LIVELIHOOD ACTIVITIES IN A WILDLIFE CONSERVANCY ON NAMIBIA'S KWANDO RIVER

By

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To my wife, Regina, for her love, encouragement, and support

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We examined livelihood activities at the household level in a wildlife conservancy along the Kwando River in the Caprivi region of Namibia. It analyzes data from surveys collected in Mashi Conservancy, a community-based natural resource management program bordered on two sides by national parks. The conservancy is remote, economically undeveloped, and has a recovering wildlife population. Its people subsist primarily on rain-fed agriculture from sandy soils in a semi-arid, drought-prone environment.

We asked how people in the conservancy make their livelihoods and what differences exist between the conservancy's riverside and interior populations. The study finds that a population centered 20 km away from the river on slightly heavier soils engages in fewer livelihood activities and has greater food security than does the riverside population. It further establishes that differences between the two populations are significant enough to indicate two distinct combinations of livelihood activity with different environmental interactions. Differences also exist among riverside households based on soil type. These findings suggest that any management action taken by the conservancy will affect household livelihoods differently based on location and that these differences must be considered as the conservancy makes the transition from a subsistence-based agricultural system to a wildlife-based economy.

CHAPTER 1
RESEARCH QUESTIONS AND HYPOTHESES

We examined data from research conducted along the Kwando River in Namibia's Eastern Caprivi region in May to July 2007. It looks at local livelihoods in a community-based natural resource management (CBNRM) area known as Mashi Conservancy. The conservancy is remote, economically undeveloped, and has a wildlife population that is recovering from years of poaching. Its people subsist primarily on rain-fed agriculture from sandy soils in a semi-arid, drought-prone environment.

The Namibian government began establishing conservancies for CBNRM in 1996 so that financial benefits from tourism and safari hunting could be captured by local communities and distributed to their residents. These conservancies are viewed as a tool for simultaneously achieving biological conservation and economic development. Under these programs, management of wildlife and other natural resources on communal lands becomes the responsibility of local communities.

Mashi Conservancy was officially gazetted in 2003. It is bordered on two sides by national parks and has a growing population of elephants and other wildlife (IRDNC 2007). This increase in wildlife has also brought an increase in crop raiding by wildlife. The combination of crop raiding, poor soils, and variable rainfall makes food security a serious concern, especially for households closest to the river. How do these challenges determine the range and reliability of livelihood activities engaged in by households? Do differences exist between the two populations' households that need to be accounted for in natural resource management planning, such as the expansion of wildlife corridors and determining income potential from wildlife?

Adams and Hulme (2001a) define CBNRM as "those principles and practices that argue that conservation goals should be pursued by strategies that emphasize the role of local residents

in decision-making about natural resources." Opening access to financial benefits from tourism and wildlife to local people on communal land represents a change in economic conditions that shifts the area from a subsistence-based agricultural system to a wildlife-based economy.

Lambin et. al. (2001) observe that changes in economic conditions mediated by institutional factors are the main drivers of land use change. Conservancies have emerged as an institutional presence that must interact with government, traditional authorities, and customary livelihood practices. Understanding how people within the conservancy make their livelihoods is a first step toward understanding how the conservancy itself might shape livelihood strategies and land use decisions in the future.

This paper asks the following questions: 1) How do people in Mashi Conservancy make their livelihoods, and how varied and reliable are those livelihoods? 2) How do livelihood activities differ between riverside and interior populations within the conservancy? 3) Do important differences in livelihood patterns exist that need to be considering when making decisions about land use and natural resource management?

The examination of livelihood activities is based on 60 household interviews about income-producing and subsistence-based activities. The study hypothesizes that:

- **H1** – People living on heavier soils away from the river (interior populations) engage in fewer livelihood activities than do riverside populations.
- **H2** - Interior populations have greater food security than do riverside populations.
- **H3** - Differences between interior and riverside populations are significant enough to suggest two distinct centers of livelihood activities with different environmental interactions.

