

THE EFFECTS OF CONSERVATION ON RISK PERCEPTION AND
BEHAVIORAL RESPONSE AMONG LOCAL AGRO-PASTORALISTS
IN NORTHERN TANZANIA, 2004-2005

Timothy David Baird

A thesis submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Arts in the Department of Geography.

Chapel Hill
2007

Approved by:

Thomas M. Whitmore

Paul W. Leslie

Wendy Wolford

©2007
Timothy David Baird
ALL RIGHTS RESERVED

ABSTRACT

TIMOTHY DAVID BAIRD: The Effects of Conservation on Risk Perception and Behavioral Response among Local Agro-pastoralists in Northern Tanzania, 2004-2005
(Under the direction of Thomas M. Whitmore)

The purpose of this study is to examine the effect that Tarangire National Park (TNP) has on local perceptions of risk and how these perceptions inform behavioral responses. Data were collected through household surveys and Participatory Risk Mapping (PRM) in 8 villages east of TNP in 2004-05. By identifying and rank-ordering respondents' perceived risks, PRM enhances understanding of the nature and variation of risks faced within a population by distinguishing between the incidence and severity of subjective risk perceptions. In addition, multivariate statistics are utilized to examine the effects of household size, wealth, and village location on risk perception. Results indicate that proximity to the park has a strong effect on the type and severity of perceived risks. Within villages close to the park, however, behavioral response to perceived risks varies considerably. This study sheds light on how behavioral response to environmental and socio-economic factors is mediated through human perception.

TABLE OF CONTENTS

LIST OF TABLES.....	vii
LIST OF FIGURES.....	viii
Chapter	
I. INTRODUCTION.....	1
A. Purpose.....	1
B. Background	4
C. Study Site.....	8
C.1. Topography	10
C.2. Rainfall & Vegetation	10
C.3. Population.....	11
C.4. Economy	12
C.5. Tarangire National Park & Local Communities	14
D. Outline	16
II. LITERATURE REVIEW & CONCEPTUAL FRAMEWORK.....	18
A. Cultural and Political Ecology	19
B. Conservation & Communities.....	23
B.1. Shifting Conservation Paradigms.....	24
B. 2. Social Impacts of Conservation.....	26
B. 3. Indigenous Peoples and Conservation.....	28

B. 4. Local, Indigenous, Traditional Environmental Knowledges.....	31
B. 5. Expert Knowledges.....	34
B. 6. Community-Based Conservation & Natural Resource Management	36
B. 7. Social Ecological Systems & Conservation.....	36
C. Human Ecology - Risk, Attitudes & Conservation	37
D. Conceptual Framework	42
III. RESEARCH QUESTIONS, DATA & METHODS	45
A. Research Questions & Hypotheses	45
B. Data	46
B.1. Fieldwork & Sampling Strategy.....	47
B.2. Data Collection Techniques.....	49
B.2.a. Participatory Risk Mapping (Risk Assessment Interview)	49
B.2.b. Household Survey	50
C. Methods of Analysis.....	51
C.1. Participatory Risk Mapping	51
C.2. Logistic Regression	53
C.2.a. Dependent Variables.....	53
C.2.b. Independent Variables.....	54
C.2.b.i. Total Household Size	56
C.2.b.ii. Total Acres Cultivated	57
C.2.b.iii. Village.....	58
C.2.c. Model Estimation	59
C.3. Descriptive Analysis of Behavioral Responses.....	59

IV. FINDINGS.....	60
A. Participatory Risk Mapping	60
B. Logistic Regression Analysis	65
C. Descriptive Analysis of Behavioral Responses.....	66
V. DISCUSSION AND CONCLUSION.....	70
A. Discussion of Findings	70
A.1. Risk Perception and the Conservation Shed	70
A.2. Household Assets and Risk Perception.....	73
A.2.a. Significant Outcomes	73
A.2.b. Non-Significant Outcomes.....	74
A.3. Mitigation and Coping Responses.....	74
A.4. Data & Methodological Limitations	77
B. Conclusion.....	78
B.1. Summary of Findings	78
B.2. Final Thoughts and Future Directions.....	80
REFERENCES.....	83

LIST OF TABLES

Table

1.1. Population and Parks in East Africa	6
3.1. Village and Sample Characteristics.....	49
3.2. Summary Statistics for Continuous Independent Variables.....	57
4.1 Description of Important Risks.....	62
4.2. Logistic Regression Results	66
4.3. Mitigation and Coping Response to Perceived Risks by Village.....	69

LIST OF FIGURES

Figure

1.1. Population Growth in East African Countries Since 1960.....	5
1.2. Annual Population Growth Rates for East Africa and the World.....	5
1.3. Map of Study Site	9
2.1. Conceptual Framework.....	44
3.1 & 3.2: Frequency distribution of Total Household Size and log transformed distribution.....	57
3.3. & 3.4. Frequency distribution of Total Acres Cultivated and log transformed distribution.....	58
4.1 Distribution of Respondents by Number of Risks Identified in Villages Both Near and Far from the Park.....	61
4.2. Risk map of villages near Tarangire National Park (n=116)	63
4.3. Risk map of villages far from Tarangire National Park (n=124).....	64

CHAPTER 1

INTRODUCTION

A. Purpose

Interactions between humans and the environment across the planet are invariably the result of complex relationships which exist among government policies, systems of economic exchange, local land use strategies, ecological processes, and environmental uncertainty. Understanding these entangled relationships is of critical importance as we move into an era of evermore rapidly changing social and environmental contexts. In recent decades, conflict in the developing world between wildlife conservation objectives and indigenous livelihood practices has severely threatened the sustainability of each enterprise (Cernea and Schmidt-Soltau 2006, 37; Quammen 2006). These concerns are increasingly relevant in East Africa along the eastern border of Tarangire National Park (TNP) in northern Tanzania.

The purpose of this thesis is to examine the effect that TNP has on local perceptions of risk among Maasai agro-pastoralists living near the park border and how these perceptions influence risk-mitigation and coping responses. The term risk here is used interchangeably with “concern” or “worry”. Smith and colleagues (2000) correctly note that many cultures do not have a word that translates exactly to the English word “risk”. This is indeed true with the Maasai of northern Tanzania.

Smith and colleagues (2000) identify two general approaches to the concept of risk. One approach focuses on subjects' perceptions and attitudes, recognizing variation among otherwise similar subjects in their appraisal of a particular risk regardless of whether any individual's appraisal is statistically consistent with past history (2000). The other, more objective approach, is frequentist, focusing on standardized, quantifiable occurrences and severities of undesirable events (2000). According to Smith and colleagues (2000), the frequentist approach generally defines "risk" as "imperfect knowledge with known probabilities of observing possible outcomes, as distinct from 'uncertainty,' for which the probabilities are unknown". In this analysis, risk¹ is taken to mean exposure to potentially unfavorable circumstances and the possibility of incurring nontrivial loss. In the East African savanna, these circumstances can include livestock and human disease, rainfall variability and drought, land tenure insecurity, problems with wildlife, agricultural pests, alienation from necessary resources and other factors that threaten one's livelihood and that can lead to food insecurity and mortality. Mitigation responses are those actions or activities that serve to mitigate one's exposure to these circumstances. Coping responses, however, are utilized when unfavorable circumstances befall a household. In other words, mitigation responses try to prevent "negative" events and coping responses try to deal with 'negative' events when they occur.

In this thesis, I hypothesize that the presence of Tarangire National Park influences the risks that locals perceive they face and that these perceptions, in turn, shape their behavior. With this aim, the analysis will proceed in four stages. In the first stage, I will review the socio-economic, political, and ecological background of this area and its inhabitants to situate the context in which human perception and behavior are

¹ During interviews, respondents are asked about "wasi" meaning worries or concerns.

formulated and managed. In the second, I will identify and compare perceived risks in villages at varying distances to the eastern border of the park to elucidate perceived risks that may be directly related to the park. In the third stage, I will examine the socio-economic correlates of perceived risks in villages near the park to determine whether the relationship between household assets and risk perception varies between “park” and “non-park” risks. It may be that wealth buffers against some risks but not others and that this is reflected in local perceptions. In the fourth, I will describe the village-level behavioral responses² to perceived risk near the park to see what risk mitigation and coping strategies are employed and evaluate how they articulate with conservation goals and economic development in this area. Along these avenues, this thesis will attempt to address the following research questions:

- 1) How does proximity to Tarangire National Park impact local perceptions of risk in Simanjiro and Kiteto districts in northern Tanzania?
- 2) Within villages close to the park, what influence do village and household factors have on perceptions of “park” risks compared to “non-park” risks?
- 3) Within villages close to the park, how are behavioral responses related to risk perception at the village level and in what ways do these behaviors articulate with conservation goals and regional development?

This research has the potential to contribute important theoretical insights in the area of social/ecological research. Traditionally, many social scientists interested in human/environment interactions have described patterns of behavior regarding land use and livelihood strategies as direct products of government policies, household demographics, ecological processes, and economic constraints and opportunities. While these factors are indeed central to behavioral outcomes, the effect of human perception in

² Throughout this thesis, the term ‘behavioral responses’ will be used to refer to mitigation and coping responses to perceived risk.

mediating the influence of these factors has been under-explored. This study conceptualizes human behavior as a product of both the objective factors that the household is exposed to *as well as* the subjective perceptions of how those factors influence household behavior. By examining how human cognition is related to livelihood and land-use change, this research moves beyond this simple deterministic models that correlate human behavior with the contextual environment³.

B. Background

Pastoral groups have shared the savanna landscape with wildlife in East Africa for thousands of years (Homewood and Rodgers 1991; Little and Dyson-Hudson 1999). In the last century, however, longstanding relationships between humans, livestock, and wildlife have been undermined by human population increase and the rise of wildlife conservation (Ellis and Swift 1988; Homewood et al. 2001). Buoyed by numerous factors including improved medical technologies which have lowered mortality rates, the populations of Kenya, Tanzania, and Uganda have increased by more than 300% since 1960 (UN 2007) (see Fig. 1.1). Figure 1.2 presents annual population growth rates in five-year intervals for these countries compared to the global mean (UN 2007). Currently, population growth rates in East Africa are among the highest in the world.

For their own part, parks and protected areas that exclude or restrict human use have also been important in reshaping human/ wildlife interactions in this region since early in the 20th century. Local residents have been regularly alienated from their lands for conservation since the first national parks were established in the 1940s. The size and number of parks continued to increase through the colonial period and accelerated

³ The term “contextual environment” is used here to refer to the social, economic, political, and ecological environment which provides the context in which households make decisions.

following independence with the support of international NGOs (Adams and McShane 1992; Neumann 1998). Wildlife protection plans in Kenya and Tanzania specifically have targeted arid/semi-arid lands formerly or presently occupied by pastoral groups (McCabe 2003a). Today, 94 protected national parks and game reserves can be found in

Fig. 1.1. Population Growth in East African Countries Since 1960

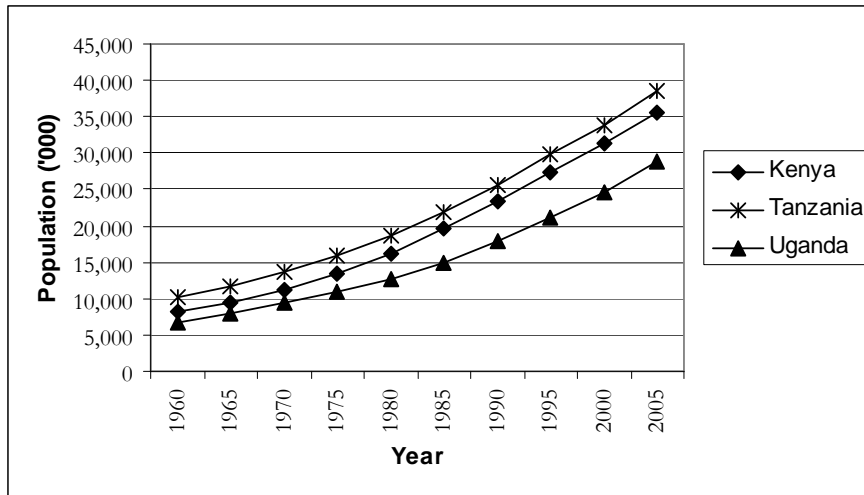
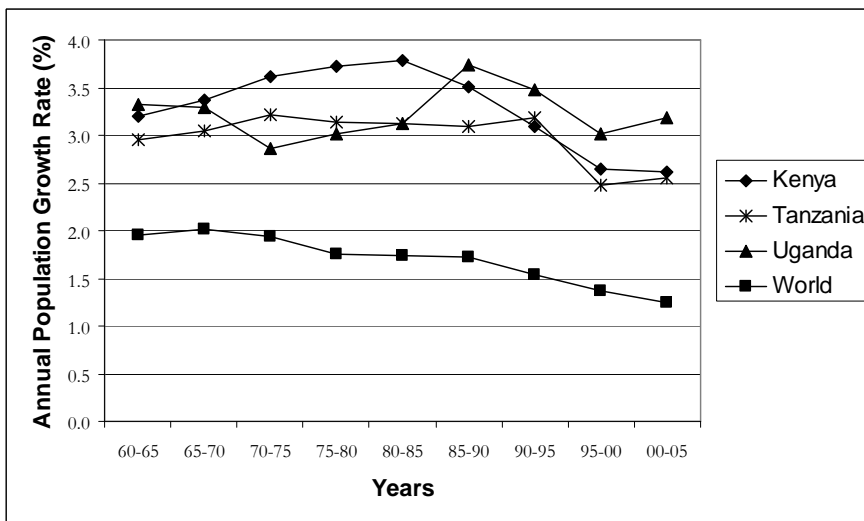


Fig. 1.2. Annual Population Growth Rates for East Africa and the World



Kenya, Tanzania and Uganda, representing about 13% of the total land area of the three countries (Barrow et al. 2001), a much larger percentage than in most countries.

Tanzania stands out with over 17% of its land area protected (see Table 1.1).

Table 1.1. Population and Parks in East Africa

	Population 2005 ('000)^a	Pop Growth Rate (00-05)^a	No. of Parks^b	Park Area (sq. km.)^b	% Total Land Area^c
Kenya	35,599	2.6%	36	43,673	7.7%
Tanzania	38,478	2.6%	32	151,496	17.1%
Uganda	28,947	3.2%	26	20,650	10.5%
Total/Avg.	103,024	2.8%^d	94	215,819	13.1%

Notes to Table 1.1: (a) From UN (2007). (b) Includes Game Reserves. Data from Barrow, Gichoni, and Infield (2001). Numbers cited in other sources sometimes vary. (c) Park area figures from Barrow, Gichoni, and Infield (2001); total land area from FAOSTAT (2003). (d) Mean value.

With these demographic and conservation transitions, protected areas have become circumscribed by growing human populations, and the “islandization” of those places has become a major concern for conservationists. Attempts to protect biodiversity, “natural” habitat, and wildlife have collided with efforts to support human land-use needs. Conflicts like these are expected to mushroom in the future.

Equally, these conditions have contributed to the widespread decline of the traditional pastoral economy in East Africa (Homewood and Rodgers 1991; Hogg 1992; Galaty 1994; Fratkin and McCabe 1999; Heald 1999; Brockington 2000; Homewood et al. 2001; Little et al. 2001; Thompson and Homewood 2002). This decline, in part, is also the result of environmental constraints to the viability of livestock grazing. Data from the Ngorongoro Conservation Area (NCA) in northern Tanzania suggest that while the human population grew steadily between the 1950s and the 1990s, the livestock population fluctuated around a long-term mean (McCabe 1992; McCabe 2003a). The consequence of this was that more and more people came to depend on the same number of animals and concomitantly households became poorer with each generation. While the

factors limiting herd size and affecting herd composition in this context are not well understood, it is believed that livestock disease, drought and increased rainfall variability served to undermine the viability of the pastoral economy.

To mitigate the risks associated with strict pastoralism, the Maasai, who represent the dominant ethnic group in the area, have begun to adopt agriculture as part of a diversified livelihood strategy (Little et al. 2001; McCabe 2003a; McCabe 2003b). Agriculture was first adopted as a livelihood diversification strategy about 40-50 years ago; however, the rate of change has increased in the past 10-15 years. Today, reliance on agriculture is the most apparent change in northern Tanzania – for some, cultivation now represents their only means of subsistence (McCabe and Leslie 2004). Others have adopted mixed-subsistence strategies (agro-pastoralism), while some remain strictly herders. In Tanzania and elsewhere, the transition from pastoralism to agro-pastoralism has led to a rapid and pronounced reconfiguration of the landscapes surrounding numerous savanna parks (Little et al. 2001; McCabe 2003b).

The adoption of agriculture by the Maasai has reinvigorated prior concerns regarding the sustainability of Maasai land-use strategies. Beginning in the 1970s, rangeland ecologists began to challenge previously held notions that pastoralist systems were not sustainable in the long-term and ultimately led to environmental degradation (see Ellis and Swift 1988). Today many ecologists (Coughenour et al. 1985; Ellis and Swift 1988; Behnke et al. 1993) see nomadic pastoralism as either having a benign effect on arid and semi-arid systems or playing an important role in maintaining those systems. Cultivation, however, continues to be widely regarded as antithetical to conservation objectives (Western and Gichohi 1993; Oates 1995; Terborgh 1999; Homewood et al.

2001) and now stands as the primary issue of contention between land managers and conservationists.

C. Study Site

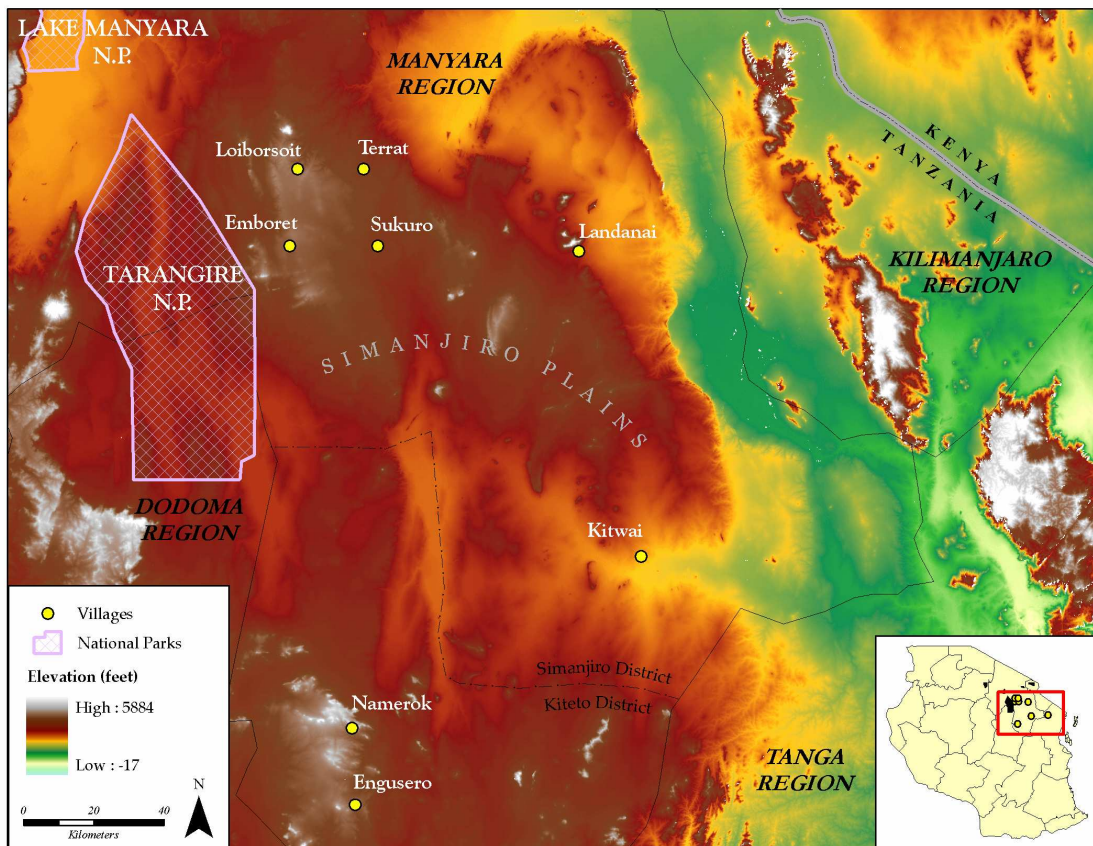
The Tarangire-Manyara region in East Africa (also called the Maasai Steppe) is the most diverse and complex grassland savanna ecosystem in the world (Olson and Dinerstein 1998; Coe et al. 1999). This area connects the Serengeti-Loliondo-Maasai Mara landscape to the west with the Amboseli-West Kilimanjaro region in the east. Areas within and surrounding this region have been internationally recognized for their biological importance. In 1979 in the area north of the Maasai Steppe, the Ngorongoro Crater, was designated by UNESCO as a World Heritage Site (UNESCO 2007). In 1987, Lake Manyara National Park earned Biosphere Reserve Status. And recently, the WWF has designated East African Acacia Savannas in the Maasai Steppe to be one of the world's 200 most biologically important and conservation worthy habitats (see Olson and Dinerstein 1998; Olson et al. 2001).

