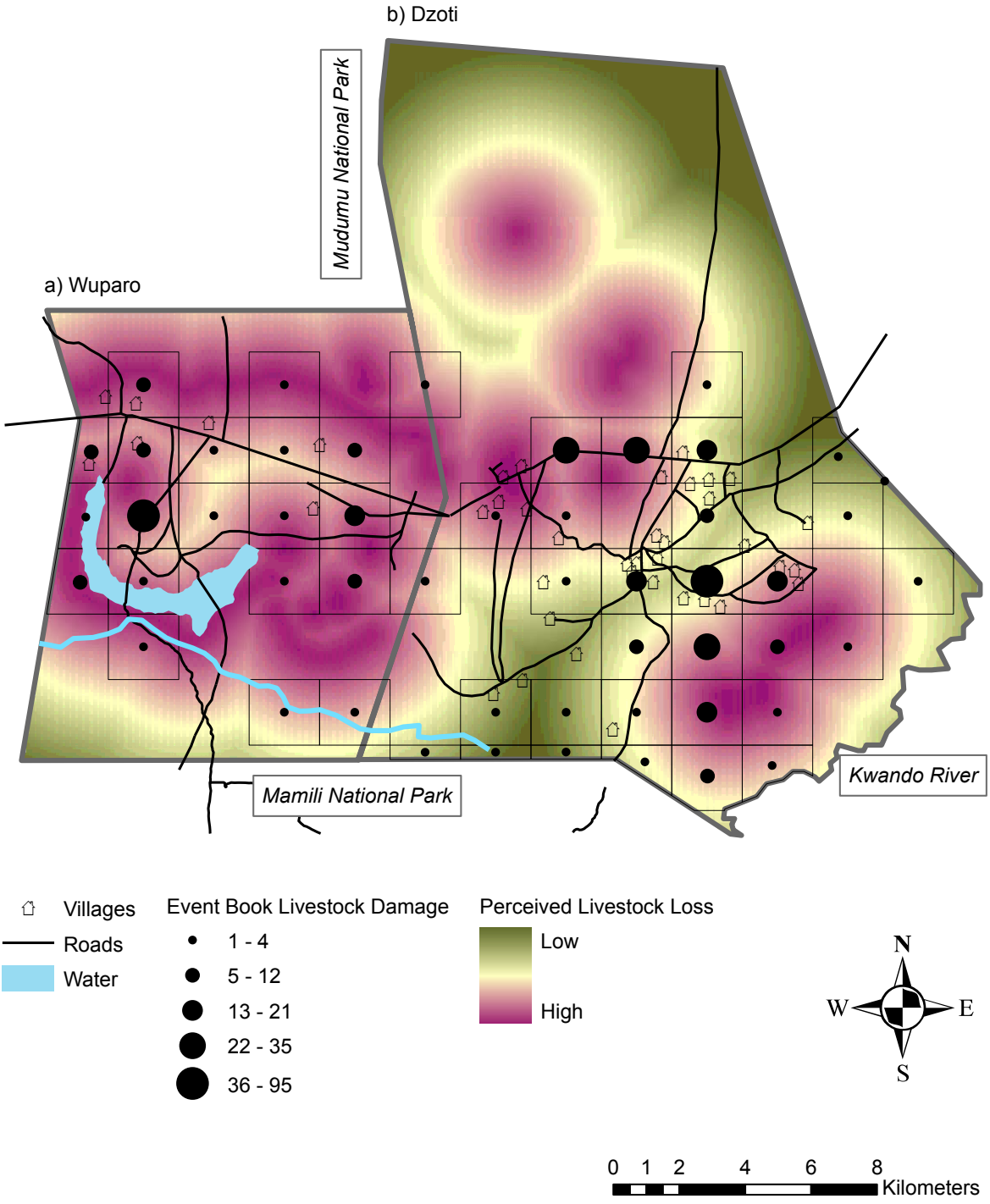


Figure G4: Perceived geographic incidents (Focus Group, 2009) of crop damage incidents and location of Event Book (2003-2008) poaching incidents in Wuparo (a) and Dzoti (b) conservancies: Mudumu South Complex, Caprivi, Namibia.