CHAPTER 2
STUDY AREA

Mashi Conservancy is located in Eastern Caprivi, Namibia (Figures 2-1 and 2-2). The conservancy is bordered on the west by the Kwando River and Bwabwata National Park. Mudumu National Park lies directly south of the conservancy. Neighboring conservancies border Mashi to the north and east.

The Mashi population is divided roughly into two centers. About 431 households live in a cluster situated 14 km to 20 km east of the Kwando River, just north of Mudumu National Park on an area of slightly heavier soils. About 515 households are located along a regularly maintained graded road that runs parallel to the Kwando River. This graded road runs south from the Trans-Caprivi Highway at Kongola. The northern sections of the road traverse relic sand dunes that rise about 50 m. These dunes flatten out about one-third of the way into the conservancy. The road then enters a landscape that shows characteristics of ancient flooding and water action, with heavier soils, grasslands and mopane woodlands.

Caprivi covers 14,528 km^2 and is one of 13 regions established by the Namibian government in 1991 (Zeller, 2000). The region is geographically removed from the rest of the country, jutting into the middle of southern Africa and bordered by Angola, Zambia, Zimbabwe and Botswana.

The study area is transnational in character and has experienced both tribal and international conflict. People and wildlife have historically crossed its political boundaries. At least five tribes make their home in the study area: Lozi, Mbukushu, Mafwe, Siyeyi, and Khoe-San. The Angolan and Zambian borders are about 55km to the north by road from the Mashi Conservancy office. The border with Botswana is less than 5 km due west, directly across the Kwando River.

Physical Characteristics

Caprivi is part of the Kalahari Basin and at one time was part of the Kalahari Desert. It now lies in a transitional zone between the desert and the Angolan highlands (Zeller, 2000). Caprivi has little variation in surface relief and a slight slope of 1110 m to 930 m, running west to east. The region's Kalahari sands are low in organic materials and nutrients, resulting in low productivity for agriculture. The soils are also vulnerable to wind and water erosion (Zeller, 2000). Floodplains along the Kwando and Chobe Rivers hold more fertile soils, as do fossil drainage lines in other parts of the region (Zeller, 2000). Mashi's interior is one such area with more fertile soils.

The Kwando River is one of 10 major freshwater wetlands in the Zambezi Basin and the only perennial river between the Kavango River, which is about 200 km to the west, and the Chobe/Zambezi river system, about 140 km to the east. Threats in this basin include overuse of river resources and reduced water flows caused by drought and water abstractions (Schuyt, 2005). The Kwando River, however, has been largely protected by war in Angola, which has inhibited population growth in the Angolan uplands that hold the river's headwaters. Wetlands are important for producing a number of products that have social and economic value to rural communities (Dixon and Wood, 2003). Wetlands serve as multi-functional reservoirs of productivity and provide hydrological benefits that communities depend on.

Average daily temperatures range from 5 C in the winter to 33 C in the summer (Naeraa et. al., 1993). Namibia's rainy season runs from October through April. Caprivi averages 600 to 700 mm of rainfall annually, producing seasonal floodplains (Devereux and Naeraa, 1996). Rainfall is highly erratic and drought occurs regularly (Jones and Murphree, 2001). Because the study area receives most of its rainfall during the summer, one failed wet season can mean drought conditions for more than a year (Brown and Lall, 2006).

Wildlife

The Kwando River serves as an important wildlife corridor for elephants and other game species that migrate north from Botswana, and to a lesser extent south from Angola and Zambia.