Tarangire National Park lies in the heart of this area of protected zones. The geographic scale of this project is limited to a sample of villages east of TNP in the districts of Simanjiro and Kiteto which also encompass the Simanjiro Plains (see Fig. 1.3). The study area can be generally described as semi-arid with mixed grasslands and woodlands. Land use is predominantly comprised of mixed agriculture, livestock grazing, and wildlife management which are each regulated in part by a bi-modal annual rainfall regime. While Tarangire NP itself protects important dry-season water resources, the Simanjiro Plains, which lie outside the eastern border of the park, provide critical grazing and calving areas for thousands of wildebeest (*Connochaetes taurinus*) and zebra

(*Equus burchelli*) that migrate to find lush forage during the wet season. In fact, the Tarangire-Manyara ecosystem boasts the second largest seasonal migration of large ungulates in East Africa after the Serengeti-Mara region, and one of the largest on the planet. (Lamprey 1964; Kahurananga 1981; Reid et al. 1998).

Villages in the districts of Simanjiro and Kiteto on the eastern border of Tarangire National Park were chosen for this study due to their proximity to the park, the importance of wildlife migration corridors in these areas, the rapid spread of agriculture in the region, and the apparent recent changes of many of the inhabitants' livelihood strategies.

Fig. 1.3. Map of Study Area



C. 1. Topography

Both Simanjiro District and Tarangire NP lie between 3°52' and 4°24' south and 36°05' and 36°39' east. The primary topographic features in this region are related to large-scale volcanic rifting. The escarpment of the Rift Valley rises from broad expansive flatlands through scattered hills to elevations between 900 and 1200 meters above sea level in TNP and between 1356 and 1605 in Simanjiro (Kahurananga and Silkiluwasha 1997). Comprised mainly of flats of lava and tuft, soils in the area are highly susceptible to erosion. Dark red sandy clay loam can be found in the well-drained areas, while the flood plains contain black cotton soils (i.e., vertisol)⁴ (Kahurananga and Silkiluwasha 1997).

C.2. Rainfall & Vegetation

Both Simanjiro and TNP are classified as semi-arid ecological zones (Pratt et al. 1966). The region experiences two rainfall seasons with the short duration rains falling from October to December and long durations rains from February to May. Average annual precipitation is 500-700mm in the lowland areas of Simanjiro (Madulu and Kiwasila 2005). Seasonal rains, however, are highly erratic and characterized by significant spatial and temporal variability.

Lamprey (1963) has described in detail the vegetation of TNP. He notes that it consists of *Combretum–Dalbergia*, *Acacia–Commiphora* woodlands and grasslands. In

⁴ When irrigation is available, crops such as cotton, wheat, sorghum and rice can be grown in vertisol. In this region, however, irrigation is uncommon and rainfed farming is very difficult with vertisol because the soil can be worked only under a very narrow range of moisture conditions: they are very hard when dry and very sticky when wet.

Simanjiro, vegetation is mainly short grassland (*Digitaria–Panicum*) (Kahurananga 1979). For a full description of Simanjiro's vegetation, see Kahurananga (1979).

C. 3. Population

Historically, migratory livestock herding was the most intensive form of land use in the Maasai Steppe region and the area was sparsely populated. During times of drought, disease, or other circumstances that that involved considerable loss of livestock (e.g., cattle raiding), the Maasai were known to settle with neighboring agricultural groups (Waller 1976; Waller 1984; Anderson 1988; Waller 1988). After a crisis, some Maasai remained permanently where they settled, while others returned to their former areas, some with wives from agricultural groups. Similarly, some members from agricultural or agro-pastoral tribes who migrated into Maa (i.e., language of the Maasai) speaking areas, in time were naturalized as Maasai (Igoe and Brockington 1997).

While many believe that the adoption of agriculture by the Maasai was largely driven by relative poverty and food insecurity, there is some ethnographic evidence that suggests that the Maasai were also motivated by economic opportunism and the potential to reduce the need to sell cattle to purchase other food and supplies (McCabe et al. 1997; Brockington 2002). The culmination of these events and governmental policies limiting access to grazing resources have tended to promote the incorporation of agriculture by the Maasai as a livelihood diversification strategy. Increased sedentism, which accompanied the adoption of agriculture, may be significantly interrelated with human population growth during this period (O'Brien et al. 1987).

The 2002 Tanzanian Population and Housing Census (Tanzanian National Bureau of Statistics 2004) reported populations of 141,000 and 152,000 in Simanjiro and Kiteto districts respectively. Average household size in Simanjiro ranges from 3.9 to 5.1. While the Maasai constitute roughly 90% of these numbers, populations of Waarusha and Barabaig are also commonly found in this region. Migration into the area has been another important source of population growth in the past 20 years (Madulu and Kiwasila 2005). OIKOS, an Italian NGO working in the area, estimated that annual population growth rates in portions of the Maasai Steppe range between 3.1 and 22.8 percent including natural increase and net in-migration (Tarangire Conservation Project/OIKOS 1998). Currently there about 350,000 herders in the Maasai Steppe who manage roughly one million zebu cattle (*Bos primigenius indicus*) (Sachedina 2006).

C.4. Economy

The Manyara Region, which includes both Tarangire National Park and Simanjiro District, is quite impoverished (Madulu and Kiwasila 2005). The transportation infrastructure is not well developed, many places in the region are without electricity, and social services are poor and/or lacking (Madulu and Kiwasila 2005). In Simanjiro, agriculture and transhumant pastoralism are the primary livelihoods with most households engaging in both activities⁵. The average income is estimated to vary between US\$150 - \$200 per year (Madulu and Kiwasila 2005).

⁵ Pastoral production systems are those in which 50% or more of households' gross revenue (i.e., the total value of marketed production plus the estimated value of subsistence production consumed by households) comes from livestock-related activities or where more than 15% of household food energy consumption consists of milk or milk products produced by the household. An agro-pastoral production system is one in which more than 50% of household gross revenue comes from farming and 10-49% from pastoralism (Swift: 1988, Morton & Meadows: 2000).

Roughly 60% of the regional economy is comprised of small and large-scale rain-fed agriculture (Madulu and Kiwasila 2005). Mechanized techniques are generally restricted to the larger farms, although tractors are commonly hired by small-scale farmers. Maize, pigeon peas, beans, sorghum, wheat, and bananas are the main crops grown in this region. In the past few years, pigeon peas in particular have become an important cash crop. Rain-fed agriculture, however, is marginal in many cases due to considerable rainfall variability.

Despite the uncertainty associated with drought, disease, and inter-tribal conflict livestock herding remains a critical part of the regional economy. Still, the Maasai have continued to diversify into other sectors. Within the last 6-8 years, wage-labor migration to Arusha and Mererani for service industry and gemstone trade jobs respectively has become increasingly common. The implications that these economic pursuits hold for land-use around Tarangire NP remain to be seen. What is clear, however, is that the survival strategy of a rural household in this area centers on a set of risk minimization procedures, of which livelihood diversification is paramount.

In concert with Simanjiro's widespread conversion to agriculture, the Maasai Steppe region has become a keystone of northern Tanzania's rapidly growing tourist economy. Visitors to Tarangire NP alone grew from 7,290 in 1988 to more than 85,000 in 2004 (Sachedina 2006). Together with nearby Manyara National Park, TNP brings in more than US \$3.2 million annually not including revenue generated by hunting tourism outside the parks (Sachedina 2006). While some of these funds are used to subsidize several smaller parks, this revenue represents a considerable source of foreign exchange for the government of Tanzania (Otto et al. 1998). Despite the ecological and economic

importance of the parks, photo and hunting tourism have yet to play a significant role in reducing poverty or supporting sustainable land use outcomes in local villages (Sachedina 2006).

C. 5. Tarangire National Park & Local Communities

Established in 1970, Tarangire National Park supports one of the highest densities of large ungulates in East Africa. In addition to harboring important populations of oryx (*Oryx beisa*) and lesser kudu (*Tragelaphus imberbis*), the park is home to the largest population of elephants (*Loxodonta africana*) in northern Tanzania (Foley 2006). While TNP serves as an important dry season refuge for wildlife, the park protects only 2,850 km² of the roughly 20,000 km² in the Tarangire-Simanjiro ecosystem. Each year, migrating ungulates and the predators that follow them spend roughly six months on lands occupied by Maasai agro-pastoral communities in Simanjiro (Sachedina 2006). Western and Gichohi (1993) have estimated that despite the large amount of protected area in East Africa, 70 percent of wildlife are dispersed outside of protected areas on land which overlaps with pastoralism. In an earlier paper, Western and Ssemakula (1981) drew from island bio-geographic theory when they suggested that unfenced, uncultivated rangelands adjacent to parks are necessary to increase the total range of resources available to wildlife and thereby promote long-term success of protected species. This is of even greater import for migratory species.

Before the establishment of the park, the areas that are now Simanjiro District and Tarangire National Park made up the traditional territory of the Kisongo Maasai (Igoe 1999). During these times, Maasai patterns of grazing and migration were quite similar

to those of the vast herds of ungulates with which they coexisted. Occasionally, livestock and/or people were attacked by predators, but largely the relationship between wildlife and herders could be characterized as symbiotic (Igoe 1999; Igoe 2002). Controlled burns set by the Maasai helped to promote flushes of nutritious grass that benefited wildlife as well as livestock (Igoe 1999; Igoe 2002). Similarly, large mammals (particularly rhinos and elephants) helped to keep down brush, which served to open new grazing areas and limit tsetse fly infestation (Igoe 1999).

With the creation of TNP, human use of resources within the park boundary was made illegal and the previous day-to-day activities of local residents were criminalized as they have been in other protected areas in Tanzania (see Neumann 1998; Brockington 2002). Exclusion has been enforced by paramilitary units of state wildlife authorities for several decades (Igoe 1999).

Partly as a result of this exclusion, land use outside the park has changed dramatically in the past two decades due to the adoption of agriculture by the Maasai. One result of this conversion is that cultivated fields are beginning to block important corridors from the park to the Simanjiro Plains threatening species which migrate to feed and give birth in the rainy season. The progressive conversion of rangelands to large-scale farming and permanent subsistence agriculture are contributing to the “islandization” of Tarangire National Park (Borner 1985). Continued "islandization" of Tarangire NP will likely precipitate population declines for many species in the ecosystem (Tarangire Conservation Project/OIKOS 1998; Voeten and Prins 1999). Aerial survey data of large migrating species suggests declines of over 50 percent in the Tarangire ecosystem during the 1990s (Tarangire Conservation Project/OIKOS 1998).

The adoption of agriculture, however, has not been a bonanza for local land users. Frequently, migrating animals destroy agricultural fields, prey on livestock and attack humans. The villages in Simanjiro district have suffered considerable resource loss in terms of land, livestock, and crops as wildlife corridors run across villages and wildlife graze outside Tarangire National Park, especially during the wet season. Ultimately, this situation threatens both the integrity of the Tarangire ecosystem and the economic viability of nearby villages.

Before the Maasai were alienated from the resources in the area that became Tarangire National Park, they faced many risks in their day-to-day livelihood activities, including drought, limited access to water, livestock predation and disease, and human disease. In the time since TNP was gazetted, new concerns have grown within local villages and some concerns have become more severe. Fuelwood is more difficult to come by, grazing lands more limited, and the threat of land alienation is persistent. The adoption of agriculture by the Maasai to adjust to these changes has left households more susceptible to rainfall variability as well as increased conflicts with wildlife as ungulates and agricultural pests destroy cultivated fields. My goal is to elucidate the process by which the contextual environment in which the Maasai live continues to influence their behaviors, which in turn serve to affect the parameters of the contextual environment.

D. Outline

This chapter has described the purpose of this study and provided an introduction to the regional issues around Tarangire National Park that have helped to shape its human/ environment system. In the next chapter, I will situate the conceptual framework within the relevant bodies of literature that inform this research. In Chapter 3, the data

and methods used in this analysis will be presented in detail. A description of the survey design and techniques for the original data collection will be followed by a detailed description of the methods employed in this paper. Chapter 4 will present the results obtained for each stage of analysis. Chapter 5 will conclude the thesis with an interpretation of the analysis results, a discussion of the assumptions and limitations of the study, and suggestions for future research.

CHAPTER 2

LITERATURE REVIEW

Conceptually, I propose heterogeneous human perception as an important mediating factor in shaping human behavior. Furthermore, I assert that contextual environment in which local perceptions are formed is profoundly affected by the presence of exclusionary wildlife parks. Broadly, I hypothesize that proximity to a protected wildlife park influences the type and intensity of local perceptions of risk which, in turn, influence diverse behavioral responses⁶. To examine these claims, I conducted a case study among several Maasai villages east of Tarangire National Park in northern Tanzania.

Theoretically, I proceed from the notion that: (1) land users in this region live within a complex and varied multi-scalar system; (2) the dominant parameters of this system are environmental variability, cultural norms, the politics of wildlife and conservation, and the economics of foodstuffs and tourism; and (3) that local adjustments to these parameters can often be seen as adaptive. In accordance with this approach, my study draws from theory and empirically based research in the fields of cultural and political ecology, human ecology, and contemporary interdisciplinary studies on conservation and communities. In this section, I will describe the historical lineage of these fields as well as the scholarship they have yielded as it applies to this study.

⁶ Specific research questions and hypotheses are detailed in Chapter 3.

A. Cultural & Political Ecology

In 1923 Harlan Barrows (1923, 3) called for a geography as human ecology which would “make clear the relationships existing between the natural environments and the distribution of the activities of man”. Two prominent academic trajectories that were initially pursued to address this call were hazards research, which sought to articulate the social aspects of environmental perturbations in developed societies, and cultural ecology, which focused on the human utilization of environmental resources in the developing world. Paul Robbins’ description of the origins of political ecology (2004) provides a thorough review of scholarship in the areas of hazards research and cultural ecology.

Beginning in the 1940s, scholars at the University of Chicago led by Gilbert White began to focus their attention on the vulnerability of modern society to environmental disturbances such as earthquakes, fires, droughts, and floods. These naturally occurring *environmental problems* were recast as environmental *and* social artifacts. This approach spawned a new, policy-oriented area of inquiry, which sought to better understand the management and amelioration of risk - defined as the quantifiable likelihood of adverse outcomes of human policies and behaviors. In an early paper, White (1945) challenged traditional construction and engineering-based approaches to dealing with floods. He claimed that building dams was irrational, expensive, and failed to address important underlying human issues. He proposed that better land-use planning and changes in human behavior could more effectively and efficiently reduce the negative consequences of future floods. The significance of this academic turn is that it

introduced the idea of risk into the realm of geography and sought to describe naturally-occurring environmental phenomena in terms of social and political dynamics.

The foundations of what would become cultural ecology were laid in the 1950s with the work of Julian Steward. Challenging the entrenched cultural-historical approach in Anthropology which he saw as overly relativistic and largely dismissive of the environmental factors in the development of culture, Steward (1955) argued that the origin of particular cultural features could be approached by understanding how humans utilized environmental resources through subsistence and work, activities, he claimed, which are part of the primary realm of culture, or the “cultural core”.

Steward (1955, 37) claimed that cultural ecology “pays attention to those features which empirical analysis shows to be most closely involved in the utilization of environment in culturally prescribed ways”. Seeking a universal science of culture which would permit cross-cultural comparisons, he advocated rigorous quantitative investigation. In time, cultural ecologists would come to utilize the science of ecology as their primary analytical tool. This led to a new vernacular in the social sciences wherein human behaviors and activities were framed in terms of their ecological function and role in regulating nutrient and energy flows within a homeostatic social-ecological system. This approach had wide-ranging appeal.

Frederick Barth (1969), for example, suggested that the inter-relationship of diverse mountain communities in Pakistan were regulated by the various niches that each group filled in the regional ecosystem. Of the Maring people of New Guinea, Roy Rappaport (1967; 1968) argued that important cultural features within their society served to stem the concerns associated with unchecked population growth and maintain

ecosystem stability. Bernard Nietschmann (1973) adopted theoretical and methodological approaches similar to those of his predecessors for his study of the Miskito Indians of Nicaragua, however, he found that the fundamental problems which the Indians faced were not driven by the internal metabolism of the ecosystem but rather the global economic market. Here we can begin to see early traces of what would become political ecology.

While much subsequent research has appropriately criticized these foundational works for their parochial view of scale, their pre-occupation with function, their obsession with energy accounting, and their tendency to essentialize human behavior, these studies were among the first to seek explanations for coupled human/ecological systems through small-scale empirical studies and therefore provide an important intellectual starting point for this thesis.

By the early 1980s shortcomings in the areas of hazards research and cultural ecology began to be articulated as new schools of thought gained momentum. The hazards approach was criticized for its presumption of rational actors and its inability to formulate a robust theoretical account of social adjustment to the environment. At the same time, criticisms of cultural ecology's adherence to the logic of ecological adaptation claimed that it led to problematic reductionist conclusions. One of the most prominent critiques during this period was from Michael Watts (1983) in his book chapter, "On the Poverty of Theory". Challenging the "naturalizing approaches" of empiricism, hazards, and cultural ecology, Watts (1983, 242) sought to establish an alternative paradigm to social-environmental relations informed by Marxist materialism, peasant studies, and historiography. Along these lines, he suggested that the "forces and social relations of

production constitute the unique starting point for human adaptation which is the appropriation and transformation of nature into material means of social reproduction”.

In calling for a regional political ecology which “combines the concerns of ecology and a broadly defined political economy,” Blaikie and Brookfield (1987) espoused an approach similar to Watts’. They suggested that land managers’ responses to changes in their social, political, or economic circumstances may be quite independent of changes in their ecological environment. Adding to this complexity, changes wrought on the land in response to social, political, or economic factors ultimately change the environmental context in which land managers will make future decisions. The authors (Blaikie and Brookfield 1987, 16) contend that to begin to understand the relationship between land degradation and society “we must put the land manager ‘centre stage’ in the explanation, and learn from the land managers’ perceptions of their problems”.

Since Blaikie and Brookfield’s 1987 book, the field of political ecology has grown rapidly and expanded into several new areas of scholarship. According to Robbins (2004), one of the primary discourses in the field of political ecology can be described as the conservation and control thesis. This approach challenges the widespread notion that conservation has a benign effect on human systems of production. Also, it focuses on the construction of conservation spaces that function as tools of statecraft and control and exclude people from the landscape. A striking application of this approach was conducted by Roderick Neumann (1998) in northern Tanzania. He showed that a pristine wilderness devoid of human activity was *constructed* during the colonial era to celebrate the flora and fauna of Africa. As a result, local producers, (the Meru), were alienated from their former lands when Arusha National Park was constructed. Central to

Neumann's argument is that the "pristine wilderness" that colonial administrators celebrated and that the independent Tanzanian government has continued to protect was a fabrication. Humans have been an integral part of that particular eco-system historically and their means of production were part and parcel of the metabolism of that system. The outcomes of this conservation cum statecraft, Neumann (1998) claims, impoverished people, threatened the moral economy, reconfigured social networks, and may lead to environmental degradation within and outside the park as local groups activate and employ various forms of everyday resistance.