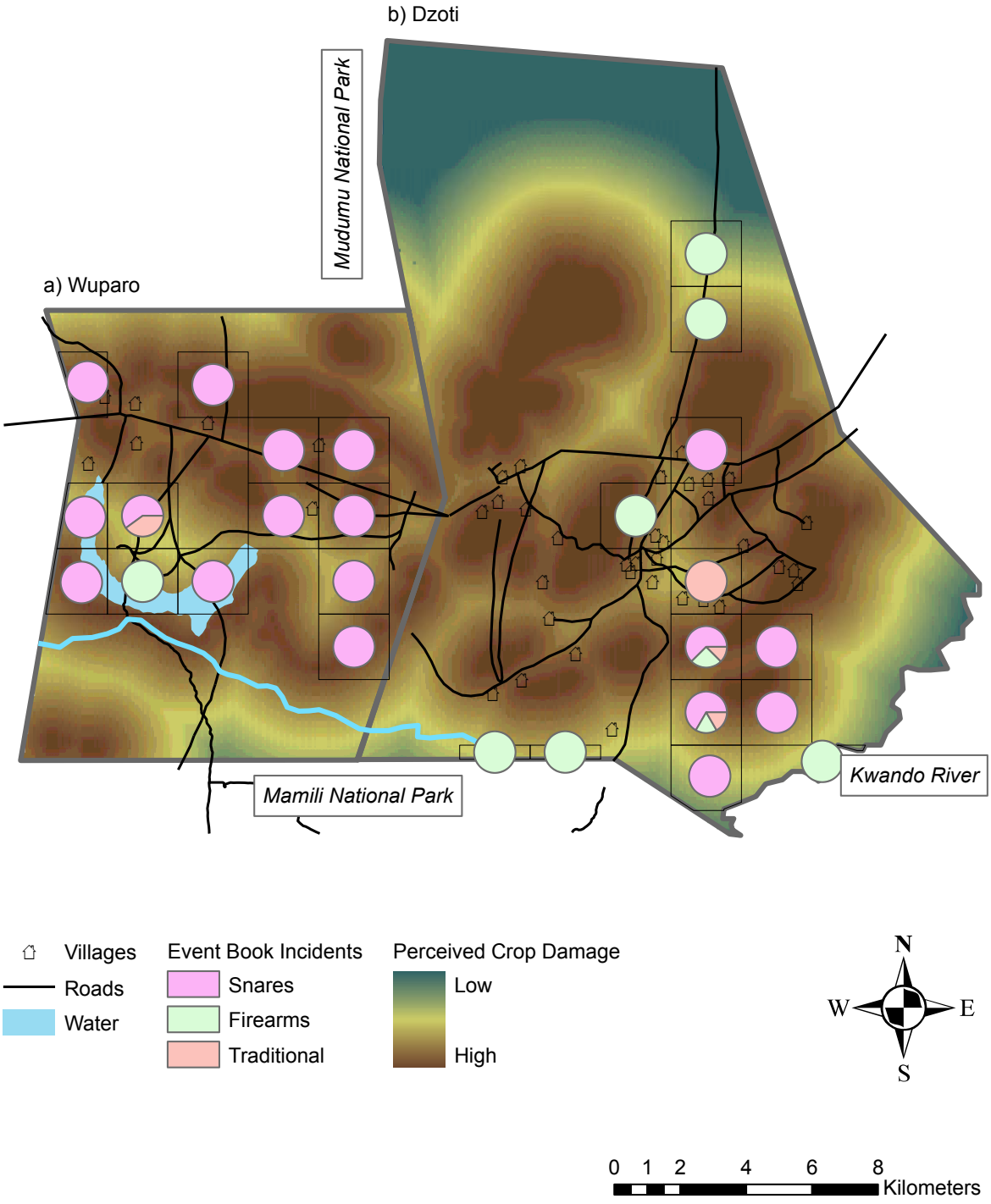


Figure G5: Perceived geographic incidents (Focus Group, 2009) of human-attack incidents and location of Event Book (2003-2008) poaching incidents in Wuparo (a) and Dzoti (b) conservancies: Mudumu South Complex, Caprivi, Namibia.