The area spanning Namibia's Caprivi region, northern Botswana, and western Zimbabwe contains Africa's largest population of elephants and one of the largest stretches of known elephant range on the continent (Skarpe et. al., 2004; Blanc et. al, 2007). The total population is estimated at about 180,000 elephants and appears to be growing at 5.4% annually (Blanc et. al., 2005). The estimated number of elephants living in Caprivi nearly doubled between 1996 and 2004 to 8,700. Increased migration from Botswana is believed to be the cause (Blanc et. al., 2007). Some elephants form resident groups close to permanent water sources such as the Kwando River, while other elephants migrate up to 200 km to reach water in the dry season (Verlinden and Gavor, 1998).

Large-scale hunting during the colonial period decimated game populations in Caprivi (National Planning Commission, 2004). From 1895 to about 1910, white criminals and poachers used Eastern Caprivi as a haven. English and Boers were known to illegally hunt big game there for sport (Fisch, 1999b). Most of these hunters came during the dry season (May to October), when malaria was less of a threat and game was concentrated near water sources.

Game species in Caprivi were abundant prior to 1895. The Chobe Valley had been the private hunting reserve of the Lozi's Paramount Chief Lewanika. Many of the game species found in Caprivi had already been hunted out or were protected in neighboring Rhodesia, such as giraffe and eland. Within a decade, these large game populations had been drastically reduced in Caprivi, with some species hunted to the point of near extinction (Fisch, 1999b). Eyewitness accounts from the period describe hunters killing between 120 and 140 head of game on a single expedition. Native residents of Caprivi benefited from these hunting operations through

employment and distribution of game meat. They also sold goods such as maize and hides to the white hunters. Rampant poaching in Caprivi ended with the establishment of German administration in 1908.

Wildlife populations recovered in the following decades, with the exception of the disappearance of black and white rhino (Rice, 1997). But during the armed conflicts of the 1970s and 80s, unlicensed hunting by South African Defense Force (SADF) personnel, civil servants and entrepreneurs again decimated much of the wildlife in Caprivi (Zeller, 2000). Law enforcement officials were reported to have also taken part. Animals were killed by machine gun from low flying helicopters or captured to sell to South African game parks (Zeller, 2000). Local people also took part as firearms became readily available (Rice, 1997). By Namibian independence in 1990, several mammal species were completely extirpated from Caprivi and many others had been severely decimated. Eland, waterbuck, wildebeest, and giraffe disappeared from East Caprivi, while roan, sable antelope, tsessebbe, and zebra populations became critically low (Rice, 1997). Red lechwe in East Caprivi, which had numbered more than 70,000 in 1973, had been reduced to a population of about 1,000 (Rice, 1997).

West Caprivi was the exception. The SADF's Colonel Breytenbach, 32nd Battalion, strictly enforced conservation regulations that helped maintain healthy populations there (Rice, 1997). West Caprivi's Bwabwata National Park, just across the Kwando River from Mashi Conservancy, had been established in 1968 as Caprivi Game Park and was controlled by SADF until Namibia`s independence in 1990. The park, which has an area of 5,715 km^2, covers the entire western portion of the Caprivi Strip between the Okavango and Kwando Rivers. Mudumu National Park, across the Kwando in East Caprivi, was proclaimed in 1990 and has an area of 1,010 km^2 (Ministry of Environment and Tourism, 2005).

Human Population

Mashi Conservancy has a population of about 4,000 residents living in more than 100 villages (Figure 2-3). The conservancy's two population areas are distributed along two roads. The riverside population is found along a graded road that runs from the village of Kongola, located about 20 km to the north, to Mudumu National Park and other settlements to the south (Figure 2-2). Villages and settlements are clustered along the graded road, which roughly parallels the Kwando River and is a throughway for tourists. Kongola is situated on the Trans-Caprivi Highway, the major artery to Caprivi's administrative capital and main market, Katima Mulilo, about 120 km to the east.

Mashi's interior population is connected to the river road by a 20 km 4x4 track through fields and bush. These settlements are situated on more fertile soils that have a higher content of clay. The interior population is more densely clustered than the riverside population and has larger agricultural fields, some exceeding 100 ha. The remainder of the conservancy is largely unsettled and consists of shrub, forest and grassland. Some cattle owners from the interior drive their herds through this area to the Kwando River during the dry season for water. A couple of cattle posts, temporary dwellings for the men who tend cattle herds, can be found in the section between the two populations with boreholes nearby.