The multitudes of relationships that exist between local land users and the growing enterprise of wildlife conservation have drawn the focus of a great volume of scholarship in the last several years. Much of this research can be described as grounded in the theoretical and ideological realm of political ecology, though many academics are reluctant to take on the label of political ecologist. For organizational purposes, I have delimited what I believe is an emergent category of research wherein practitioners from both the physical and the social sciences are beginning to forge a meaningful dialogue on issues related to the inter-relationship between conservation interests and community development.

B. Conservation and Communities

While forms of exclusionary land management have existed for centuries (Colchester 2004), it was during the late 17th and early 18th centuries that commercial trading companies' interest in unfamiliar plant and animal species and foreign geologies spurred the widespread scientific inquiry in these areas which has ultimately led to

modern forms of natural resource protection (Grove 1992). Scientific institutions were developed in the 19th century to investigate the implications of ecological change wrought by imperialism and the prospects of land management (Grove 1992). In 1832, artist George Catlin made the first request that a large area of the American wilderness be set aside as a national park (Dasmann 1988). Forty years later, Yellowstone National Park was born and with it the modern template for conservation. For decades, especially during the colonial era, the Yellowstone model served as the dominant conservation paradigm throughout the world. Many scholars have argued that the application of this model has undermined the rights of indigenous groups and led to significant social and economic problems (see Colchester 2004).

In the following review, I trace the major paradigm shifts and ascendant foci in social/ecological research as they have applied to the issue of conservation in the last three decades.

B.1. Shifting Conservation Paradigms

Traditional approaches to biodiversity protection in the developing world including “fortress conservation” and “command and control tactics” (Neumann 1998; Brockington 2002) have tended to blame environmental degradation on rural, often poor, land users. Common justifications for this claim have been that population increase and accompanying growth in population density and local extractive practices such as fuel-wood harvesting or subsistence hunting and fishing threaten important ecosystems that must be protected. Generally, proponents of this approach have advocated for the removal of local people from protected areas of biological significance to allay further

destruction (Terborgh 2004). Locals are thus excluded from lands that they had previously occupied, and perhaps equally important, they are also excluded from the project of conservation itself. The result of applying “Yellowstone” conservation approaches to developing countries, as Ghimire and Pimbert (1997) note, has increased the risk of food insecurity and undermined many livelihood strategies of people living in and around protected areas.

One significant turn in conservation thinking has been towards the enlistment of local, generally rural, people in the conservation enterprise (Alcorn 1993). In the context of tropical forests, Schwarzmann and colleagues (2000) have reiterated that parks formed by the exclusion of residents can have unfavorable consequences. They suggest that environmental political constituencies are necessary for the long-term conservation of tropical forests and that local groups are often potent political actors in these regions. The authors (Schwarzmann et al. 2000) also question one of the undercurrents of traditional conservation which casts local people as enemies of nature. Forests residents, they argue, protect more land from deforestation and logging than parks in Amazonia.

Equally ascendant in the literature on conservation and communities is the idea that parks are politically, geographically, and even ecologically *constructed*. Sanderson and Bird (1998, 441) have pointed out that through the creation of parks, humans have regulated natural processes that shape ecosystems, turned biota into commoditized resources, and transformed “politically convenient spaces into ecologically important sites”. They describe parks as islands which ultimately need to be linked to the outside world, often through buffer zones or other sustainable-use areas and contend that there is

nothing more political than “conferring these zones and the political status of ‘local community’ on people” (Sanderson and Bird 1998, 444).

Another major fixture in the arena of conservation research is the ongoing dialogue that exists between conservationists and social advocates. Redford and colleagues (2006) have suggested that the exchange between these two groups has become increasingly brittle threatening the prospects for both protected areas and the people living near them, while others have suggested that the human-nature dichotomy is disingenuous and counter-productive (Paterson 2006). In their edited volume, *Parks in Peril: People Politics and Protected Areas*, Redford and colleagues (1998, 457) assert that parks “were designed to preserve nature, not to cure structural problems such as poverty, unequal land distribution and resource allocation, corruption, economic injustice, and market failure” (see also Brandon 1998). Parks, they suggest, cannot be all things to all people.

B. 2. Social Impacts of Conservation

A comparatively small number of individual studies have investigated the social, economic, and political impacts of conservation on those living in or displaced from protected areas (Olwig and Olwig 1979; Tacconi and Bennett 1995; Ghimire and Pimbert 1997; Shyamsundar and Kramer 1997; Neumann 1998; Brockington 1999; Emerton 2001; Brockington 2002; Geisler 2003). To this end, one analytical framework offered West and colleagues (2006, 255) has described the “virtualizing vision” of protected areas noting how increasingly they color the “means by which many people see, understand, experience, and use the parts of the world that are often called nature and the

environment”. They suggest that research must move beyond analysis of discourse and power and investigate how violence, conflict, power relations and governmentality are implicated in the production of space, place, and peoples.

An alternate framework offered by Cernea and Schmidt-Soltau (2006) for examining the influence of parks focuses on the relationship between poverty risks and protected areas. Utilizing empirical data from 12 cases studies in central Africa, the authors outline a new theoretical construct they refer to as Impoverishment Risks and Reconstruction (IRR) with corresponding methodological approaches (interviews, land use mapping, and resource valuation). They (Cernea and Schmidt-Soltau 2006) break down risk into several categories including: risk of landlessness, joblessness, homelessness, marginalization, food insecurity, increased morbidity and mortality, loss of access to common property, and social disarticulation. They argue that the template for park construction which includes forced displacements is no longer tenable and in fact threatens the biodiversity it purports to protect by impoverishing local people. The authors (Cernea and Schmidt-Soltau 2006) conclude that parks are decidedly contributing to increased risk and marginalization of those who already rank among the poorest. Ultimately, they propose a “double sustainability” for future projects to protect both biodiversity and livelihoods.

In a review of 20 recent studies from 49 tropical protected areas, Naughton-Treves and colleagues (2005a) conclude that expectations regarding conservation’s ability to alleviate poverty must be tempered. Utilizing primarily remotely sensed images of deforestation in and around parks, the studies show that parks are reasonably successful at guarding against deforestation inside parks, but that deforestation in

surrounding areas is creating ecological islands. They (Naughton-Treves et al. 2005a) point out that many development projects now aim to link social development with conservation and sustainable use practices in buffer zones. The approach itself has been framed as a type of coercion which ultimately leads to further impoverishment and proffers only questionable returns to biodiversity (Neumann 1997). Citing Sen (1981), Naughton-Treves and colleagues (2005a, 243) assert that “local projects in and around protected areas cannot alleviate poverty for a substantial number of people if they are in fact made poor by the workings of a broader economic system that constrains their ability to acquire goods”.

Peres has turned these arguments on their heads by suggesting that indigenous land rights in the Amazon and “rapidly evolving ‘traditional practices’” have given local groups a “blank check” to exploit natural resources (Peres 1994, 586). He claims that widespread liquidation of land resource capital is ongoing among numerous indigenous groups as logging and mining companies compete for land concessions. He suggests that land-use policy in these areas should be reformed to avoid an increasingly broad development frontier. In this way, he feels, indigenous groups may regain some of their lost credibility as conservationists (see Redford and Stearman 1993a).

B. 3. Indigenous Peoples and Conservation

Implicit in most discussions of conservation in the developing world are general assumptions about the relationships between *nature* and *indigenous groups*. I use italics here to represent the highly contested nature of these terms. Discussions of these issues were invigorated by Redford and Stearman (1993a) when they asked: what interest do

indigenous people and conservationists have in common. They (1993a, 251) claim that “if some indigenous peoples have presented themselves uncritically as “natural conservationists,” it is only because they recognize the power of this concept in rallying support for their struggle for land rights, particularly from important international conservation organizations”. Alcorn (1993) challenges their definition of indigenous conservation pointing out that the term “conservation” is not directly translated into any non-European language. She (Alcorn 1993) concludes that partnerships with indigenous peoples offer the best option for achieving on-the-ground conservation both inside and outside of parks. She warns, however, partnerships may be threatened by entrenched power relationships that privilege those who grant lands rights, frame discussions and define knowledge.

The discussion between Alcorn and Redford and Stearmann has served as an important catalyst for scholarship in the area of indigenous peoples and conservation. Particularly, the question of whether the concept of the “ecologically noble savage” (see Redford 1990) is a myth has continued to inspire research. Ruttan and Mulder (1999) have investigated this within the context of East African pastoralists, specifically the Barabaig of Tanzania. Using economic game theory to test Hames’ concept (1987, 810) of conservation, which emphasizes short-term restraint for long-term benefits, they report that under *some* conditions conservation can be an outcome of individuals’ attempting to increase their own economic returns. They claim that this calls into question the assumption that conservation and economic maximization are antithetical to one another. These results, however, are not consistent with research conducted by Alvard in Peru. According to Alvard (1995, 810), conservation refers to actions that “are intended to and

do in fact prevent or mitigate resource depletion, species extinction, and habitat degradation”. He found that the Piro do not adjust their hunting behavior to conserve species vulnerable to extinction. Instead, decisions appear to be consistent with the predictions of foraging theory (Alvard 1993).

Smith and Wishnie (2000) adopt Alvard’s definition of conservation in their review of conservation and subsistence in small scale societies. This framework, they assert, “implies a design process, either evolutionary or intentional” (2000, 515). They conclude that while the ethnographic record does not afford a rigorous assessment of this claim, their survey of empirical research suggests that conservation is uncommon, particularly for large animal prey. The authors understand the contentious nature of a definition of conservation that requires evidence of intent or design, however, they claim that labeling any behavior that limits rates of resource extraction as conservation ascribes a functionalist approach to understanding subsistence behavior.

Departing somewhat from this exchange, Colchester (2000) states that conservationists are right to examine the relationship between indigenous people and biodiversity, however, he suggests that conservation policy that is formulated exclusively on the basis of faunal population dynamics is misguided. Furthermore, he (Colchester 2000) asserts that an examination of the effects of dynamic social and political systems and proximity to markets on livelihood strategies and resource extraction is necessary. Challenging advocates of people-free parks (see Hunter 1996), he notes that conservationists cannot rely on state bureaucracies to protect large, remote tracks of land (Colchester 1998b). They must enlist grounded indigenous knowledge of the ecosystems they wish to conserve.

B. 4. Local, Indigenous, Traditional Environmental Knowledges

Noting that the dialogue between researcher and informant too often obscures etic and emic cognitions, Posey (1992) has framed the concept of indigenous environmental knowledge under the banner of “reality”. He (Posey 1992, 26) suggests that anthropologists should endeavor to interpret the reality of native peoples. This may be achieved, he claims, through the development of a “hybrid field of ethnobiology that trains students to weigh as equally important the cognitive analyses of semantic fields and the gathering of basic geological and ecological data”. More specifically, Posey advocates the use of traditional environmental knowledge in the formulation of new testable hypotheses (1992).

Scott (1998, 311) has proposed the Greek concept of *mētis* as a way of conceptualizing knowledge embedded in local experience and therefore comparing it with a “more general, abstract knowledge deployed by the state”. The author makes the argument that many forms of high modernism have replaced a valuable collaboration between these two forms of knowledge with a rigid scientific view, which dismisses practical know-how as insignificant. Scott (1998) illustrates the important inter-connection between the two knowledges asserting that the “thin simplifications” and generalized knowledge which the state enlists as part of their control strategy often suppress, the practical skills that underwrite any complex activity. He (Scott 1998) argues that the post-revolution era under Lenin and the Ujamaa period in Tanzania aptly demonstrate how the resistance and improvisation of local knowledge helped to achieve state objectives which had been formulated through sanctioned knowledge and rule.

By focusing on the tension between state and local knowledges, Haenn (1999) has found that conflict between local land users and government sponsored conservationists can be vital to the conservation/development enterprise. Focusing on the Calakmul Biosphere Reserve in Mexico, she (Haenn 1999) provides an ethnoecology which characterizes important differences in environmental knowledge between campesinos who view the forest as a productive space and conservationists who view the forest as a place that needs to be protected. To quell opposition to the reserve, government agents increased aid to the region through conservation/development projects while interactions between the reserve director and local land users helped to press for an environmentalism based on sustainable resource use.

Agrawal (1995) has attributed the growing interest in “indigenous knowledge” and its application towards conservation and development as a response to the failure of grand theories to explain the current development and conservation struggles (Dove 2006) in poor countries. In response to this interest, he (Agrawal 1995) has challenged the dichotomy of scientific and indigenous knowledges espoused by “indigenistas”. Through a categorization of the major themes that separate indigenous from western knowledge he asserts that the dichotomy it is bound to fail not only because of the heterogeneity of the elements involved, but also because it seeks to “separate and fix in time and space systems that can never be thus separated or so fixed” (Agrawal 1995, 422).

Resisting, somewhat, Agrawal’s call, Kalland (2000) has discussed the prospects and limitations of the concept of indigenous environmental knowledge, which he sees as the politization of local/practical knowledge. For conservation to succeed, he argues, we

must move beyond a Cartesian model of scientific knowledge (see Ellen and Harris 2000) to an understanding of the connection between people's perception of nature and their behavior. Kalland (2000) offers a conceptual framework to this end. Simply utilizing indigenous knowledge as tool to both draw empirical observations of natural phenomena and as a paradigm through which observations are interpreted is not sufficient to mobilize conservation behaviors. Local management regimes, he asserts, must incorporate a third knowledge, institutional knowledge, which describes how people organize themselves in relation to an ecosystem.

Dove (2000, 240) contends that Agrawal's 1995 work left unanswered, "the further questions whether constructed dichotomies like that of engineer – bricoleur or indigenous – non-indigenous may play productive (as well as unproductive) roles in scholarship and whether they are, in any case, not inevitable?" He suggests that our study of the concept of indigenous knowledge may be most important for what it tells us about knowledge. Using a case study of rubber production in South-East Asia, Dove suggests that a history of knowledge construction can be characterized by three critical discontinuities, involving the separation of the rubber plant from its original conceptual context, extensive experimentation with rubber production technologies and diversification of the number and type of rubber stakeholders. He concludes that the concept of indigenous knowledge is a type of self-privileging "dividing practice" (Foucault 1982), but that bridging the divide may not be as appropriate as preserving and negotiating it.

Dove (2006, 196) has reviewed much of the literature on indigenous knowledge and environmental politics. He suggests that the emergence of this camp grew as a

reaction to the “historical proliferation of discourses that largely and uncritically blamed local populations for environmental degradation. Born largely from neo-Malthusian concerns for population increase, these discourses have been widely criticized for being simplistic and apolitical. While much of the critical social literature on indigenous knowledge has adopted Agrawal’s concern about simplistic and deterministic classifications of knowledge, there are many, particularly in the physical sciences, who continue to refine the scientific/indigenous knowledge dichotomy.

B.5. Expert Knowledges

Fazey and colleagues (2006) have framed this discussion in terms of expert vs. experiential knowledges. They suggest that because experiential knowledge will always play a role in decision-making, the integration of experiential and expert knowledges can improve the prospect of positive conservation outcomes. Others feel that new paradigms that seek to alleviate poverty and integrate conservation objectives with development strategies will ultimately fail to protect critical areas of biodiversity. Locke and Dearden (2005) assert that the objectives of conservation will not be well served by the World Conservation Union’s (IUCN) new foci of alleviating poverty and integrating humans and protected areas through new IUCN protected area categories. This strategy, they (Locke and Dearden 2005, 1) suggest, will “devalue conservation biology, undermine the creation of more strictly protected reserves, inflate the amount of area in reserves and place people at the centre of the protected area agenda at the expense of wild biodiversity”.

Brechin and colleagues (2002) have attributed the resurgence of traditional, top-down approaches to conservation within the academy to the perceived failure of integrated conservation and development projects (ICDPs). Claiming that conservation is fundamentally a social and political process, the authors outline and discuss six key elements of these processes that conservation programs often overlook: human dignity, legitimacy, governance, accountability, adaptation and learning, and non-local forces. To ensure the long-term success of protected areas, the authors (Brechin et al. 2002) claim that the conservation community must work constructively with people at all levels to promote social justice.

Drawing on important differences which exist between societal levels, Thompson and Homewood (2002) have provided an important statement on the valuation of resources within the context of protected areas. Using survey methods and informal interviews, the authors show that the patterns of access to resources, and the mechanisms whereby those patterns of access are controlled are as important as the valuation of those resources. They find that in Kenya, near Maasai Mara National Park, group ranch members are increasingly likely to lease their land for cultivation despite the higher returns to tourism. Local elites on the other hand, have benefited disproportionately through their ability to control the distribution of tourist proceeds. Consequently, they have become more likely to pursue land uses that promote wildlife conservation.

B.6. Community-Based Conservation & Natural Resource Management

Over the past several years, a number of new strategies have been proffered to address, in tandem, the objectives of conservation and the often deleterious social

consequences of protected areas. While somewhat different in their approaches, community-based conservation (CBC), community based natural resource management (CBNRM), and integrated conservation and development projects (ICDPs) have sought to alleviate poverty and develop rural communities through conservation friendly activities. In many cases, these projects have been part of structural adjustment programs organized by international lending and donor organizations (World Bank, IMF, USAID, UNDP, etc.) and/or other NGOs. A large body of literature has addressed the impetus and history of these approaches in Africa (Newmark and Hough 2000; Barrow et al. 2001); the prospects for East African conservation and development (McCabe 1992); the conceptual origins of “community” (Agrawal and Gibson 1999); the challenge of heterogeneous economic motivations (Hackel 1999); the role of conditionality in development (Schroeder 2005); power relationships (Brockington 2004); institutional simplifications (Li 2002); and the absence of tenable alternatives to these approaches (Adams et al. 2004).

B.7. Social Ecological Systems & Conservation

Berkes (2004) has pointed to paradigm shifts in theoretical and applied ecology to help examine the implications of CBC and other integrated social/ecological programs. Replacing the classical paradigm of succession and equilibrium, the “new” ecology (see, Zimmerer 1994; Scoones 1999) emphasizes complex adaptive systems (Gunderson and Holling 2002), flux and disequilibrium (Ellis and Swift 1988). Fiedler and colleagues (1997, 83) have described the implications of these paradigm shifts for conservation: “(1) the replacement of a model in which some species are better adapted than others with a

model in which all species are simply differently adapted; (2) the population as the fundamental unit, or currency in conservation; (3) the recognition of the complexity of patch dynamics overlain by habitat fragmentation and the confounding implications of these; and (4) a greater appreciation of multiscale phenomena". While many ecologists have called for an integration of current ecological thinking to be applied in conservation planning (see, Wallington et al. 2005), Berkes (2004) has extended this concern to include humans as an integral part of nature. He proposes integrating lessons from the fields of common property, traditional ecological knowledge, environmental ethics, political ecology, and environmental history with the theories presented by disequilibrium ecology.

Tracing the major arguments in the literature on conservation and communities, several broad themes arise that form a basis for the conceptual framework of this study. First, parks formed by the exclusion of residents or the alienation of local people from important resources can have unfavorable consequences including poverty risks. Secondly, important epistemological differences exist between indigenous groups, state sponsored resource managers, and western trained academics. Lastly, local or indigenous knowledge can be used as a tool to draw empirical observations and that research should seek to understand the connections between people's perception of nature and their behavior.

C. Human Ecology – Risk, Attitudes & Conservation

The rise of interdisciplinary research in the last several years has begun to yield important new research trajectories in many areas, particularly in the realm of human

ecology. New areas of integrated social/ecological research include the analysis of risk and the study of human perception as they relate to environmental resources, degradation and conservation.