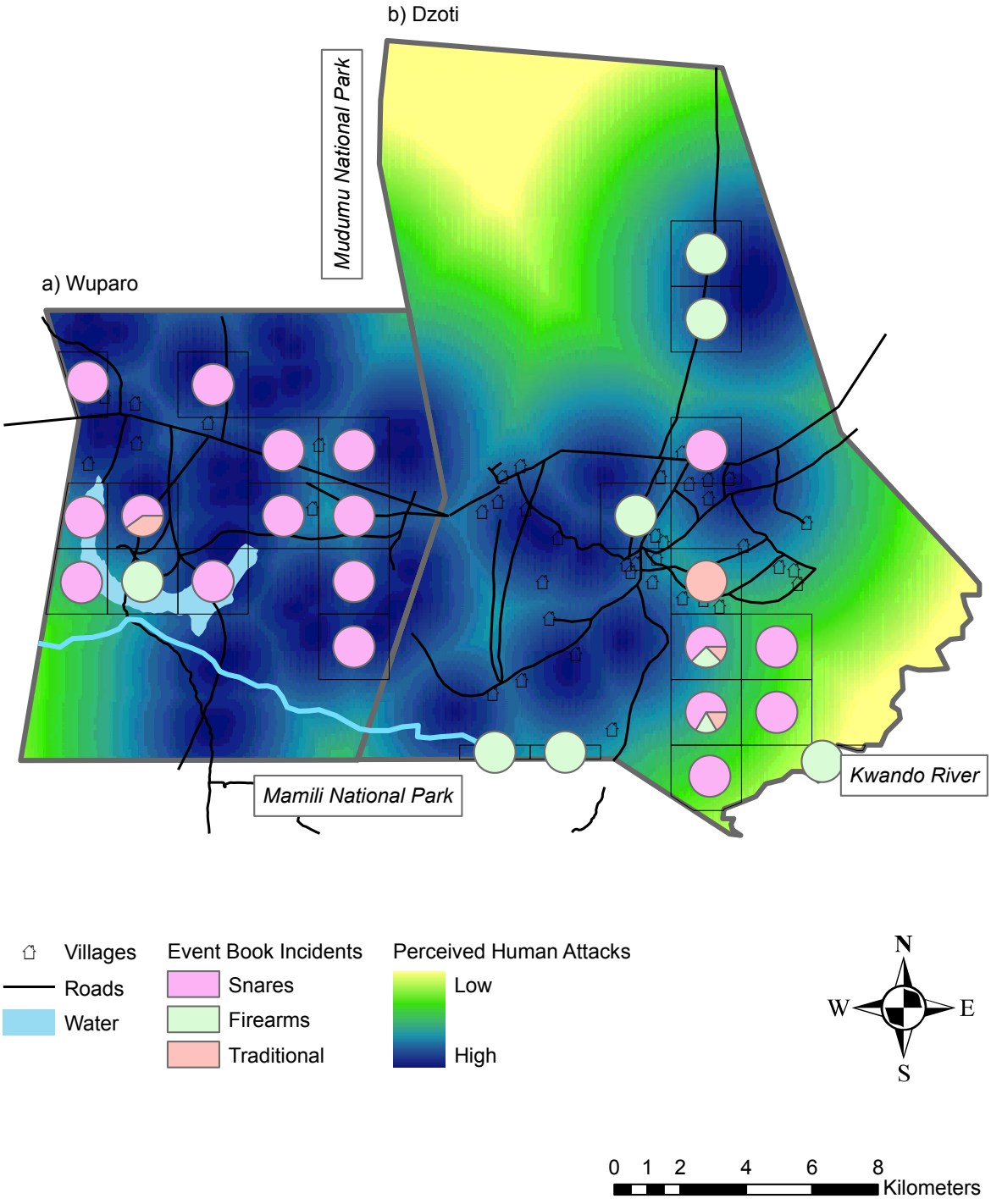
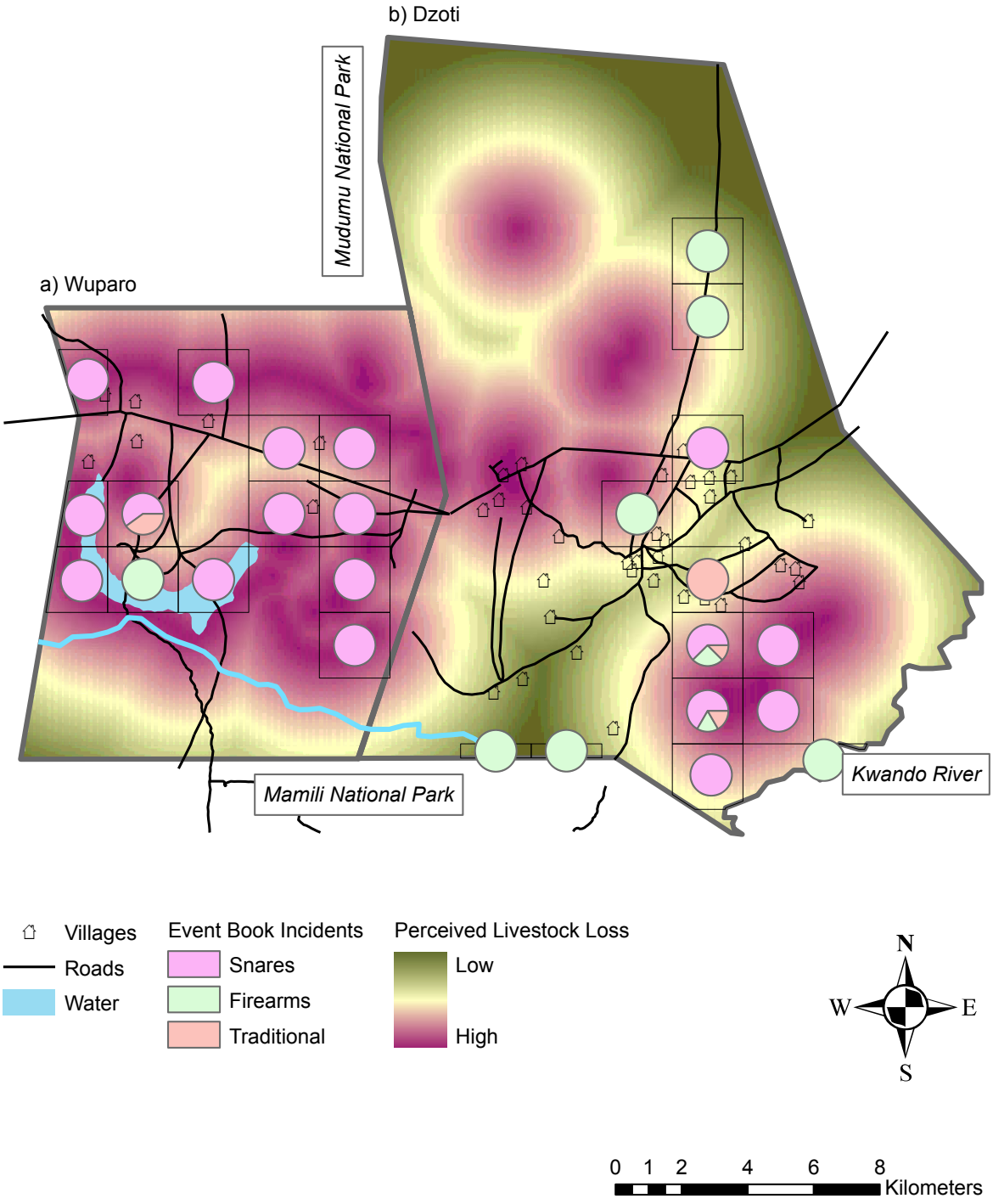


Figure G6: Perceived geographic incidents (Focus Group, 2009) of livestock depredation incidents and location of Event Book (2003-2008) poaching incidents in Wuparo (a) and Dzoti (b) conservancies: Mudumu South Complex, Caprivi, Namibia.



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