In 1909, the German colonial administration estimated Caprivi's population at 11,300 people (Fisch, 1999b). According to Namibia's Central Bureau of Statistics, about 86,000 people now live in Eastern Caprivi (National Planning Commission, 2004). The 2001 Census lists Caprivi's overall growth rate at 1.8%. Seventy-two percent of Caprivians live in rural areas, and population density is 5.5 persons per km^2 (Namibia Population and Housing Census, 2001).

According to Mendelsohn and Roberts (1997), 61% of the total area of Eastern Caprivi has less than 1 person per km^2. As of 1997, Mashi's interior area of Sachona and its riverside area of

Lizauli both had population densities of 20 to 50 people per km^2. By contrast, the area in between the two centers has a density of 1 person per km^2.

As a whole, Eastern Caprivi experienced an annual growth rate of greater than 4% between 1966 and 1996 (Mendelsohn and Roberts, 1997). The initial population boost came from armed conflict along the border with Angola. Continued warfare in Angola after Namibia's independence and a poor economy in Zambia have driven people to seek better opportunities in East Caprivi, made easier by completion of the Trans-Caprivi Highway in the mid-1990's. This has resulted in increased competition for land, worsening conditions for agriculture and overall environmental degradation (Zeller, 2000). Expansion of settlements, more cultivation, widespread use of fire and greater pressure on grazing lands have increased soil erosion and bush encroachment, in some cases severely disturbing local ecosystems (Zeller, 2000).

In 1996, Eastern Caprivi had 124,000 head of cattle (Mendelsohn and Roberts, 1997). The cattle population saw a dramatic increase between 1976 and 1996 as vaccinations reduced livestock diseases and lower river levels and less flooding along Caprivi's southern border opened up more land for grazing. Consequently, grazing pressure doubled between 1985 and 1996 (Mendelsohn and Roberts, 1997). In 1997, the interior area of Sachona had 10-25 cattle per km^2, while the riverside area of Lizauli had 1-5 cattle per km^2. Mashi's interior area has moderate grazing potential, while most of its riverside has poor grazing potential

Pre-Colonial History

Khoe-San (bushmen) tribes historically used the Caprivi region for hunting and gathering, primarily inhabiting western Caprivi. In the 17th or 18th century, modern day Caprivians began moving into the area. Caprivi residents historically referred to the Kwando River as the Mashi (Fisch, 1999a).

By the 1830's, the Barotse Empire (the Lozi) controlled eastern Caprivi. The empire centered on the upper Zambezi floodplain and extended to Victoria Falls. The Lozi ruled over the Subiya, Fwe, Yeyi and Mbukushu tribes (Zeller, 2000). The Lozi placed the ethnic tribes they conquered under a tenure system similar to Europe's feudal system. Pure blooded Lozi were made chiefs, and everyone else was essentially enslaved to the chief. Protection and the right to exist on the land were paid for in-kind or through personal service. This state of dependency existed in Caprivi for generations. Conquered ethnic groups were required to pay tribute in the form of maize, hides, ivory and goats (Fisch, 1999b).

The Lozi also had a tradition of taking one or two wives from the conquered tribes. This strengthened loyalty toward the Lozi and resulted in a strong mixing of tribal heritage to the point that an individual's tribal membership could be determined only by paternal line of descent (Fisch, 1999b). Caprivi continues to be characterized by close family ties with people from Botswana, Zambia and Zimbabwe. Over time, this has led to strong personal and economic exchange between these areas (Zeller, 2000).