In the last two decades, human ecologists have begun to integrate biological and economic ideas of risk within the realm of human ecological research. In the field of behavioral ecology Stephens (1990) described how older models of decision-making borrowed from economics have ignored random variation in the decision-maker's environment. Randomness, he argued, can be included in these models in two ways: by including measures of risk and uncertainty (i.e., incomplete information). Winterhalder (1990) mobilized the concept of subsistence risk minimization to explore commonalities between pre-modern open field agriculture in England and modern hunter-gatherer subsistence strategies. Most recently, the argument has been made that anthropology could benefit from the development of models of risk-sensitive adaptation (Winterhalder et al. 1999). In East Africa, McPeak and Barrett (2001) have examined the critical relationships between risk, mobility, and household herd size among pastoralists in northern Kenya and Ethiopia. In their analysis they describe how climatic variability, price volatility, disease outbreaks, and violence severely undermine the stability of the pastoralist livelihood. The combined effect of these shocks can reduce herds below sustainable thresholds, forcing herders to abandon *ex ante* risk mitigation strategies and adopt *ex post* coping strategies.

As studies of the effects of risk in social-ecological systems have progressed, new scholarship in the social sciences has begun to examine attitudes and human perception, particularly as they relate to resource management and conservation. Cinner and Pollnac

(2004) claim that understanding how socioeconomic factors affect environmental stewardship and values can help to inform the development of effective conservation programs. In their study of fisheries in Mahahual, Mexico, they (Cinner and Pollnac 2004) conclude that wealth is the most important socioeconomic variable influencing perceptions of coastal resources for their study site. Ward and colleagues (2000) have examined perceptions of environmental degradation among pastoralists in Namibia to determine how well they correlate with empirical measurements of environmental quality. They found that the widespread perceived cause of degradation, decline in annual rainfall, is not consistent with long-term rainfall records. Studies of the attitudes and perceptions of people living with the risk of earthquakes have been studied in Bucharest (Armas 2006). Statistical results from this study indicate that perceptions vary considerably with respect to age, gender, level of education and insurance against loss. These types of concerns were well studied by human geographers, particularly in the 1960s.

A number of studies have examined attitudes regarding conservation in East Africa. Using survey methods to solicit attitudes of 1190 Tanzanians living near Arusha, Tarangire, Lake Manyara and Mikumi National Parks and the Selous Game Reserve, Newmark and colleagues (1993) found that 71% were opposed to the abolishment of nearby parks, however roughly half indicated that nothing good came from park employees or administrators. Negative attitudes towards conservation were correlated with past problems with wildlife, shortage of land for grazing and farming, problems with flooding and long-term residency. McClanahan and colleagues (2005) have tested the hypothesis that positive perceptions towards restrictive fisheries management and marine

protected areas (MPAs) in Kenya would increase with wealth, education, age, and years of employment. They found that wealth was not a significant factor, and that type of employment had the strongest effect, with fisherman having significantly less positive perceptions towards protected areas than government managers. In Laikipia district, Kenya, Gadd (2005) has examined conflict between wildlife (primarily elephants) and pastoralists and agro-pastoralists, and local attitudes regarding conservation. While respondents were generally negative about aspects of wildlife conservation, important differences in attitudes existed between farmers and pastoralists, with farmers being less tolerant of elephants (Gadd 2005). In communities that benefited from tourism, however, this distinction was less clear. Neither education nor wealth correlated with positive attitudes of conservation. Gadd (2005) asserts that this is because of the role of tourism programs that benefit those lacking material wealth.

Perception of risk is an aspect of human cognition that has inspired some research in several disciplines including psychology, environmental psychology, economics, environmental perception, and hazards research. While much of the foundational research on risk perception has been conducted by psychologists (see, Sjöberg 2000), geographers and human ecologists have begun to appreciate the importance of human perception in understanding social/ecological systems and conservation. Lisa Naughton-Treves has incorporated a risk perception component in her study of crop damage near Kibale National Park in Uganda (Naughton-Treves 1998; Naughton-Treves and Treves 2005b). She notes that perceptions of crop damage often focus on large, punctuated events like elephant raiding and tend to marginalize persistent yet obscure forms of degradation caused by mice or insects. One of the factors limiting research on risk

perception has been, and continues to be, finding appropriate ways to conceive of risk and measure or record it.

To facilitate their research among pastoralists and agro-pastoralists in northern Kenya, Smith and colleagues (2000; 2001) devised an efficient method for examining heterogeneous risk perception among a seemingly homogenous group. They describe Participatory Risk Mapping (PRM) (see also Quinn et al. 2003) as an “easy-to-field” method and useful way for respondents to communicate concerns, in their own words, from the bottom-up. This method was used in this study and is described in greater detail in the following sections. For their own study, Smith and colleagues (2000) were able to identify considerable variation in risk perception according to a number of strata including gender, wealth, and primary economic activity.

My study is situated within a conceptual framework where local perceptions of risk and wildlife conservation are intimately related. Currently, the relative absence of rigorous analyses of the effects of conservation on risk perception and behavioral responses to perceived risk is conspicuous. Studies that have made assessments of attitudes, perceptions, and/or risk have focused exclusively on their proximate causes (i.e., predictor variables) and have failed to examine their consequences. Arguably, the latter are of equal or perhaps greater importance for conservation and development planning. Utilizing the PRM methodology developed by Smith and colleagues, I will examine the effect of conservation on local risk perception and behavioral response to perceived risk in four villages near the border of Tarangire National Park in northern Tanzania.

D. Conceptual Framework

In an rarely cited paper, Harold Brookfield (1969) suggests that "decision-makers operating in an environment base their decisions on the environment as they perceive it, not as it is. The action resulting from decision, on the other hand, is played out in a real environment". Building on prior research which has established the critical importance of understanding social-ecological systems, the plurality of interactions between conservation and communities, and the relevance of human perception, the objective of this study is to provide a further empirically-based case study to ongoing human/nature research that links the contextual environment, human perception, and behavior in landscapes that carry the burdens of both wildlife conservation and social production. These concerns are especially relevant in the case of Tarangire National Park and the villages of Simanjiro District in northern Tanzania.

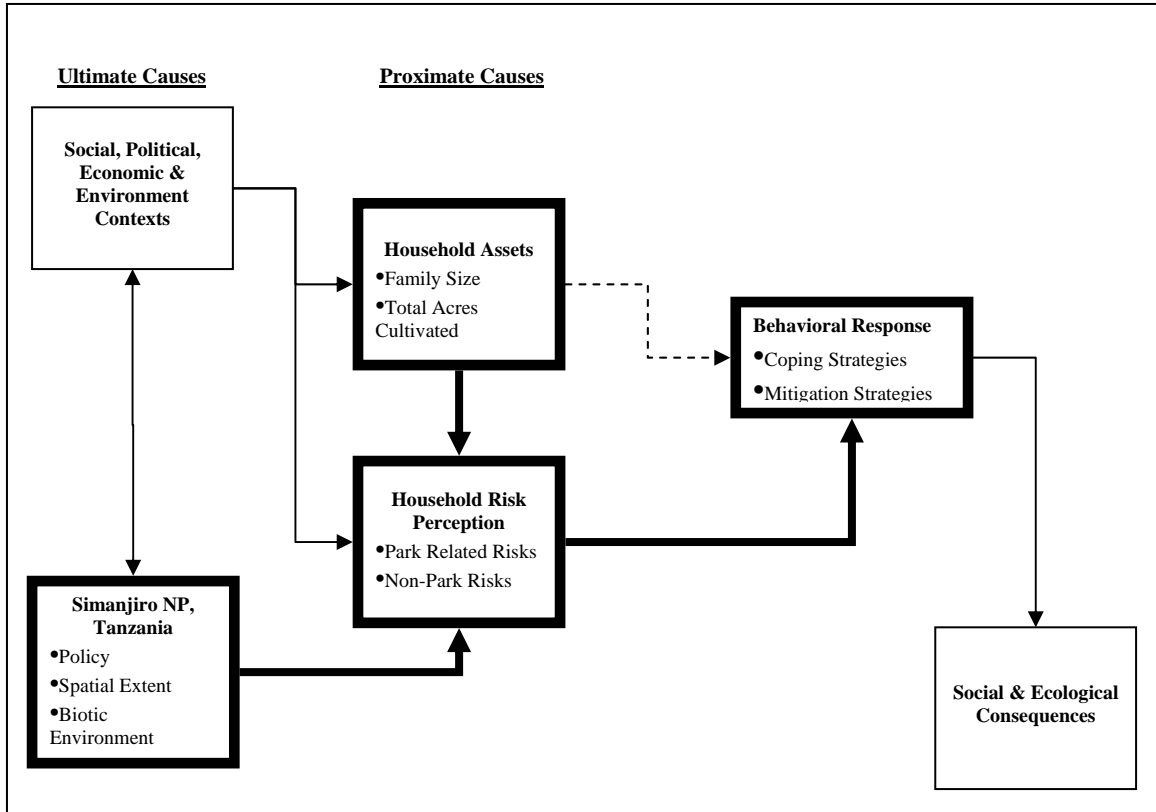
Figure 2.1 provides a visual representation of the conceptual framework for this study. This diagram shows the intervening forces that mediate the relationship between the ultimate causes found in the contextual environment (see footnote 3), which includes the national park, and the social and ecological outcomes that are rooted in that context. To address these types of questions, a great volume of research has sought to identify the proximate causes, at various scales, of social change and socially-derived ecological change. These studies have generally focused on ostensibly objective phenomena such as education, income, race, gender, land-use practices, government policies, market access and integration, access to capital and technology, social organization, health measures, and many other phenomena to understand how social-ecological relationships change. Often, these phenomena are quantified, though not in all cases. In most cases, however,

these phenomena have been simply correlated, either quantitatively or descriptively, with human behavior. This correlation is represented by the dashed lines in Figure 2.1 that link *Household Assets* to *Behavioral Responses*.

In an effort to move closer to the proximate causes of human behavior as it relates to conservation, this paper presents human perception as an important factor which mediates the relationship between the context in which humans live and the behaviors that they pursue.

In Figure 2.1, both household-level assets and higher level socio-economic, political, and environmental contexts influence households' perceptions of the risks that they face and, through these, the behaviors that households will pursue. I hypothesize that the presence of the park influences both the type and magnitude of perceived risks. Because land-use decisions are generally made at the household level, the household is the analytical unit for this study. Due to data limitations, the bolded lines in Fig. 2.1 represent the aspects of this conceptual framework that I will investigate. A complete description of the data and methods used in this study follows in Chapter 3.

Fig. 2.1. Conceptual Framework



CHAPTER 3

RESEARCH QUESTIONS, DATA AND METHODS

The previous chapters provided an introduction to the research topic, study site characteristics and a review of the literature that informs this thesis. In this chapter, I will describe the research questions and hypotheses that frame this research and data and methods of analysis.

A. Research Questions & Hypotheses

This research is guided by three general research questions and eight corresponding hypotheses. These hypotheses represent the main relationships I expect to find between household proximity to the park, perceptions of risk, wealth and behavioral response.

Q1. What are local perceptions of risk and how does proximity to Tarangire National Park impact these?

- H1. People in villages close to the park identify more perceived risks than villages far from the park.
- H2. People in villages close to the park will identify some different perceived risks than people in villages from far the park. These risks will be more related to the park than common risks identified in all the villages.
- H3. People in villages close to the park will identify some similar perceived risks as people in villages far from the park, but with different incidence and severity.

Q2. Within villages close to the park, how do village and household factors impact the perception of “park related” risks compared to “non-park related” ones?

- H4. The relationship between household acres cultivated and “park related” risks will be different than the relationship between acres cultivated and “non-park related” risks.
- H5. The relationship between household livestock units and “park related” risks will be different than the relationship between livestock units and “non-park related” risks.
- H6. Perceptions of “park related” risks will vary by village⁷(Tobler 1970).

Q3. Within villages close to the park, what are the mitigation and coping responses and how are they related to risk perception at the village level?

- H7. Mitigation and coping responses for park and non-park risks vary between households and villages.
- H8. A greater number of mitigation and coping strategies are identified for “park related” risks compared to ‘non-park related’ risks⁸.

B. Data

Data used in this study were collected as part of a large, multi-site⁹, collaborative research project between the University of North Carolina at Chapel Hill (UNC), the University of Colorado at Boulder (CU), the University of Florida at Gainesville (UFL), and the University of Dar es Salaam (UDS) in Tanzania to investigate the consequences

⁷ Following traditional anthropological inclinations, I do not have strong reasons to assume that homogeneity exists either within or between villages in this case, however, I invoke Tobler’s first law of geography here and hypothesize that despite variability, commonalities in perception of risk within villages will be greater than commonalities between villages. I would further hypothesize that this is due to networks of communication and exchange that are narrowly bounded spatially although this is not part of my analysis.

⁸ With this hypothesis, I am exploring the idea that a certain limited number of “best practices” will have evolved for dealing with longstanding risks, whereas risks that have developed more recently, such as those associated with the park, will initially stimulate a large number of mitigation and coping responses as individuals and groups explore a variety of mitigation and coping behaviors.

⁹ Collaborators at the University of Florida at Gainesville are conducting similar research around Kibale National Park in Uganda.

of parks for land use, livelihood diversification and biodiversity in East Africa. In addition to social data, remotely sensed images and biodiversity sampling have been utilized within this larger project to analyze the spatial configuration of land use, land cover, and biodiversity gradients near the park boundary. My own study focuses exclusively on data generated through social data collection methods.

Social data were collected between October 2004 and July 2005 by a team of researchers from the UDS and local interviewers assembled by Dr. Paul Leslie (UNC) and Dr. Terry McCabe (CU). The data collection, sampling strategy, and survey design presented below were determined by them and are summarized here based on personal communication with them. Although I have visited the field site on two occasions and met with several of the enumerators, I was not directly involved in the survey design or data collection.

B.1. Fieldwork & Sampling Strategy

To examine the effect of proximity to the park boundary on local perceptions of risk, 4 villages close to the park and 4 villages farther from the park were selected in which to conduct cross-sectional household surveys and semi-structured risk assessment interviews. Data collection was then carried out in two phases. In the first phase, researchers from the University of Dar es Salaam conducted risk-perception interviews in the villages far from the park boundary. A total of 124 interviews were conducted with male household heads in the villages of Landanai, Kitwai A, Namerok and Engusero (see Fig. 1.3) in October, 2004. In the second phase trained, local, field assistants carried out the bulk of the household surveys and risk assessment interviews in the four villages near

the park during the first 5 months of 2005¹⁰. For this study, “near the park” is defined as being within two villages adjacent the park boundary. Villages in Tanzania are nucleated administrative units that were delimited through the national “villagization” program of the 1970s which sought to promote national productivity and social welfare through resettlement schemes (Cooke 2007). Villages in this area are spatially large (i.e., similar in size to townships or counties in the U.S.) and generally have low population density. Surveys and interviews were conducted near the park with household heads¹¹ in the villages of Loiborsoit, Emboret, Sukuro and Terrat (see Fig. 1.3) for a total of 116 households. Due to the low population density of this area, the paucity of roads and other infrastructure, and the inherent danger of traveling overland by foot through the savanna, surveys and interviews were administered opportunistically. However, enumerators were instructed to conduct interviews in households from a variety of location and wealth classes. A summary of this information together with village population estimates from the Tanzanian Census of 2002 (Tanzanian National Bureau of Statistics 2004) are presented in Table 3.1.

¹⁰ Dr. Terry McCabe (University of Colorado at Boulder) conducted several of the initial surveys.

¹¹ While there were a few widowed women who were surveyed, household heads were generally men and therefore the sample reflects a strong gender bias.

Table 3.1. Village and Sample Characteristics

Village	District	Near Park?	Household Survey		Risk Sample Size	Survey Sample Size
			and/or Risk Assessment	Population		
Loiborsoit	Simanjiro	Yes	Both	4,154	29	29
Emboret	Simanjiro	Yes	Both	2,254	30	30
Sukuro	Simanjiro	Yes	Both	2,703	27	27
Terrat	Simanjiro	Yes	Both	2,944	30	30
Kitwai A	Simanjiro	No	Risk Assessment	1,274	30	0
Landanai	Simanjiro	No	Risk Assessment	3,580	31	0
Namerok	Kiteto	No	Risk Assessment	5,087	33	0
Engusero	Kiteto	No	Risk Assessment	7,205	30	0
<i>Total</i>					<i>240</i>	<i>116</i>

B.2. Data Collection Techniques

As noted above, two social data collection methods were utilized during field research for this study: a household survey and a semi-structured risk assessment interview which is referred to as “participatory risk mapping”. These methods are described in detail below.

B.2.a. Participatory Risk Mapping (Risk Assessment Interview)

Designed by Smith and colleagues (2000) to examine heterogeneity of risk exposure within seemingly homogenous pastoralist communities in southern Ethiopia and northern Kenya, Participatory Risk Mapping (PRM) is a two-stage system of ordinal rankings, wherein respondents first identify risks and then rank the risks they have identified. To begin, respondents are interviewed and asked to identify risks they face. As noted earlier, the term risk here is used interchangeably with “concern” or “worry”. In this case, risk is taken to mean exposure to potentially unfavorable circumstances and the possibility of incurring nontrivial loss (Smith et al. 2000). These responses are recorded in the respondent’s own words. There is no limit on the number of risks that

may be identified and therefore the total number of risks identified by each respondent varies. When the respondent has identified all the risk he perceives, the interviewer then asks the respondent to rank these risks from most severe to least severe. One of the benefits of this technique is that the respondents are able to identify the risks that concern them in an open-ended fashion, rather than respond to risks suggested by researchers. Furthermore, since respondents are then asked to rank the risks that they identify, this method yields ordinal as well as categorical information on household risk assessment.

PRM derives from a lineage of participatory, rapid appraisal methods that have gained popularity in recent years. Two approaches, in particular, require further elaboration: Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA).

Chambers has provided valuable comparison of these two approaches:

RRA itself evolved during the late 1970s and early 1980s as a response to the biased perceptions derived from rural development tourism and the many defects and high costs of large-scale questionnaire surveys. PRA has much in common with RRA, but differs basically in the ownership of information, and the nature of the process: in RRA information is more elicited and extracted by outsiders as part of a process of data gathering; in PRA it is more generated, analyzed, owned and shared by local people as part of a process of their own empowerment. (1994b)

In addition, RRA has typically functioned as a verbal technique while PRA has tended to be more visual (see Chambers 1994a; Chambers 1994c). Participatory Risk Mapping can be seen as a conflation of these approaches with a particular application to risk assessment. Analyses of PRM data will be discussed in the following section.

B.2.b. Household Survey

Household surveys were conducted together with risk assessment interviews in villages close to the park. (Surveys were not administered in villages far from the park due to issues of time and funding.) In surveyed villages, data were collected by trained, local enumerators during the first half of 2005. This survey included questions about

current and historical information on basic household demographic variables including migration history, livelihood activities including agriculture and pastoralism, wage-labor employment, land allocation and tenure, and household assets. Lastly, enumerators asked a series of open-ended questions about the ways that households act to mitigate or to cope with their exposure to perceived risk. These questions were part of the risk assessment interview in the villages close to the park. Questions regarding coping and mitigation were not asked in the villages far from the park. The variables used for my analysis will be identified in the following section.

C. Methods of Analysis

In the first stage of analysis, participatory risk mapping is used to compare the type, incidence, and severity of perceived risks of villagers living near the park boundary to those living far from the immediate impacts of the park. In the second stage, multivariate statistics are used to examine the effect of household assets (i.e., wealth measures) on perceptions of risk within villages near the park. In the third stage, I describe variation in behavioral response (i.e., risk mitigation or risk coping strategies) to perceived risk within the villages close to the park.

C.1. Participatory Risk Mapping

To address the questions “What are local perceptions of risk and how does proximity to Tarangire National Park impact these?” (Research Question #1) data generated from the risk assessment interviews are used to construct risk maps. Risk maps

are simply graphic representations of incidence and severity indices. These indices are described here.