The Lozi's political structure has persisted through today. Paramount Chief Lewanika, who ruled from 1878 to 1916, divided his territory into provinces that were governed by close relatives. Each province had several districts, and each of these districts was run by an induna, or headman. The induna collected taxes, recruited soldiers and maintained political order. In addition to this district headman were minor indunas. These village headmen served as intermediaries between their people and the Lozi leaders (Fisch, 1999b).

The traditional title for the headman of the area along the Mashi River was Siluka. His headquarters were located near the confluence of the Mashi and Luyana Rivers, just north of Caprivi in modern-day Zambia. A minor induna named Mayuni had his headquarters along the

Mashi River in what is now known as Mayuni Conservancy, directly north of Mashi Conservancy. Mayuni's mother was Yeyi, his father was Lozi, and his first wife was Fwe (Fisch, 1999b).

Pre-colonial livelihoods in Caprivi involved fishing, hunting and gathering, agriculture and pastoralism. Plowing with oxen and other agricultural techniques weren't practiced until the 1920s, when they were introduced by European missionaries (Zeller, 2000).

Colonial Rule

In 1890, the British agreed to give the German government a strip of land that would connect German South West Africa (modern day Namibia) to the Zambezi River. The Germans hoped that the Zambezi would provide access to their colonies in East Africa. But the river proved unnavigable, and German officials soon lost interest in developing the remote region, which became known as the Caprivi Zipfel, known as the Caprivi Strip in English (Fisch, 1999a).

It would be another 18 years before the Germans actually arrived to claim the territory (Bruchmann, 2000). Prior to 1908, few Germans ventured into Caprivi. The route was difficult and dangerous, especially along the marshes of the Mashi (Kwando) River (Zeller, 2000). Despite its inaccessibility from the west, Caprivi had thriving settlements, especially along the Zambezi River. One German visitor to the region in 1904 estimated that 40,000 head of cattle grazed in Eastern Caprivi on the Zambezi floodplains.

Capt. Kurt Streitwolf, the first official German resident of Caprivi, introduced an administrative structure based on traditional authority that lasted from 1909 to 1972. He sought to gain the cooperation of traditional leaders by adopting a simplified version of the Lozi tribal system. Native inhabitants were allowed to retain ownership of inherited land and have use of it.

He restricted the rights of chiefs as little as possible while controlling the activities of white traders and settlers (Fisch, 1999b).

Streitwolf considered Caprivi's game and woodlands as its most valuable assets (Fisch, 1999b). He proposed that hunting licenses be sold to British game hunters at a premium price in order to fund operations at Caprivi's administrative headquarters, but the idea was rejected by his superiors in Windhoek.

The local people of Caprivi were subject to frequent administrative changes and consequently didn't develop strong loyalties toward the government in Windhoek.

- British officials occupied Caprivi at the start of World War I, in September 1914, in a bloodless surrender by the Germans.
- In 1920, the League of Nations assigned South West Africa, including the Caprivi Strip, to the Union of South Africa, which devolved authority for the region to the Bechuanaland Protectorate (now Botswana).
- From 1929 to 1939, administrative control came from Windhoek.
- In 1939, control of East Caprivi was granted to the Department of Native Affairs in Pretoria, South Africa.
- From 1940 to 1980, Caprivi was administered as a Bantustan, otherwise known as a Native Reserve, by South Africa's apartheid government in Pretoria (Tvedten, 2002).
- South Africa established a transitional government in Namibia in 1985.
- Namibia achieved independence in 1990.

Conflict

A history of armed conflict in Caprivi has hurt the region's standing as a tourist destination.

Beginning in the 1970's, the South African Defense Force fought along the border of the Caprivi Strip against the Movimento Popular da Libertação de Angola, the South West African People's Organization (SWAPO), Cubans, Russians and other eastern bloc nations. The conflict

resulted in a quick build-up of infrastructure in the area, including airports, roads, electricity and bridges. West Caprivi, from the Kwando River to the Kavango River, was heavily fortified until the end of the war for independence in 1989 (Fisch, 1999a).