As noted above, PRM is a two-stage system of ordinal rankings, wherein respondents first identify risks and then rank the risks they have identified. From this ranking simple incidence and severity indices can be calculated for each risk variable that is mentioned by at least one respondent in the population. An incidence index for a given risk is simply the proportion of respondents interviewed that identified that risk. Thus, the incidence index is a value for each risk variable ranging from 0 (no one identified the risk) to 1 (everyone identified the risk). This measures the breadth of perceived exposure to a given risk in a sample population independent of how severe each respondent ranked that risk.

Because the rank of each risk identified by each respondent varies, severity is also measured using an index. This process is described by Smith and colleagues (2001):

The ordinality of the data permit ready comparison of risks for a given respondent, but since the number of identified risks varies across individuals, one needs to be careful about comparing the ordered data across respondents identifying different numbers of reportable hazards. Simply put, it matters whether a risk is ranked second most important out of six or out of only two. We render the data comparable across respondents by constructing risk assessment indices, thereby rendering the ordinal data pseudo-cardinal...

The method of index construction is not self evident with such data because of the unavoidable metric tradeoff. Any factor not identified as a hazard can surely take value zero, while the greatest hazard one faces can be arbitrarily assigned a value of one without loss of generality, yielding boundary values of zero (not identified as a source of risk) and one (identified as the primary source of risk) for each respondent. That part is straightforward. The question becomes how to handle 'interior values', those identified hazards not deemed of greatest concern.

A simple example might help clarify the issue. Imagine a respondent one declares two factors, A and B, to be significant hazards, with A the more severe of the two. Respondent two declares five factors to be significant, A, B, C, D, and E, with A rated most serious, followed by B, C, D and E, in that order. So let A take value one for both respondents, as both deem it the greatest hazard they face. And factors C, D, and E clearly take value zero for the first respondent since they were not identified as risks. The issue of index construction revolves then around how to handle factors like B.

One approach that the authors suggest is to employ uniform intervals between ranked factors for a given respondent. This interval is simply defined for each respondent i as

$1/n_i$ where n_i is the number of risk identified by that respondent. An individual severity index value R_{ij} , for risk j of rank r among a group of n risks identified by respondent i is thus: $R_{ij} = 1 - [(r_{ij}-1)/n_i]$. This sets the most serious risk ($r = 1$) to $R_{ij} = 1$, and the least serious risk ($r = n_i$) to $1/n_i$ (i.e., 1 interval up from zero). All risks that are not identified by respondent i are assigned a value of zero. To calculate the sample (or subsample) severity index, S , for a given risk, Smith and colleagues take the mean of the severity index for that risk for the subset of those respondents identifying that risk (2000).

The resulting incidence and severity values for each risk variable can be plotted graphically to “map” the risk profile of the subject population. The maps function as visual representations of the character of risk perception in sample populations. Figures 4.2 and 4.3 in the following chapter represent the risk maps for the villages close to the park and the villages far from the park respectively.

C.2. Logistic Regression

To examine how household assets correlate with perceptions of “park related” risks compared to “non-park related” risks within villages *near* the park (Research Question #2), I have estimated eight logistic regression models. Risk assessment and household survey data are used here to construct dependent and independent variables respectively. Problems of heteroskedasticity, multicollinearity, extreme outliers, and missing data were not found to exist with these data.

C.2.a. Dependent Variables

The construction of dependent variables for this analysis was determined by the results of the risk maps and will be discussed further in the findings section. In the

villages *near* the park, risks that were perceived by a large percentage (greater than 30%)¹² of the respondents were divided into two groups – those risks that were also identified by respondents (any percentage) from villages far from the park and those that weren't. I have labeled these groups “non-park related” and “park related” risks respectively. Ultimately, two dichotomous dependent variables were constructed to facilitate statistical analysis. For the first dependent variable, respondents were coded 1 if they ranked a “park related” risk 1st or 2nd (most severe or second most severe), and 0 if they did not. For the second dependent variable respondents were coded 1 if they ranked a “non-park related” risk 1st or 2nd and 0 if they did not¹³. Ultimately, I am interested in whether “park related” risks are perceived by households in the same way as “non-park” related risks. Coding dependent variables in this way permits comparison of the odds of ranking “park related” risks with the odds of ranking “non-park related” risks. A more complete description of how these variables are constructed is presented in Section 4.B.

C.2.b. Independent Variables

Two primary predictor variables are included as proxies for household assets: Total Household Size, and Total Acres Cultivated. To control for the effect of village

¹² The 30% threshold constituted a natural break in the data. One variable with an incidence of 30% was not included in the analysis because it is somewhat ambiguous how the variable ‘losing land’ should be interpreted. Every respondent who identified ‘losing land’ also identified ‘conservation’, however, many respondents identifying ‘conservation’ did not also identify ‘losing land’. It may be that some respondents are combining the threats of losing land and land-use restriction under the banner of ‘conservation’ while others are not. Alternatively, the perceived threat of ‘losing land’ may not be due to the threat of park expansion. It is generally unclear how this variable should be interpreted and is therefore omitted from my analysis. Due to the very small number of respondents (n=4) ranking ‘losing land’ as their 1st or 2nd most severe risk the inclusion or omission of this variable would likely have a negligible effect on the odds ratios.

¹³ I dichotomized the rankings in this way to achieve greater statistical power with such a small sample size. 1st and 2nd ranked risks were included in the same category because while most “park related” risks were identified by most respondents, generally they were not ranked most severe.

differences, a dummy variable for village is also included. While livestock holdings certainly constitute important household assets, standard stock units (SSU) are omitted from this analysis due to their high correlation with Total Household Size (Pearson's correlation > 0.6). The decision to include Total Household Size in lieu of SSU was informed by the extensive literature on pastoralism (Herskovits 1926; Schneider 1957; Deschler 1965; McCabe 2004).

The question of why pastoralists keep large herds was originally presented by Herskovits (1926). The first assumptions were that the practice of keeping large herds of relatively unproductive animals was irrational and ultimately unsustainable. This argument was countered by materialist arguments which suggested that the reason for large herds was to mitigate the risks associated with drought (Schneider 1957; Deschler 1965). These arguments stressed that pastoralists knew that many animals would die during periods of drought and that the surviving animals would be needed to reestablish the herd. McCabe (2004) points out that the underlying assumption here was that herds were an end in themselves – they provided food and were a store of wealth. He suggests that what are missing from these explanations are the goals of pastoralists themselves.

In his book, *Cattle Bring Us to Our Enemies* (2004), McCabe argues that “the livestock herd is... the primary means by which individual pastoral people are able to initially form a family, and it is through the herd that family growth is possible.¹⁴” Using data from four Turkana families in northwestern Kenya, McCabe shows that, during a 15 year period (1980 – 1995), household herd sizes fluctuated while family size steadily increased. He concludes that while it is disingenuous to suggest that the Turkana seek to

¹⁴ In most African pastoral cultures, bridewealth must be paid in the form of livestock to the father of the woman being married. Only after full payment of the negotiated “price” is the husband able to make claims on the offspring of the marriage – thereby legitimizing his family and his status in the community.

maximize their family size¹⁵, there is little question that the Turkana strive to increase their family size.

McCabe's research suggests that increasing family size may be interpreted as a goal of pastoral peoples in East Africa. It is important to note that family size, herd size, and other material wealth are ultimately interrelated. A family cannot be formed or grown (through additional wives) without livestock. Conversely, grazing and milking livestock and tending to agricultural plots demand considerable labor inputs which are generally supplied by the family. Still, whereas herd size may vary from year to year, family size tends to increase through time.

In addition to family size¹⁶, I include the total number of acres cultivated in the year preceding the survey as a proxy variable for household assets. By including this as a wealth indicator, I account for the primary differences in livelihood strategy in this area.

C.2.b.i. Total Household Size

This continuous variable was created by summing the number of wives, children, and others living in the household that each respondent identified. The natural log of this value was taken to normalize its distribution. Summary statistics for this variable are presented in Table 3.3. Figures 3.1 and 3.2 show the distribution of this variable before and after the natural log was taken respectively¹⁷. The normal distribution line is represented by the curved line in each figure.

¹⁵ There are several cultural factors which suggest otherwise including age at marriage and birth intervals.

¹⁶ Family size and household size are used synonymously in this paper.

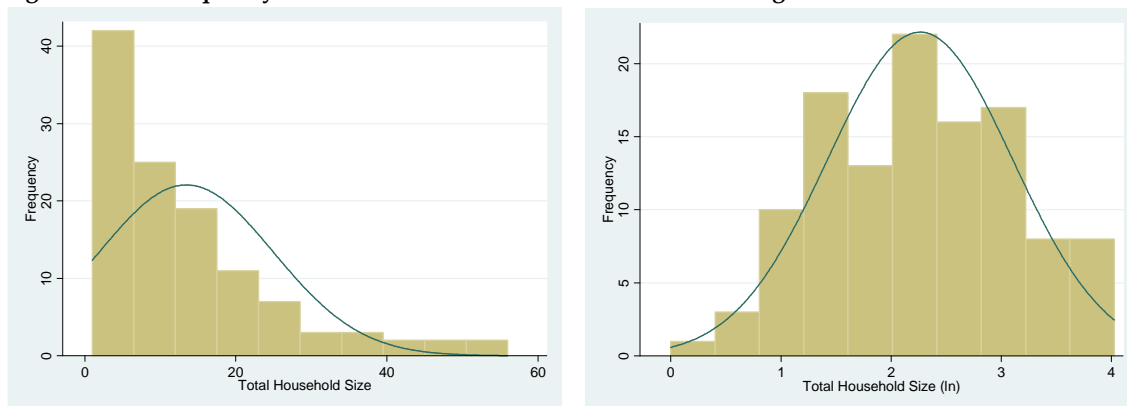
¹⁷ A Shapiro-Wilk test for normality indicates that we cannot reject that the hypothesis that the log transformation of Total Household Size is normally distributed ($p=0.50$).

Table 3.2. Summary Statistics for Continuous Independent Variables

	N	Mean	Standard Deviation	Range	Skewness
Total Household Size	116	13.45	11.53	1-56	1.58
Total Acres Cultivated	116	8.19	8.70	0-60	3.03

I hypothesize that the odds of ranking “park related” risks will increase as total household size increases and that the odds of ranking “non-park related” risks will decrease as the total household size increases.

Fig. 3.1. & 3.2. Frequency Distribution of Total Household Size and Log Transformed Distribution.



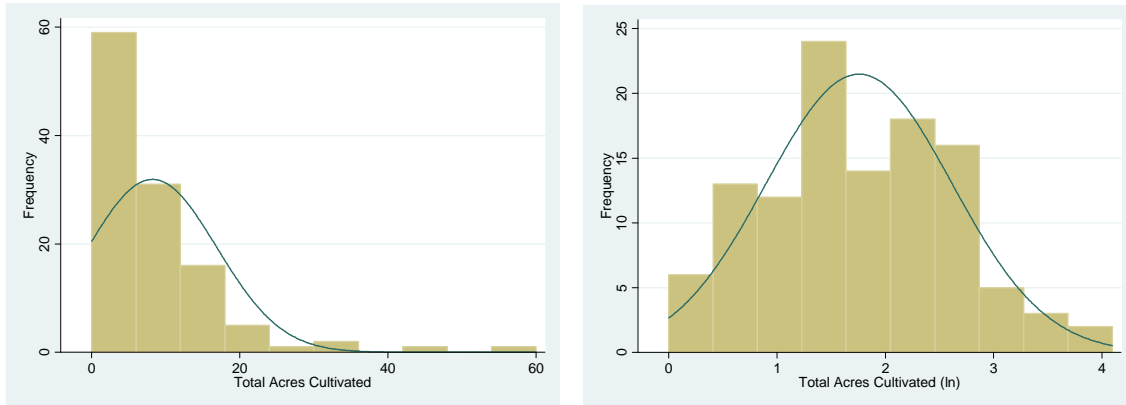
C.2.b.ii. Total Acres Cultivated

This continuous variable was created by summing the number of acres cultivated in the year prior to the survey by the household head and others living in the same household. Summary statistics for this variable are presented in Table 3.3. The natural log of this value was taken to normalize its distribution. Figures 3.3 and 3.4 show the distribution of this variable before and after the natural log was taken respectively.¹⁸ Again, the normal distribution line is represented by the curved line in each figure.

¹⁸ A Shapiro-Wilk test for normality indicates that we cannot reject the hypothesis that the log transformation of Total Acres Cultivated is normally distributed (p=0.84).

I expect that the odds of ranking “park related” risks will increase as total cultivated area increases and that the odds of ranking “non-park” risks will decrease as the total cultivated area increases.

Fig. 3.3 & 3.4: Frequency Distribution of Total Acres Cultivated and Log Transformed Distribution.



C.2.b.iii. Village

The final variable for this analysis is the village of the respondent. This is treated as a dummy variable to preserve degrees of freedom. The village of Terrat has coordinated with Tanzania National Parks (TANAPA) to set some of its land aside specifically for wildebeest to graze. For this reason it appears to be the most conservation friendly of the four villages near the park and is therefore treated as the referent village. Table 3.1 presents the number of respondents from each village.

While village is included in my models primarily as a control variable, I am interested to see its effect on the dependent variables. I expect that the odds of ranking “park related” risks will vary by village due to community specific networks of communication and exchange. I don’t feel that differences between villages will be as

strong for “non-park” related risks due to the longstanding nature of those concerns (human disease, livestock disease, and drought) in this region.

C.2.c. Model Estimation

Logistic regression is used to estimate the odds ratios for two sets of models. In the first set of models, the odds ratios for ranking “park related” risks 1st or 2nd will be estimated for total household size, total acres cultivated, and village. In the second set of models, the odds ratios for ranking “non-park related” risks 1st or 2nd will be estimated for the same independent variables. Given the data limitations, including a small sample size, significance will be determined at the $\alpha = 0.1$ level. These models are represented here in equation form:

$$Y_P = \beta_0 + \beta_1 X + \beta_2 Z + \beta_3 W + \varepsilon$$

$$Y_{NP} = \beta_0 + \beta_1 X + \beta_2 Z + \beta_3 W + \varepsilon$$

Y_P = Respondent ranked park related risk as 1st or 2nd most severe

Y_{NP} = Respondent ranked non-park related risk as 1st or 2nd most severe

X = Total Household Size (ln)

Z = Total Acres Cultivated (ln)

W = Village (Emboret, Loiborsoit, Sukuro, Terrat [referent])

C.3. Descriptive Analysis of Behavioral Responses

To address the questions “What are local mitigation and coping responses and how are they related to risk perception?” (Research Question #3), simple descriptive quantitative data generated from the risk assessment interviews are used to describe how local agro-pastoralists respond to certain park and non-park perceived risks.

CHAPTER 4

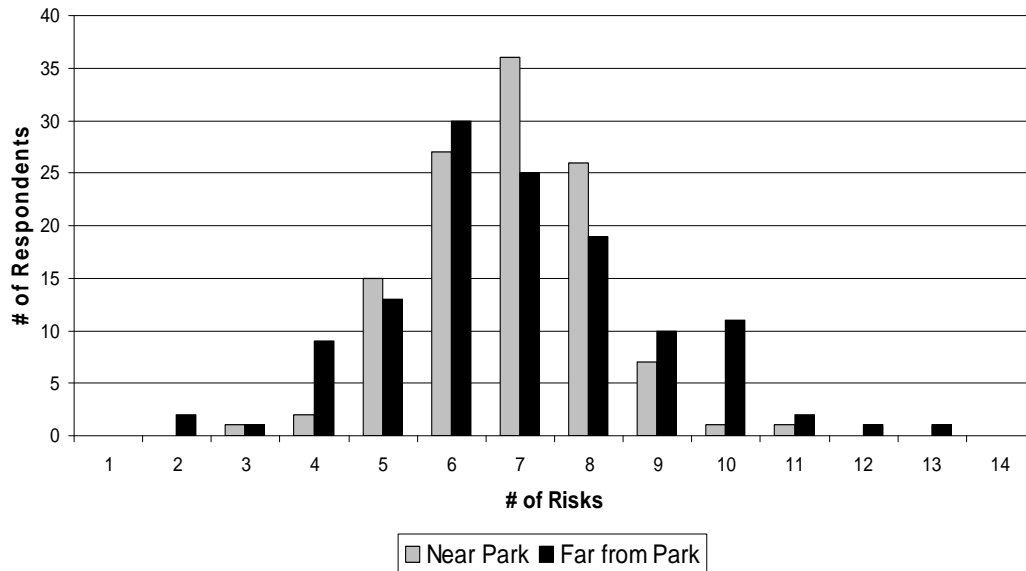
FINDINGS

As discussed earlier, this analysis consists of three parts: (1) participatory risk mapping is utilized to identify and compare local perceptions of risk in villages both near and far from the boundary of Tarangire National Park; (2) logistic regression is used to assess how household assets are related to perception of “park related” risks compared to “non-park related” risks in villages near the park; and (3) simple descriptive analysis is used to examine what actions local land-managers take to respond to their perceptions of risk. The results for each of these parts are presented below without commentary or elaboration. Discussion and interpretation follows in Chapter 5.

A. Participatory Risk Mapping

Using data from the risk assessment interviews, Fig. 4.1 shows the distribution of respondents according to the number of risks that were identified. Respondents are divided into two groups: those living in villages near the park and those living in villages far from the park. This figure shows that respondents in villages near the park tended to identify the same number of risks as respondents from villages far from the park. The means for the two groups are both 6.8 and the standard deviation for the villages far from the park is 2.2 compared to 1.3 for villages near the park.

Fig. 4.1. Distribution of Respondents by Number of Risks Identified in Villages Both Near and Far from the Park.



Figures 4.2 and 4.3 below present the risk maps for the villages near the park and those far from the park respectively. In these diagrams, the x-axis represents the incidence of the perceived risk (i.e., the percentage of respondents that identified that risk) and mean severity is measured on the y-axis (i.e., an index that averages the rank for all the respondents that identified that risk). The maps are each divided in four quadrants to aid viewing. It is important to note that severity increases as it goes up the y-axis and incidence increases as it moves across the x-axis from left to right. Therefore, the upper-right quadrant contains risks that were identified by more than half of the respondents in the sample and the average rank of that risk by the respondents who identified it is also above average on the severity index. Conversely, in the lower-left quadrant are risks that were identified by fewer than half of the respondents and that were generally perceived as below average threats.

Comparison of the risk maps reveals important differences between the two groups of villages. Specifically, the villages near the park boundary identify four high-

incidence risks (right quadrants) that are not identified at all in the villages far from the park. These “new” or additional risks are: *Conservation*, *Wildlife Eating Farm*, *Wildlife Eating Livestock*, and *Wildlife Eating People*. Table 4.1 below provides descriptions of these risks. I make the assumption that these risks are more *directly* related to the presence of the park and the wildlife that the park supports than other risks that were mentioned in both groups of villages. It is important to note as well that there are a few high-incidence risks in the villages far from the park that either are not observed or are observed with much lower incidence and severity in the villages near the park. In addition to the “new” (park related) risks, I am interested in three higher incidence risks that were identified in both groups of villages: human disease, livestock disease, and drought. See table 4.1 for descriptions.

Table 4.1. Description of Important Risks

Risk Variable	Description
Park Risks	
Conservation	Risk that policies related to conservation will limit land use activities outside the park and/or that the park will expand and land-users will suffer land alienation.
Wildlife Eating Farm	Risk that wildlife (zebra, elephants, etc.) will prey on agricultural plots thereby reducing yields.
Wildlife Eating Livestock	Risk that wildlife (lions, leopards, etc.) will prey on livestock thereby reducing herd size.
Wildlife Eating People	Risk that wildlife (lions, buffalo, etc.) will attack humans. Animal attacks have led to injury and death.
Non Park Risks	
Human Disease	Risk that friends, family members or others in the community will fall ill, will require medical attention of some sort, and may die.
Livestock Disease	Risk that livestock will fall ill, will require medical attention of some sort, and may die.
Drought	Risk that drought will reduce the yields of agricultural plots or threaten livestock through decreased grassland productivity.