Prior to that, in 1964, the Caprivi African National Union (CANU) demanded the liberation of Caprivi from South African occupation. Many members fled to Zambia after the arrest of CANU's president. Young Caprivians began joining the military wing of SWAPO. SWAPO and CANU members collaborated on sabotage and terrorism against South African forces in Caprivi (Fisch, 1999a). SWAPO ultimately became Namibia's ruling party at independence in 1990. By then, the party had broken all ties with CANU, and East Caprivi became known as an area of political opposition.

Mishake Muyongo, CANU's second president, wanted Caprivi to become a semi-autonomous province of Zambia. Caprivi secessionists had been sent to Angola for military training and returned to Caprivi in October 1998. They gathered in Mudumu National Park and were supplied food by the local population in Mashi's interior (Fisch, 1999a). Caprivi police were alerted to the situation, resulting in several arrests and the exodus of about 2,000 activists into Botswana by the end of the year. Muyongo and Chief Bwima Mamili, the seventh of the Mamili chiefs, were granted asylum in Denmark in 1998 for their roles in the secessionist Caprivi Freedom Movement (Fisch, 1999a).

But the secessionist movement persisted. An armed uprising took place in Katima Mulilo in August 1999, with most of the armed rebels coming from Linyanti, home of Chief Mamili. The attack on the airport and government installations came as a surprise but was short-lived (Zeller, 2000).

In January 2000, three French children were killed and their parents critically wounded in a West Caprivi attack by uniformed men who were identified as UNITA rebels from Angola. That same day two people were wounded in an attack on a Danish aid agency truck in the same area (BBC News, 2000). At least 18 people died in 2000 as a result of the violence (Bruchmann, 2000). As a result, tourism came to a standstill, resulting in widespread unemployment.

The conflict set back efforts by the government and NGOs to promote socio-economic development in the region (Zeller, 2000).

Economic Development

As in much of southern Africa, livestock production and marginal, dryland crop production are the predominant land uses in Caprivi (Walker, 1999).

Caprivi currently ranks at the bottom of Namibia's thirteen administrative districts in terms of the U.N.'s human development index (Zeller, 2000). Reaching Katima Mulilo by road from Windhoek was nearly impossible until the 1950s, when 4x4s became available and a primitive bridge was built across the Kwando River (Fisch, 1999a). This lack of development began to change when armed conflict erupted during the 1960s against the People's Liberation Army of Namibia. South Africans developed water supply, agricultural extension, health care facilities, schools and housing projects (Zeller, 2000). During the 1960s and early 1970s, Katima Mulilo saw rapid expansion and population increases.

From 1966 until Namibia's independence in 1990, pro-government military operations fueled trade and business in Katima Mulilo. The rural economy, however, suffered. Caprivi had been self-sufficient in its production of maize in the 1960's but produced only 35 to 45% of its needs by the early 1980's (Tvedten, 2002). Following independence, unemployment and poverty became a larger problem for Caprivi residents (Fisch, 1999a).

Following independence, Namibia built the Trans Caprivi Highway to establish a trade corridor with Zambia and other southern African countries while also promoting tourism in the Zambezi River basin. Construction of the highway began in the mid-1990's and was completed in 2005 (New Era, 2007). The creation of the tar road has opened up regional trade, allowing for the transport of goods loaded off container ships at Walvis Bay, on Namibia's coast, to the interior of southern Africa. It has given Caprivi residents greater access to local markets and cities such as Katima Mulilo, Rundu, and Windhoek. It has also opened up Caprivi to tourists en route from popular destinations such as Namibia's Etosha Pan, Zimbabwe's Victoria Falls, and Botswana's Chobe National Park.