Fig. 4.2. Risk Map of Villages Near Tarangire National Park (n=116)

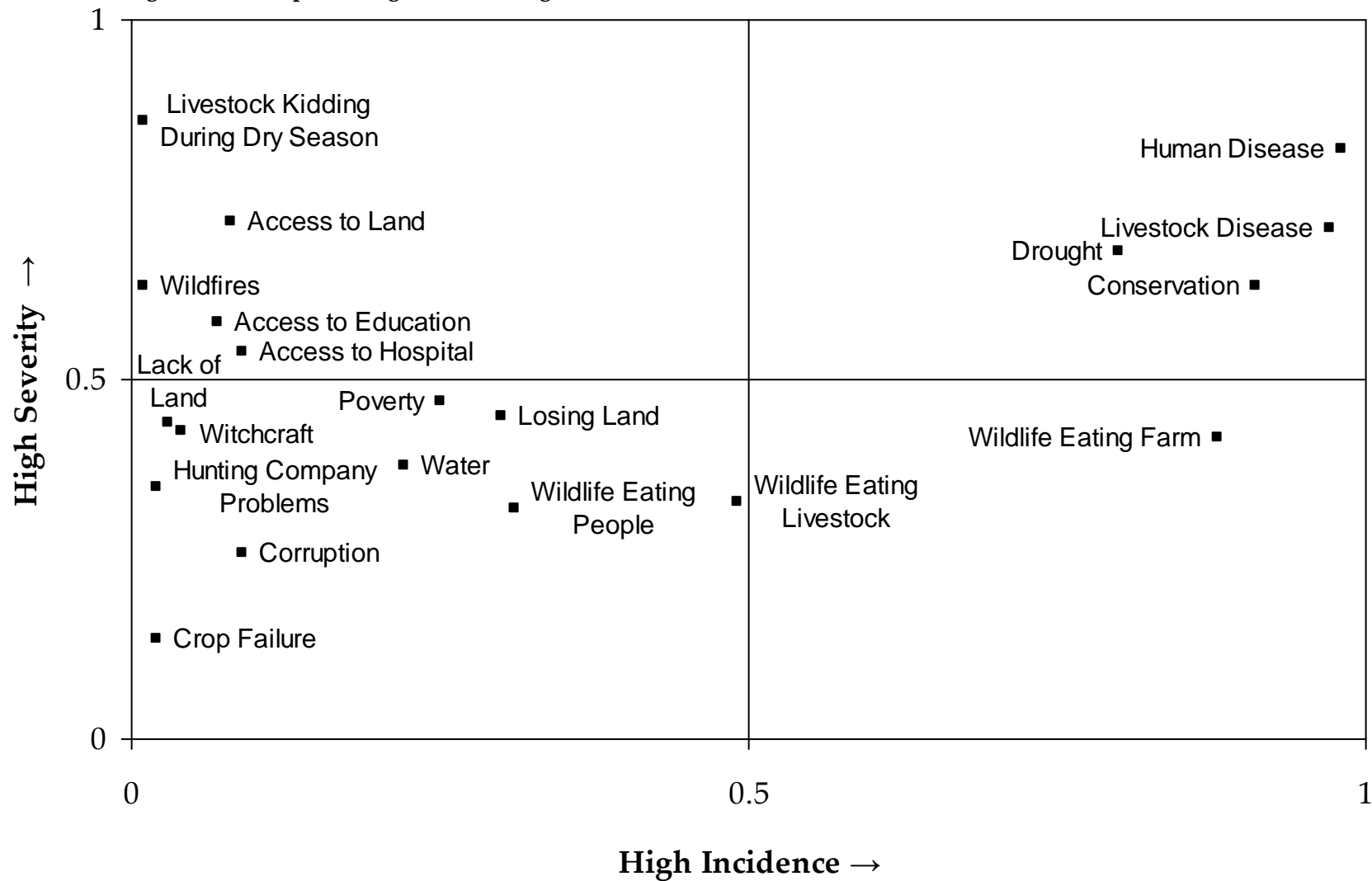
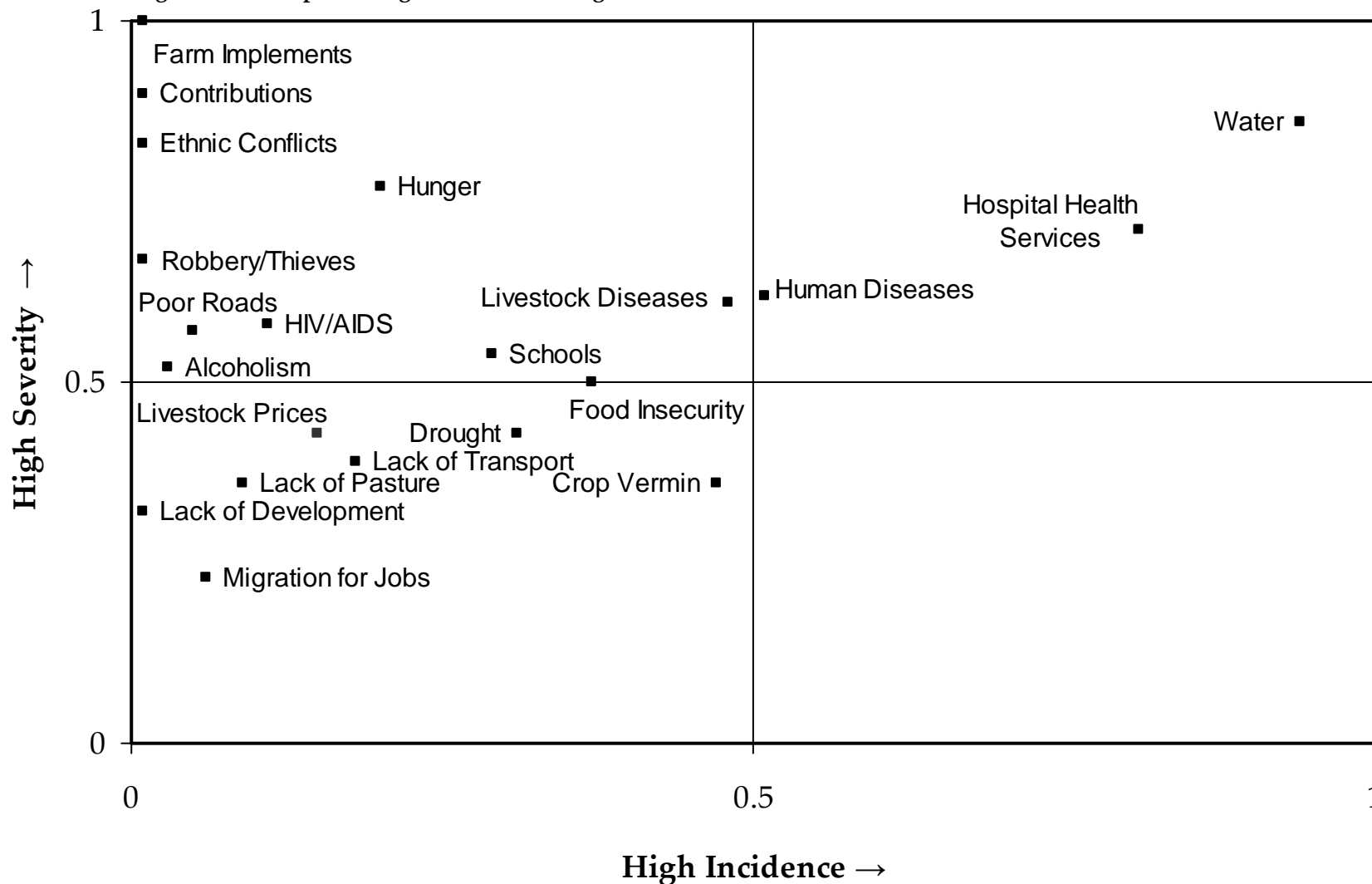


Fig. 4.3. Risk Map of Villages Far From Tarangire National Park (n=124)



While important arguments can be made that villagers' perceptions of each of the risks in Table 4.1 are influenced by the park, for the purpose of analysis we stratify these risks into "park related" and "non-park related" where "park related" risks are those that were only identified by the villages close to the park but not in the villages far from the park¹⁹. Similarly, "non-park related" risks are those that were mentioned by both groups of villages.

B. Logistic Regression Analysis

For the purpose of statistical analysis, I focus only on higher incidence risks (>0.30) in the villages close to the park²⁰. Again, see Table 4.1 for descriptions of the risks that were used to construct dependent variables for this analysis. As noted in section Chapter 3, *C.2.a. Dependent Variables*, two dichotomous dependent variables were created for this analysis. For the first variable, respondents were coded 1 if they ranked any of the "park related" risks from Table 4.1 as their 1st or 2nd most severe risk and 0 if they did not. For the other dependent variable, respondents were coded 1 if they ranked any of the "non-park related" risks from Table 4.1 as their 1st or 2nd most severe risk and 0 if they did not. For a more complete description, please refer back to the methods section.

Table 4.2 below presents results from logistic regression analysis for each of the dependent variables. Neither household size nor acres cultivated have odds ratios that are statistically different from 1 at the $\alpha = 0.1$ level for any of the models for either

¹⁹ To improve clarity on the risk maps, some very low incidence points are deliberately omitted. It is important to stress that in this analysis I am focusing exclusively on high incidence risks (see footnote 12).

²⁰ Unfortunately, I only have data on household assets and demographics for the villages close to the park so a more thorough comparison of these two groups of villages is not possible at this time.

dependent variable. The villages of Emboret and Sukuro, however, are 2.91 and 4.50 times more likely to rank park risks as 1st or 2nd than the referent village when controlling for the household assets variables, respectively. These odds are significant at the 0.1 and 0.05 levels respectively. No significant results are found for any of the predictor variables in the models estimating the odds of ranking “non-park related” risks.

Table 4.2. Logistic Regression Results

	Park Risks Ranked 1 or 2				Non-Park Risks Ranked 1 or 2			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
<u>Household Assets</u>								
Total HH Size (ln)	1.00 (0.226)			0.73 (0.246)	1.18 (0.432)			0.55 (0.279)
Acres Cult. (ln)		1.05 (0.237)		1.08 (0.297)		1.19 (0.433)		1.26 (0.541)
<u>Villages</u>								
Emboret			2.75* (1.516)	2.91* (1.725)			0.37 (0.272)	0.41 (0.324)
Loiborsoit			1.24 (0.713)	1.60 (1.098)			3.11 (3.689)	4.91 (6.410)
Sukuro			2.96* (1.672)	4.50** (3.285)			2.89 (3.429)	6.29 (8.627)
N	116	113	116	113	116	113	116	113
Pseudo r-squared	0.00	0.00	0.04	0.05	0.00	0.00	0.10	0.12

Standard errors in parentheses. * and ** indicate significantly different than 1 at the ten and five percent α levels respectively.

C. Descriptive Analysis of Behavioral Responses

Table 4.3 below presents data from the risk assessment interviews regarding mitigation and coping responses to perceived risk. These data were collected through open ended questions which followed respondents’ ranking of their perceived risks. Responses were not aggressively solicited and therefore do not represent an exhaustive record of respondents’ behavioral responses to all perceived risks. Instead, these data simply represent the behaviors that the respondents were most eager to discuss. Please note that in some cases respondents engage in multiple activities to respond to single

risks. Conversely, singular activities may be effective in mitigating several different risks.

Table 4.3 presents these data largely as they were recorded in the interviews. Responses were identified for four perceived risks: Conservation, Wildlife Eating Farm, Livestock Disease, and Human Disease. These constitute two “park related” risks and two “non-park related” risks. For each risk, responses are stratified by village and divided into responses that either mitigate the threat of the perceived risk or cope with exposure to adverse circumstances. I refer to these as mitigation or coping responses. Conceptually, mitigation responses are responses that are utilized to avoid unfavorable outcomes while coping responses are employed by households *after* they have suffered unfavorable outcomes. For each response, I calculate the proportion of respondents identifying the risk that utilize that specific response. For example, of the 30 respondents in Terrat, 28 of them indicated that livestock disease was a risk that they face. Of those 28, 24 (or roughly 86%) said that they vaccinate their cattle to mitigate their exposure to livestock disease.

While sufficient data are lacking to draw many conclusions regarding behavioral responses to the perceived risks of Wildlife Eating Farm and Human Disease, the threats posed by Conservation and Livestock Disease yield more robust numbers. Perhaps the most conspicuous finding here is that mitigation responses to the perceived threat of conservation vary considerably between groups of villages. In the villages of Terrat and Emboret 53.8% and 73% respectively of the people who identified Conservation as a risk farm as much as possible to mitigate that threat compared to 16.7% and 12% in Sukuro

and Loiborsoit respectively. Alternatively, in Sukuro and Loiborsoit 54.2% and 76% respectively feel that there is nothing they can do to mitigate the threat of conservation.

While most respondents in each village identified livestock disease as an important risk, only in Terrat and Emboret are vaccines commonly used with 86% and 97% vaccination by concerned herders respectively. In Sukuro and Loiborsoit, those numbers drop to 11% and 0% respectively in favor of the coping strategy: treat as needed (81.5% and 81% respectively). These apparent village groups are reconfigured when we look at the use of dipping as a mitigation strategy. “Dipping” refers to the act of bathing livestock in water treated with acaricides to control tick infestation which is a major source of disease transmission. In Loiborsoit and Emboret, 48% and 70% respectively utilize dipping compared to 15% and 11% for Sukuro and Terrat respectively.

It is important to remember that informal interview methods were used to acquire these data. That there were only two mitigation strategies mentioned in Sukuro (27 indicated livestock disease as a threat) for livestock disease representing a sample of 7 does not mean that 20 or more people do not utilize any mitigation strategies. It only means that they were not brought up in the interviews. What these data do reveal, particularly in cases with larger number of interview responses, are broad trends in local priorities and behaviors and how those vary from village to village.

Table 4.3. Mitigation and Coping Response to Perceived Risks by Village

Mitigation/ Coping Strategies for Identified Risks	Sukuro (n=27)			Loiborsoit (n=29)			Terrat (n=30)			Emboeret (n=30)		
	# for Strategy	# for Risk	%	# for Strategy	# for Risk	%	# for Strategy	# for Risk	%	# for Strategy	# for Risk	%
Conservation												
<i>Mitigation</i>												
Don't farm	1	24	4.2%	0	25	0%	0	26	0%	0	30	0%
Farm as much as possible	4	24	16.7%	3	25	12%	14	26	53.8%	22	30	73%
Get land title	1	24	4.2%	0	25	0%	1	26	4%	0	30	0%
Rely on village leaders	1	24	4.2%	2	25	8%	0	26	0%	0	30	0%
Pray	0	24	0.0%	0	25	0%	0	26	0%	1	30	3%
Get sub-lease	4	24	16.7%	1	25	4%	0	26	0%	0	30	0%
Nothing can be done	13	24	54.2%	19	25	76%	0	26	0%	1	30	3%
<i>Coping</i>												
	0	24	0.0%	0	25	0%	0	26	0%	0	30	0%
Wildlife Eating Farm												
<i>Mitigation</i>												
Guard land	1	25	4.0%	0	27	0%	3	20	15%	10	29	34%
Build fence	1	25	4.0%	0	27	0%	6	20	30%	0	29	0%
<i>Coping</i>												
Report Losses to Govt.	0	25	0.0%	0	27	0%	0	20	0%	2	29	7%
Livestock Disease												
<i>Mitigation</i>												
Vaccination	3	27	11.1%	0	27	0%	24	28	86%	29	30	97%
Dipping	4	27	14.8%	13	27	48%	3	28	11%	21	30	70%
Avoid wildebeest	0	27	0.0%	0	27	0%	0	28	0%	1	30	3%
Traditional medicines	0	27	0.0%	0	27	0%	1	28	4%	0	30	0%
<i>Coping</i>												
Treat as needed	22	27	81.5%	22	27	81%	2	28	7%	24	30	80%
Traditional medicines	0	27	0.0%	0	27	0%	1	28	4%	0	30	0%
Human Disease												
<i>Mitigation</i>												
Use condoms	0	27	0.0%	0	29	0%	2	29	7%	0	29	0%
Vaccinate	0	27	0.0%	0	29	0%	1	29	3%	1	29	3%
Pray	0	27	0.0%	0	29	0%	1	29	3%	0	29	0%
Traditional medicines	0	27	0.0%	0	29	0%	2	29	7%	0	29	0%
<i>Coping</i>												
Traditional medicines	0	27	0.0%	0	29	0%	2	29	7%	2	29	7%
Go to clinic	0	27	0.0%	0	29	0%	0	29	0%	9	29	31%

CHAPTER 5

DISCUSSION AND CONCLUSIONS

A. Discussion of Findings

The purpose of this discussion is not to articulate a cohesive analysis of the environmental, economic, and institutional forces that are currently being played out around Tarangire National Park, but to lay the groundwork for further analysis in this area within a framework conceptualized by the land managers' perceptions of their problems. This exercise is well-suited to provide immensely relevant information on the proximate causes of human behavior – the perceptions of those whose behavior we are trying to understand. In this way land use, livelihood diversification, organized resistance, and myriad other forms of human behavior can be understood more richly than simply through ubiquitous top down approaches to research and development.

A.1. Risk Perception and the Conservation Shed

PRM findings indicate that villagers close to the park do not perceive a greater number of risks than villagers far from the park boundary (see Fig. 4.1). My hypothesis (H1) that villagers near the park would identify a greater number of perceived risks than villagers far from the park possibly due to added obstacles imposed by the park must be rejected. While this may simply reflect a general mental threshold in the ordering of perceived risks, another potential interpretation can be drawn from this finding. It may be

that while the park imposes some new risks, it also serves to alleviate some. For example, lack of transport is identified as a risk by roughly a quarter of the respondents in the distant villages but it is not mentioned in the villages close to the park. In this particular case, it may be that the park has contributed to the development of local infrastructure in nearby villages or at least more traffic making it easier to get a ride.

While villagers close to the park are not differentiated from distant villagers according to the number of risks they identify, differences certainly exist in the types of risks that each group is concerned with. In villages near the park, several risks are identified that are not identified in distant villages: conservation, wildlife eating farm²¹, wildlife eating livestock and wildlife eating people. As noted earlier, these “new” or different risks appear to be directly related to the park. These findings support my hypothesis (H2) that villagers close to the park will perceive different risks than distant villagers and that these “new” risks will be park related.

PRM results also support the hypothesis that villagers close to the park and distant villagers perceive some similar risks, but with different incidence and severity (H3). “Hospital/health services” and access to “water” have much higher values for incidence in villages far from the park than in villages close to the park. Conversely, “human disease,” “livestock disease” and “drought” have considerably higher incidence and severity values in villages near the park than distant villages. This may suggest that opportunities and constraints introduced by the park impact the universality and relative severity of longstanding concerns – exacerbating them in some cases through alienation

²¹ Almost half of the respondents in villages far from the park identified crop vermin as a risk. It is unclear, however, how similar “crop vermin” is to the risk of “wildlife eating farm” identified by villagers near the park. Here, I make the assumption that vermin are smaller, insect and rodent type pests whereas problems of wildlife disrupting agricultural fields are associated with larger order mammals like wildebeest, zebra, and elephant as well as meso-fauna such as porcupines, baboons, etc.

of natural resources and mitigating them through park sponsored development projects like bore holes for accessing water (Cooke 2007) or improvement of local transportation infrastructure.

The accumulation of these findings suggests the presence of an apparent *conservation shed* wherein human perception is directly impacted by the park. Outside of this area, respondents do not identify risks that are directly related to the park. Also, the importance of traditional concerns in villages close to the park (livestock disease, drought, etc.) varies considerably from perception of those risks further from the park boundary. As an example, the high incidence and severity of drought in park-side villages compared to distant villages suggests that traditional strategies to mitigate the threat of rainfall variability have been impacted negatively by the presence of the park²². The concept of the conservation shed represents the spatial extent of the impact of the park on local perceptions of risk. While the precise boundaries of this area of impact are not readily apparent here, this analysis does suggest that it exists somewhere between the two groups of villages. Alternatively, gradients of impact may exist wherein perceptions of “park related” risks are not categorically present or absent but vary in incidence and severity as distance to the park border varies. Equally, the effect of the park on “non-park” related risks at various distances from the park should be examined further.

²² While the villages far from the park have a similar long-term climate and rainfall regime to the villages near the park, I have not controlled for recent climatic differences between the two villages in this analysis. Another potential confounding factor that I do not control for is the idea that one’s perception of the threat of drought may vary considerably depending on one’s livelihood. In this area, a livelihood characterized by rain-fed agriculture, for instance, is typically more vulnerable to drought than one characterized by livestock production. Comprehensive data on livelihood activities, however, has not yet been collected in the villages far from the park.

A.2. Household Assets and Risk Perception

A.2.a. Significant Outcomes

My hypothesis that “park related” risks will vary by village cannot be rejected based on this analysis. We found that Emboret and Sukuro have significantly greater odds of ranking “park related” risks 1st or 2nd compared to the referent village, Terrat. Loiborsoit, however, was not found to be statistically different from Terrat for this dependent variable. These results are consistent whether or not we control for household size and total acres cultivated, although the odds ratios for the villages do increase when we include the household asset variables. Conversely, none of the villages had odds of ranking “non-park” related risks that differed significantly from Terrat. While this may simply be a function of a small sample, these results are consistent with the expectation that differences between villages will not be as strong for “non-park” related risks due to the longstanding nature of those concerns in this region.

Cumulatively, these results suggest that the relationship between villages and “park related” risks is different than the relationship between villages and “non-park related” risks. In other words, the perceived risks associated with the park are greater in some villages than in others. This pattern is not borne out for the distribution of perceived risks not directly associated with the park. Arguably, park risks are not only different than non-park risks, they also function differently – mapping to some groups but not others. This may be due to wildlife migration corridors, networks of communication, or community activism. Ultimately, these results suggest that further analysis is required to understand better the nature of these villages and their interaction with the park.

A.2.b. Non-Significant Outcomes

Based on the regression results presented in table 4.2, I must reject hypotheses 4 and 5 that acres cultivated and household size are correlated with “park related” risks differently than they are with “non-park related” risks respectively. While the small sample may have obscured significant relationships for the household assets variable, the non-significant results for each of our estimated models may suggest the idiosyncratic nature of perception. It may be that for some respondents wealth does not act as a buffer against perceived risk, as we would expect, but instead causes the respondent to guard more closely their assets and perceive risks more intensely. Alternatively, respondents may relax their perceptions of risk if they are sufficiently buffered by wealth. Ultimately, these contrasting motivations may make estimating the proximate modifiers of perception difficult. It is worth noting here that several variations of the independent variables were used in these models including measures of livestock, livestock per capita, and total acres cultivated per capita. In each case the results were not significant.

A.3. Mitigation and Coping Responses

Findings from the behavioral response interviews presented in Table 4.3 provide some support for the hypothesis that mitigation and coping responses for park and non-park risks vary between households and villages (H7). Respondents in the four villages identified 7 mitigation responses to the perceived risk of conservation and 6 mitigation and coping responses for dealing with livestock disease. Specific responses or strategies

are clustered in certain villages and not in others. This suggests a certain measure of response diversity which exists at household as well as the village level.

Data show that families in the villages of Terrat and Emboret who indicated that they respond to the threat of conservation (or future land alienation) by “farming as much as possible” may be cultivating land for reasons beyond their own subsistence needs, labor endowments, and/or economic capabilities. It provides some empirical evidence for the idea that land conversion to agriculture in this area appears to be driven by concerns among the land-users in these villages that expansion of the park boundaries, the establishment of a wildlife management area, and/or the extension of further land-use restrictions are inevitable (see Sachedina 2006). The Maasai here are acutely aware of evictions that have taken place in other areas of northern Tanzania, most notably Serengeti and Mkomazi National Parks (Igoe 1999; Sachedina 2006), and are fearful that just compensation from the government for their present land-holdings will only be awarded for “improved lands” not for grazing lands as was the case in those parks. These perceived risks of eviction and compensation have prompted the Maasai to enlist the resources (i.e., tractors) of wealthy farmers from outside the region to till increasingly large plots in the areas surrounding the park – a sort of *pre-emptive farming* and/or *pre-emptive sharecropping*. Unable to provide monetary payment for the use of outside tractors, many Maasai have arranged to provide compensation in the form of land-use privileges. In this way, a larger area of land will be tilled than is required by the landholder, with rights to farm the remaining tilled land going to the tractor owner for a pre-determined period of time. The result is that the Maasai retain rights to a larger area of tilled, or “improved”, land than they would otherwise. The Maasai tend to regard this as

“branding” their land as they would with their livestock. As noted earlier, this practice has driven the rapid expansion of agriculture in this area, threatening critical wildlife migration corridors between TNP and the Simanjiro Plains and affecting the viability of many species.

What is especially curious here is that respondents in the villages of Sukuro and Loiborsoit did not indicate that *pre-emptive farming* is a tactic that they employ to mitigate the threat of land alienation. Most responded that there is nothing that can be done. Perhaps this reflects barriers to communication or tenuous relationships between villages that undermine the adoption of neighboring behaviors. Alternatively, it may simply suggest differences in: local feelings of empowerment; access to land, labor or tractors; temperament of influential persons or village leaders; or willingness to divulge certain information to interviewers.

While Table 4.3 does indicate that a greater number of responses were indicated for the perceived risk of conservation than for livestock disease, it is my impression that sufficient data does not exist to comment on the hypothesis that a greater number of mitigation and coping strategies are identified for “park related” risks compared to “non-park related” risks (H8). The intuition behind this final hypothesis was that a certain limited number of best practices would have evolved for longstanding risks (i.e., livestock disease, drought, etc.) and that the imposition of relatively new risks would yield a greater variety of responses for a period of time while the efficacy of those responses was being evaluated. Here, I make the assumption that newer risks do not affect strategic responses to older risks. In other words, it is possible that the threat of conservation, which requires its own behavioral responses, may impact the type and

number of behaviors employed to mitigate or cope with the perceived risk of livestock disease or other “non-park” risks.

A.4. Data & Methodological Limitations

Due to the subjective and variable quality of human perception, quantification and ordinal ranking of discrete perceived risks can only provide crude approximation of the risk perception landscape in any area. This is an unavoidable limitation of the PRM method. Risk mapping, however, is useful in identifying major concerns and broad trends and perhaps more importantly, drawing attention to perception as a proximate cause of human behavior.

Statistical analyses here are limited by the small sample size. This has the effect of inflating the standard errors and making statistical significance harder to achieve. Moreover, these data were generated through opportunistic sampling and therefore conclusions drawn from this analysis are only representative at the level of the sample itself. Simple random sampling would be preferable, but the nature of the field site and the lack of accurate census data from which to construct a sampling frame present considerable barriers to this type of sampling. Also, continuous dependent variables may also provide more robust results, but constructing indices of severity values for different groups of risks (park vs. non-park) seems to be a substantially more contrived measure of risk perception. Future analysis may be able to accommodate this type of methodology through the use of ordered probit models and/or doubly-censored estimation models (Smith et al. 2001). These methods are not utilized here because they require further

manipulation of the data which introduces an added level of abstraction that was not valuable to address these research questions.

Unfortunately, behavioral response data do not contain mitigation and coping responses for each risk identified and are largely anecdotal. Fortunately, most respondents did describe responses to the risks associated with conservation and livestock.

B. Conclusion

B.1. Summary of Findings

The purpose of this thesis was to gain a more nuanced understanding of the growing conflict between wildlife conservation objectives and indigenous livelihood practices that exists in Tanzania and throughout the developing world. To address this issue, I conducted a case study of household concerns and behaviors in a region bordering Tarangire National Park in northern Tanzania. Specifically, this thesis examined the effect that TNP has on local perceptions of risk among Maasai agro-pastoralists living near the park border, how perceptions relate to socio-economic factors and ultimately how they influence risk-mitigation and coping responses. Analysis of this relationship was guided by three broad research questions presented in Chapter 1:

- How does proximity to Tarangire National Park impact local perceptions of risk in Simanjiro and Kiteto districts in northern Tanzania?
- Within villages close to the park, what influence do household and village factors have on perceptions of ‘park’ risks compared to ‘non-park’ risks?

- Within villages close to the park, how are behavioral responses related to risk perception at the village level and in what ways do these behaviors articulate with conservation goals and regional development?

This study conceptualizes human behavior as a product of both the objective factors that the household is exposed to *as well as* the subjective perceptions of how those factors influence household behavior. I view perception of risk as an important mediating factor in the relationship between human behavior and the contextual environment in which human decisions are made. This is an important addition to many traditional approaches to studying social-ecological systems which promises to contribute important theoretical insights to a growing body of research in the area of human perception.

Results indicate that villagers living near the park appear to face different risks than villagers further from the park as well as equivalent risks at varying intensity²³. This suggests the presence of a certain “conservation shed” wherein the park has a direct influence on perceptions of risk and consequently land-use strategies to mitigate or cope with risk. The conservation shed does not appear to reach the outlying villages but does extend to villages that do not share a border with the park and that may be as much as 60km from the park.

Within the conservation shed, household wealth in the forms of acres cultivated and household size do not appear to influence the incidence or severity of “park” or “non-park” related risks. However, certain villages near the park are more likely to rank “park

²³ It is important to note here that this study conceptualizes proximity in a strictly Euclidean sense. I recognize that this approach obscures other important types of proximity which are non-spatial and may include types of economic or social proximity. For this empirical study, my conceptualization of proximity is limited by the data. Future studies of this type, however, would benefit from a broader conceptualization of proximity.

related” concerns as the #1 or #2 risks that they face than other park-side villages. This pattern cannot be shown with statistical significance for “non-park” related risks.

Essentially, villages differ in their perception of the severity of “park related” risks while they do not differ for “non-park” related risks. This suggests that the effects of the park vary significantly by village but not by household attributes. Non-significant results for the household asset variables are consistent with prior studies in Kenya discussed in the literature review (Gadd 2005; McClanahan et al. 2005) which have found that wealth is not a suitable predictor for attitudes regarding natural resources and conservation.

Lastly, behavioral responses to perceived risks within the conservation shed also seem to vary among villages. In some villages, respondents have adopted a strategy of pre-emptive farming to mitigate the threat of future park expansion and land alienation. This approach may prove to have profoundly negative consequences for the flora and fauna that depend on open savanna grasslands, especially large migratory mammals. The economic sustainability of this agricultural strategy also remains to be seen as rainfall, labor availability and market prices fluctuate. Conversely, other villages seem to believe they are disempowered and unable to mitigate the threat of park expansion. In half of the villages a large majority of respondents indicated that there was nothing they could do to alleviate this threat.

B.2. Future Directions and Final Thoughts

Building on this study, future analyses which would be of great benefit in this area would be an examination of the relationship between risk assessment and social networks of exchange and reciprocity. Wealth, among the Maasai, may best be described

in terms of those resources which allow one to persist into the future. These resources may take the form of large families, livestock, farmland, material possessions, etc. However, a mainstay of the Maasai social system is a type of moral economy (see Thompson 1971; Neumann 1998; Robbins 2004) whereby family, friends and community members provide necessary goods (food, shelter, livestock, etc.) when individuals or families are struck by adverse circumstances. An individual's social network, therefore, provides an effective buffer against many types of risk. Understanding the relationship between these networks and perceived risks is necessary.

Conceptualizing risks as discrete entities is problematic and demands reconsideration. Alternative approaches to conceptualizing risk are necessary for this type of analysis to move forward. One such approach would be to understand how risks operate together, form groups of risks, and ultimately how certain groups relate to other groups. Other considerations can be identified in the arena of objective risk research. As noted earlier, a handful of studies have compared objective measures of risk exposure with perceptions of risk and found that they are not often highly correlated. New research may investigate the how perception of risk in the past shapes objective risk in the future and *vice versa*.

Finally, the concept of the conservation shed should be developed further to understand the continuum of social and ecological impacts, both direct and indirect, that exist in the lands adjacent to parks. Proximity to the park can and should be included in analyses through continuous measures of Euclidean and transport network distances. Proximity, however, cannot be limited to these types of data but should include operational measures of social, cultural, economic, and political proximity as well.

Parks are neither self-contained ecosystems nor pristine natural areas devoid of social and economic implications. They are hybrid social-environmental spaces constructed and reconstructed cyclically through social, economic, political, and ecological processes. The protection of wildlife, ecosystems, and ecosystem services throughout East Africa and the whole of the developing world are important, necessary, and critical. Equally critical, and in fact intimately intertwined with the fate of ecosystems in these regions, are spaces for empowered local management of natural resources and autonomy to pursue cultural and material reproduction. The future of these spaces is unknown, for in the present we are only just scratching the surface of how they work, how they change and perhaps more importantly, what they mean.

REFERENCES

- Adams, J. S. and T. O. McShane (1992). The Myth of Wild Africa. Berkeley, University of California Press.
- Adams, W. M., J. Elliott, et al. (2004). "Biodiversity conservation and the eradication of poverty." Science **306**(5699): 1146-1149.
- Agrawal, A. (1995). "Dismantling the Divide Between Indigenous and Scientific Knowledge." Development and Change **26**: 413-439.
- Agrawal, A. and C. C. Gibson (1999). "Enchantment and Disenchantment: The Role of Community in Natural Resource Conservation." World Development **27**(4): 629-649.
- Alcorn, J. B. (1993). "Indigenous People and Conservation." Conservation Biology **7**(2): 424-426.
- Alvard, M. S. (1993). "Testing the "Ecologically Noble Savage" Hypothesis: Interspecific Prey Choice by Piro Hunters of Amazonian Peru." Human Ecology **21**(4): 355-387.
- Alvard, M. S. (1995). "Intraspecific prey choice by prey choice by Amazonia hunters." Current Anthropology **36**: 789-818.
- Anderson, D. (1988). Cultivating Pastoralists: Ecology and Economy of the Chamus II of Baringo, 1840-1980. The Ecology of Survival. D. Johnson and D. M. Anderson. Boulder, Westview Press.
- Armas, I. (2006). "Earthquake Risk Perception in Bucharest, Romania." Risk Analysis **26**(5): 1223-1234.
- Barrow, E., H. Gichohi, et al. (2001). The evolution of community conservation policy and practice in East Africa. African Wildlife and Livelihoods: the promise and performance of community conservation. D. Hulme and M. Murphree. Oxford, James Currey: 59-73.
- Barrows, H. H. (1923). "Geography as Human Ecology." Annals of the Association of American Geographers **13**(1): 1-14.
- Barth, F. (1969). Ecological Relationships of Ethnic Groups in Swat, North Pakistan. Environment and Cultural Behavior. A. P. Vayda. New York, The Natural History Press: 362-376.
- Behnke, R. H., I. Scoones, et al., Eds. (1993). Range Ecology at Disequilibrium: New Models of natural Variability and d Pastoral Adaptation in African Savannas. London, Overseas Development Institute.

- Berkes, F. (2004). "Rethinking Community-Based Conservation." Conservation Biology **18**(3): 621-630.
- Blaikie, P. and H. Brookfield (1987). Defining and Debating the Problem. Land Degradation and Society. P. Blaikie and H. Brookfield. New York, Methuen: 1-26.
- Blaikie, P. and H. Brookfield, Eds. (1987). Land Degradation and Society. New York, Methuen.
- Borner, M. (1985). "The Increasing Isolation of Tarangire National Park." Oryx **19**(2): 91-96.
- Brandon, K. (1998). Perils to Parks: The Social Context of Threats. Parks in Peril: People, Politics, and Protected Areas. K. Brandon, K. Redford and S. Sanderson. Washington D.C., Island Press: 415-439.
- Brechin, S. R., P. R. Wilshusen, et al. (2002). "Beyond the Square Wheel: Toward a More Comprehensive Understanding of Biodiversity Conservation as Social and Political Process." Society and Natural Resources **15**: 41-64.
- Brockington, D. (1999). "Conservation, Displacement and Livelihoods. The Consequences of the Eviction for Pastoralists Moved from the Mkomazi Game Reserve, Tanzania." Nomadic Peoples **3**(2): 74-96.
- Brockington, D. (2000). "Pastoralism on the Margins: The decline and dispersal of herding on the Uмба Nyika from 1800 to 1919." Azania **XXXV**: 1-19.
- Brockington, D. (2002). Fortress Conservation: The Preservation of the Mkomazi Game Reserve, Tanzania. Bloomington, IN, Indiana University Press.
- Brockington, D. (2004). "Community Conservation, Inequality and Injustice: Myths of Power in Protected Area Management." Conservation & Society **2**(2): 411-432.
- Brookfield, H. (1969). "On the environment as perceived." Progress in Geography **1**: 51-80.
- Cernea, M. M. and K. Schmidt-Soltau (2006). "Poverty Risks and National Parks: Policy Issues in Conservation and Resettlement." World Development **34**(10): 1808-1830.
- Chambers, R. (1994a). "The Origins and Practice of Participatory Rural Appraisal." World Development **22**(7): 953-969.
- Chambers, R. (1994b). "Participatory Rural Appraisal (PRA): Analysis of Experience." World Development **22**(9): 1253-1268.
- Chambers, R. (1994c). "Participatory Rural Appraisal (PRA): Challenges, Potentials and Paradigm." World Development **22**(10): 1437-1454.

- Cinner, J. E. and R. B. Pollnac (2004). "Poverty, perceptions and planning: why socioeconomics matter in the management of Mexican reefs." Ocean & Coastal Management **47**(9-10): 479-493.
- Coe, M., N. McWilliam, et al., Eds. (1999). Mkomazi: The Ecology, Biodiversity and Conservation of a Tanzanian Savanna. London, Royal Geographical Society (with the Institute of British Geographers).
- Colchester, M. (1998b). "Who will garrison the fortresses? A reply to Spinage." Oryx **32**(3): 11-13.
- Colchester, M. (2000). "Self-Determination or Environmental Determinism for Indigenous Peoples in Tropical Forest Conservation." Conservation Biology **14**(5): 1365-1367.
- Colchester, M. (2004). "Conservation policy and indigenous peoples." Environmental Science & Policy **7**: 145-153.
- Cooke, A. E. (2007). Subdividing the Savanna: the ecology of change in Northern Tanzania. Dept. of Ecology. Chapel Hill, University of North Carolina. **PhD Dissertation**.
- Coughenour, M. B., J. E. Ellis, et al. (1985). "Energy Extraction and Use in a Nomadic Pastoral Ecosystem." Science **230**(4726): 619-625.
- Dasmann, R. (1988). National Parks, Nature Conservation, and "Future Primitive". Tribal Peoples and Development Issues: A Global Overview. J. H. Bodley. Mountain View, CA, Mayfield Publishing Company: 301-310.
- Deschler, W. W. (1965). Native cattle keeping in eastern Africa. Man, culture, and animals: The role of animals in human ecological adjustment. A. Leeds and A. Vayda. Washington D.C., American Association for the Advancement of Science. **Publication 78**.
- Dove, M. (2000). The Life-Cycle of Indigenous Knowledge, and the Case of Natural Rubber Production. Indigenous Environmental Knowledge and its Transformations: Critical Anthropological Perspectives. R. Ellen, P. Parkes and A. Bicker. London, Gordon & Breach Publishing Group: 213-251.
- Dove, M. (2006). "Indigenous Peoples and Environmental Politics." Annual Review of Anthropology **35**(1): 191-208.
- Ellen, R. and H. Harris (2000). Introduction. Indigenous Environmental Knowledge and its Transformations. R. Ellen, P. Parkes and A. Bicker. London, Gordon & Breach Publishing Group: 1 - 34.

- Ellis, J. E. and D. M. Swift (1988). "Stability of African Pastoral Ecosystems: Alternate Paradigms and Implications for Development." Journal of Range Management **41**(6): 450-459.
- Emerton, L. (2001). The nature of benefits and the benefits of nature. Why wildlife conservation has not economically benefited communities in Africa. African Wildlife and Livestock: The promise and Performance of Community Conservation. D. Hulme and M. Murphree. Portsmouth, NH, Heinemann: 208-226.
- Fazey, I., J. A. Fazey, et al. (2006). "The nature and role of experiential knowledge for environmental conservation." Environmental Conservation **33**(1): 1-10.
- Fiedler, P. L., P. S. White, et al. (1997). The Paradigm Shift in Ecology and Its Implications for Conservation. The Ecological Basis of Conservation. S. T. A. Pickett, R. S. Ostfeld, M. Shachak and G. E. Likens. New York, Chapman & Hall: 83-92.
- Foley, C. (2006). Tarangire Elephant Project. New York, Wildlife Conservation Society.
- Foucault, M. (1982). Afterword: The subject and power. Michel Foucault, Beyond structuralism and hermeneutics. H. Dreyfus and P. Rabinow. Chicago, University of Chicago Press.
- Fratkin, E. and J. T. McCabe (1999). "East African Pastoralism at the Crossroads: An Introduction." Nomadic Peoples **3**(2): 5-15.
- Gadd, M. (2005). "Conservation outside parks: attitudes of local people in Laikipia, Kenya." Environmental Conservation **32**(1): 50-63.
- Galaty, J. G. (1994). "Ha(1)ving land in common: the subdivision of Maasai group ranches in Kenya." Nomadic Peoples **34/35**: 109-122.
- Geisler, C. (2003). Your park, my poverty. Using impact analysis to counter displacement effects of environmental greenlining. Contested Nature: Promoting International Biodiversity with Social Justice in the Twenty-First Century. S. R. Brechin, P. R. Wilshusen, C. L. Fortwangler and P. West. Albany, State University N.Y. Press: 217-229.
- Ghimire, K. B. and M. P. Pimbert (1997). Social change and conservation: An overview of issues and concepts. Social Change and Conservation: Environmental Politics and Impacts of National Parks and Protected Areas. K. B. Ghimire and M. P. Pimbert. London, Earthscan.
- Grove, R. H. (1992). Origins of Western Environmentalism. Scientific American. **267**: 42-47.
- Gunderson, L. H. and C. S. Holling (2002). Panarchy: Understanding Transformations in Human and Natural Systems. Washington, Island Press.

- Hackel, J. (1999). "Community Conservation and the Future of Africa's Wildlife." Conservation Biology **13**(4): 726-734.
- Haenn, N. (1999). "The Power of Environmental Knowledge: Ethnoecology and Environmental Conflicts in Mexican Conservation." Human Ecology **27**(3): 477- 491.
- Hames, R. B. (1987). Game conservation or efficient hunting? The Question of the Commons: The Culture and Ecology of Communal Resources. B. J. McCay and J. M. Acheson. Tucson, University of Arizona Press: 92-107.
- Heald, S. (1999). "Agricultural intensification and the decline of pastoralism: Kenya." Africa **69**(2): 213-237.
- Herskovits, M. (1926). "The cattle complex in East Africa." American Anthropologist **28**: 230-272.
- Hogg, R. (1992). "Should Pastoralism Continue as a Way of Life." Disasters **16**: 131-136.
- Homewood, K., E. F. Lambin, et al. (2001). "Long-term changes in Serengeti-Mara wildebeest and land cover: Pastoralism, population, or policies?" Proceedings - National Academy of Sciences USA **98**(22): 12544-12549.
- Homewood, K. M. and W. A. Rodgers (1991). Maasailand ecology: pastoralist development and wildlife conservation in Ngorongoro, Tanzania. Cambridge, Cambridge University Press.
- Hunter, M., Jr. (1996). "Benchmarks for Managing Ecosystems: Are Human Activities Natural?" Conservation Biology **10**(3): 695-697.
- Igoe, J. (1999). Roadblocks to Community Conservation in Tanzania: A Case Study from Simanjiro District. W.P. No 218. Boston, African Studies Center, Boston University.
- Igoe, J. (2002). National Parks and Human Ecosystems: The Challenge to Community Conservation. A Case Study from Simanjiro Tanzania. Conservation and Mobile Indigenous Peoples. D. Chatty and M. Colchester. New York, Berghahn Books: 77-96.
- Igoe, J. and D. Brockington (1997). Community Conservation, Development and Control of Natural Resources: A Case Study from Northeast Tanzania, IEED.
- Kahurananga, J. (1979). "The vegetation of the Simanjiro Plains, Northern Tanzania." African Journal of Ecology **19**: 225-238.
- Kahurananga, J. (1981). "Population Estimates, Densities and Biomass of Large Herbivores in Simanjiro Plains, Northern Tanzania." African Journal of Ecology **19**: 225-238.

- Kahurananga, J. and F. Silkiluwasha (1997). "The migration of zebra and wildebeest between Tarangire National Park and Simanjiro Plains, northern Tanzania, in 1972 and recent trends." African Journal of Ecology **35**(3): 179-185.
- Kalland, A. (2000). Indigenous Knowledge: Prospects and Limitations. Indigenous Environmental Knowledge and its Transformations. R. Ellen, P. Parkes and A. Bicker. London, Routledge: 319-336.
- Lamprey, H. (1963). "Ecological separation of the large species in the Tarangire Game Reserve, Tanganyika." East African Wildlife Journal **1**: 67-92.
- Lamprey, H. (1964). "Estimation of the Large Mammal Densities, Biomass, and Energy Exchange in the Tarangire Game Reserve and the Maasai Steppe in Tanzania." East African Wildlife Journal(1): 63-92.
- Li, T. M. (2002). "Engaging Simplifications: Community-Based Resource Management, Market Processes and State Agendas in Upland Southeast Asia." World Development **30**(2): 265-283.
- Little, M. and R. Dyson-Hudson (1999). Framework and Theory. Turkana Herders of the Dry Savanna: Ecology and biobehavioral response to an uncertain environment. M. Little and P. Leslie. Oxford, Oxford University Press: 3-23.
- Little, P. D., K. Smith, et al. (2001). "Avoiding disaster: Diversification and risk management among East African herders." Development and Change **32**(3): 401-433.
- Locke, H. and P. Dearden (2005). "Rethinking protected area categories and the new paradigm." Environmental Conservation **32**(1): 1-10.
- Madulu, N. F. and H. Kiwasila (2005). Causes and Consequences of Changing Land Use and Livelihood Diversification in Northern Tanzania, Institute of Resource Assessment, University of Dar es Salaam.
- McCabe, J. T. (1992). "Can Conservation and Development be Coupled Among Pastoral People? An Examination of the Maasai of the Ngorongoro Conservation Area, Tanzania." Human Organization **51**(4): 353-366.
- McCabe, J. T. (2003a). "Disequilibrium ecosystems and livelihood diversification among the Maasai of Northern Tanzania: implications for conservation policy in Eastern Africa." Nomadic Peoples **7**(1): 74-92.
- McCabe, J. T. (2003b). "Sustainability and livelihood diversification among the Maasai of Northern Tanzania." Human Organization **62**(2): 100-111.
- McCabe, J. T. (2004). Cattle Bring Us to Our Enemies: Turkana Ecology, Politics, and Raiding in a Disequilibrium System. Ann Arbor, The University of Michigan Press.

- McCabe, J. T. and P. W. Leslie (2004). *Alternative Consequences of Migration for Land Use and Conservation in Northern Tanzania*, Proposal to The John D. and Catherine T. MacArthur Foundation.
- McCabe, J. T., N. Mollel, et al. (1997). *Food Insecurity and the Role of Cultivation. Multiple Land-Use: The Experience of the Ngorongoro Conservation Area, Tanzania*. M. Thompson. Gland Switzerland, IUCN: 397-416.
- McClanahan, T., J. Davies, et al. (2005). "Factors influencing resource users and managers' perceptions towards marine protected area management in Kenya." *Environmental Conservation* **32**(1): 42-49.
- McPeak, J. G. and C. B. Barrett (2001). "Differential Risk Exposure and Stochastic Poverty Traps Among East African Pastoralists." *American Journal of Agricultural Economics* **83**(3): 674-679.
- Naughton-Treves, L. (1998). "Predicting Patterns of Crop Damage by Wildlife around Kibale National Park, Uganda." *Conservation Biology* **12**(1): 156-168.
- Naughton-Treves, L., M. B. Holland, et al. (2005a). "The Role of Protecting Areas in Conserving Biodiversity and Sustaining Local Livelihoods." *Annu. Rev. Environ. Resour.* **30**: 219-252.
- Naughton-Treves, L. and A. Treves (2005b). *Socio-ecological factors shaping local support for wildlife: crop-raiding by elephants and other wildlife in Africa. People and Wildlife: Conflict or Coexistence*. R. Woodroffe, S. Thirgood and A. Rabinowitz. Cambridge, Cambridge University Press: 252-277.
- Neumann, R. (1997). "Primitive Ideas: protected are buffer zones and the politics of land in Africa." *Development and Change* **28**: 579-82.
- Neumann, R., P. (1998). *Imposing Wilderness: Struggles Over Livelihood and Nature Preservation in Africa*. Berkeley, University of California Press.
- Newmark, W. D. and J. L. Hough (2000). "Conserving Wildlife in Africa: Integrated Conservation and Development Projects and Beyond." *BioScience* **50**(7): 585-592.
- Newmark, W. D., N. L. Leonard, et al. (1993). "Conservation attitudes of local people living adjacent to five protected areas in Tanzania." *Biological Conservation* **63**(2): 177-183.
- Nietschmann, B. (1973). *Between Land and Water: The Subsistence Ecology of the Miskito Indians, Eastern Nicaragua*. New York, Seminar Press.
- O'Brien, M. J., D. P. Braun, et al. (1987). "Sedentism, Population Growth, and Resource Selection in the Woodland Midwest: A Review of Coevolutionary Developments." *Current Anthropology* **28**(2): 177-197.

- Oates, J. F. (1995). "The dangers of conservation by rural development: A case study from the forests of Nigeria." Oryx **29**: 115-122.
- Olson, D. and Dinerstein (1998). "The Global 200: A Representation Approach to Conserving the Earth's Most Biologically Valuable Ecoregions." Conservation Biology **12**(3).
- Olson, D., E. Dinerstein, et al. (2001). "Terrestrial Ecoregions of the World: A New Map of Life on Earth." BioScience **51**(11): 933-938.
- Olwig, K. F. and K. Olwig (1979). "Underdevelopment and the development of 'natural' park ideology." Antipode **11**(21): 16-25.
- Otto, J., B. A. Kamara, et al. (1998). Closing Corridors: Impact of Policy Practices and Privatisation on Wildlife Movements in the Tarangire-Manyara Area. EPIQ. Dar es Salaam, USAID/Tanzania: 64.
- Paterson, B. (2006). "Ethics for Wildlife Conservation: Overcoming the Human-Nature Dualism." BioScience **56**(2): 144-150.
- Peres, C. A. (1994). "Indigenous Reserves and Nature Conservation in Amazonian Forests." Conservation Biology **8**(2): 586-588.
- Posey, D. A. (1992). Interpreting and applying the "reality" of indigenous concepts: What is necessary to learn from the natives? Conservation of the Neotropical Forests: Working from Traditional Resource Use. K. Redford and C. Padoch. Irvington, NY, Columbia University Press: 21-34.
- Pratt, D. J., P. J. Greenway, et al. (1966). "A classification of East African rangeland." Journal of Applied Ecology **3**: 369-382.
- Quammen, D. (2006). World Parks at Risk: An Endangered Idea. National Geographic. **210**: 42-67.
- Quinn, C., M. Huby, et al. (2003). "Local perceptions of risk to livelihood in semi-arid Tanzania." Journal of Environmental Management **68**(1): 111-119.
- Rappaport, R. (1967). "Ritual Regulation of Environmental Relations among a New Guinea People." Ethnology **6**: 17-30.
- Rappaport, R. A. (1968). Pigs for the Ancestors. New Haven, Yale University Press.
- Redford, K., K. Brandon, et al. (1998). Holding Ground. Parks in Peril: People, Politics, and Protected Areas. K. Brandon, K. Redford and S. Sanderson. Washington D.C., Island Press: 455-463.
- Redford, K. H. (1990). "The Ecologically Noble Savage." Orion **9**(3): 25-29.

- Redford, K. H., J. G. Robinson, et al. (2006). "Parks as Shibboleths." Conservation Biology **20**(1): 1-2.
- Redford, K. H. and A. M. Stearman (1993a). "Forest-dwelling native Amazonians and the conservation of biodiversity." Conservation Biology **7**: 248-255.
- Reid, R. S., R. L. Kruska, et al. (1998). Conservation crises of the 21st century: Tension zones among wildlife, people and livestock across Africa in 2040. International Congress of Ecology. Florence, Italy.
- Robbins, P. (2004). Political Ecology. Malden, MA, Blackwell Publishing Ltd.
- Ruttan, L. M. and M. B. Mulder (1999). "Are East African Pastoralists Truly Conservationists?" Current Anthropology **40**(5): 621-637.
- Sachedina, H. (2006). Conservation, Land Rights and Livelihoods in the Tarangire Ecosystem of Tanzania: Increasing incentives for non-conservation compatible land use change through conservation policy. Pastoralism and Poverty Reduction in East Africa: A Policy Research Conference. Nairobi, Kenya, International Livestock Research Institute.
- Sanderson, S. and S. Bird (1998). The New Politics of Protected Areas. Parks in Peril: People, Politics, and Protected Areas. K. Brandon, K. Redford and S. Sanderson. Washington D.C., Island Press: 441-454.
- Schneider, H. (1957). The Pakot (Suk) of Kenya with special reference to the role of livestock in the subsistence economy. Ann Arbor, University of Michigan Press.
- Schroeder, R. (2005). Community, Forestry, and Conditionality in The Gambia. Communities and Conservation: Histories and Politics of Community-Based Natural Resource Management. J. P. Brosius, A. L. Tsing and C. Zerner. New York, AltaMira: 207-229.
- Schwartzmann, S., A. Moreira, et al. (2000). "Rethinking Tropical Forest Conservation: Perils in Parks." Conservation Biology **14**(5): 1351-1357.
- Scoones, I. (1999). "New Ecology and the Social Sciences: What Prospects for a Fruitful Engagement?" Annual Review of Anthropology **28**: 479-507.
- Scott, J. C. (1998). Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed. New Haven, Yale University Press.
- Sen, A. (1981). "Ingredients of Famine Analysis: Availability and Entitlements." The Quarterly Journal of Economics **96**(3): 433-464.
- Shyamsundar, P. and R. Kramer (1997). "Biodiversity conservation - at what cost? A study of households in the vicinity of Madagascar's Mantadia National Park." Ambio **26**(3): 180-184.

- Sjoberg, L. (2000). "Factors in Risk Perception." Risk Analysis **20**(1): 1-11.
- Smith, E. A. and M. Wishnie (2000). "Conservation and Subsistence in Small-Scale Societies." Annual Review of Anthropology **29**(1): 493-524.
- Smith, K., C. B. Barrett, et al. (2000). "Participatory Risk Mapping for Targeting Research and Assistance: With an Example from East African Pastoralists." World Development **28**(11): 1945-1959.
- Smith, K., C. B. Barrett, et al. (2001). "Not Necessarily in the Same Boat: Heterogeneous Risk Assessment Among East African Pastoralists." The Journal of Development Studies **37**(5): 1-30.
- Stephens, D. W. (1990). Risk and Incomplete Information in Behavioral Ecology. Risk and Uncertainty in Tribal and Peasant Economies. E. Cashdan. Boulder, Westview Press: 19-46.
- Steward, J. H. (1955). The Concept and Method of Cultural Ecology. Theory of Culture Change: Methodology of Multilinear Evolution. J. H. Steward. Chicago, University of Chicago Press: 30-42.
- Tacconi, L. and J. Bennett (1995). "Biodiversity Conservation: the process of economic assessment of a protected area in Vanuatu." Development and Change **26**: 89-110.
- Tanzanian National Bureau of Statistics (2004). 2002 Population and Housing Census: General Report. <http://www.tanzania.go.tz/census/census/index.html>.
- Tarangire Conservation Project/OIKOS (1998). Tarangire Conservation Project: Analysis of Migratory Movements of Large Mammals and their Interaction with Human Activities in the Tarangire Area in Tanzania as a Contribution to a Conservation and Sustainable Development Strategy, University of Milan (Varese Branch) and OIKOS: 122.
- Terborgh, J. (1999). Requiem for Nature. Washington, Island Press.
- Terborgh, J. (2004). Requiem for Nature. Washington, Island Press.
- Thompson, E. P. (1971). "The moral economy of the English crowd in the eighteenth century." Past and Present **50**: 76-136.
- Thompson, M. and K. Homewood (2002). "Entrepreneurs, elites, and exclusion in Maasailand: Trends in wildlife conservation and pastoralist development." Human Ecology **30**(1): 107-138.
- Tobler, W. R. (1970). "A computer movie simulating urban growth in the Detroit region." Economic Geography **46**: 234-240.

- UN (2007). World Population Prospects: The 2006 Revision Population Database, UN Department of Economic and Social Affairs, Population Division.
- UNESCO (2007). World Heritage List, Ngorongoro Conservation Area. <http://whc.unesco.org/en/list/39>.
- Voeten, M. M. and H. H. T. Prins (1999). "Resource partitioning between sympatric wild and domestic herbivores in the Tarangire region of Tanzania." Oecologia **120**(2): 287-294.
- Waller, R. (1976). "The Maasai and the British: Land Matters." Journal of African History **17**: 529-553.
- Waller, R. (1984). "Interaction and Identity on the Periphery: The Trans-Mara Maasai." International Journal of African Historical Studies **17**: 243-284.
- Waller, R. (1988). Emutai: Crisis and Response in Maasailand, 1883-1902. The Ecology of Survival. D. Johnson and D. M. Anderson. London, James Curry.
- Wallington, T. J., R. J. Hobbs, et al. (2005). "Implications of Current Ecological Thinking for Biodiversity Conservation: a Review of the Salient Issues." Ecology and Society **10**(1): 15.
- Ward, D., B. T. Ngairorue, et al. (2000). "Perceptions and realities of land degradation in arid Otjimbingwe, Namibia." Journal of Arid Environments **45**(4): 337-356.
- Watts, M. (1983). On the Poverty of Theory: Natural Hazards Research in Context. Interpretations of Calamity: from the viewpoint of human ecology. K. Hewitt. Boston, Allen and Unwin: 231-262.
- West, P., J. Igoe, et al. (2006). "Parks and Peoples: The Social Impact of Protected Areas." Annual Review of Anthropology **35**: 251-277.
- Western, D. and H. Gichohi (1993). "Segregation effects and impoverishment of savanna parks: the case for ecosystem viability analysis." African Journal of Ecology **31**(4): 269.
- Western, D. and J. Ssemakula (1981). "The Future of Savanna Ecosystems." African Journal of Ecology **19**: 7-19.
- White, G. F. (1945). Human Adjustments to Floods: A Geographical Approach to the Flood Problem in the United States. Chicago, University of Chicago, Department of Geography: Research paper no. 29.
- Winterhalder, B. (1990). Open Field, Common Pot: Harvest Variability and Risk Avoidance in Agricultural and Foraging Societies. Risk and Uncertainty in Tribal and Peasant Economies. E. Cashdan. Boulder, Westview Press: 67-87.

Winterhalder, B., F. Lu, et al. (1999). "Risk-Sensitive Adaptive Tactics: Models and Evidence from Subsistence Studies in Biology and Anthropology." Journal of Archaeological Research 7(4): 301-348.

Zimmerer, K. (1994). "Human Geography and the 'New Ecology': the Prospect and Promise of Integration." Annals of the Association of American Geographers 84(1): 108-125.