Role of Conservancies

Prior to colonial rule, traditional authorities in eastern Caprivi had a number of restrictions regulating the use of natural resources. Lozi authorities established forest reserves and protected certain tree species and individual trees (Zeller, 2000). Chiefs controlled the hunting of "royal game" and establishing hunting seasons for particular species. The hunting of unprotected species required permission from the induna. The unlawful harvesting of natural resources, hunting or fishing could result in fines that were usually paid in livestock.

This is not to suggest that land use problems didn't exist in Caprivi. German administrator Viktor von Frankenberg observed during his residence between 1911 and 1914 that many Caprivians burned and cleared new fields after only a few seasons of cultivation. He had begun making plans to promote afforestation and better land use practices prior to his surrender to the British at the start of World War I (Fisch, 1999b).

The Nature Conservation Amendment Act of 1996 paved the way for Namibia's present-day CBNRM program. The Act called for the collective management of wildlife and tourism through a common property resource management institution known as a conservancy. Rural

communities were given the same rights as white freeholders to use and benefit from wildlife and to receive tourism concessions as an incentive for conserving wildlife (Jones and Murphree, 2001).

The CBNRM program gives local people a stake in wildlife management that includes authority over management decisions. This represents an important change as people living in East Caprivi were hostile toward early conservation actions by the government. Initial efforts to curb illegal hunting along the Kwando in the 1980's by the newly created Department of Nature Conservation focused on anti-poaching activities that included little or no community interaction. Consequently, local people became hostile toward park staff. At one point, a government employee was shot and injured after being mistaken for a park ranger (Rice, 1997).

In 1993, the government appointed community game guards in communities that requested them. This initiative, which preceded efforts to establish CBNRM programs, sought to establish a mechanism for engaging local communities in wildlife conservation. The community game guards conducted wildlife patrols and monitoring and assisted communities with wildlife-related issues such as problem-animal control (Rice, 1997). Several communities that are now part of Mashi Conservancy took part in the initial program: Ngonga, Namushasha, and Lizauli. These initial efforts, however, revealed a lack of commitment to wildlife conservation within these communities. The first four years of the program (1993-1997) resulted in dismissals and replacements of game guards. Most notably, a Lizauli game guard was arrested for possession of ivory (Rice, 1997).

Since then, CBNRM has brought potential for significant changes to rural livelihoods in the Kwando region. Seeking to provide incentives for local people to better manage wildlife

populations, the program operates on the premise that if communities are given sufficient authority and control over wildlife, the benefits will outweigh the costs (Jones et. al., 2002).

Poor people do not have the means to grow or buy enough food in a system that relies on marginal agriculture (Walker, 1999). Such is the case along the Kwando River. One of CBNRM's goals is to improve the economic welfare of local people by moving away from marginal forms of agriculture and instead focusing on less extractive land uses that benefit from the region's biological resources (Walker, 1999). Community conservation is seen as an insurance policy against drought by spreading risk across more livelihood options (Jones and Murphree, 2001).

The hunting and viewing of game animals in the wild plays an important economic role in southern Africa's semi-arid regions (Barnes, 1999). For communal areas, linking wildlife systems to tourism can generate wealth without the biological limits of pastoral and ranching systems (Cumming, 1999). However, there is no guarantee that benefits will be distributed equally within a conservancy (Baker, 1997). The number of people who cannot secure tourism jobs or benefits from tourism could be significantly larger than the number who can, creating the potential for resentment and consumptive land use practices (Vanderpost, 2006).

Wildlife in southern Africa has economic value (Barnes, 2001; Humavindu and Barnes 2003). In 2000, nearly one-quarter of income from safari hunters in Namibia accrued to the rural poor, making the industry important for economic development. Barnes et. al. (2002) report that Namibia's conservancies are economically efficient and have a high likelihood of being sustainable. However, Adams and Hulme (2001b) point out that trade-offs between economic development and conservation can be substantial except in rare situations that involve high-value

tourism and safari hunting on agriculturally marginal lands with low human populations and where human activity has a low impact on the rate of environmental change.

Mashi Conservancy

Mashi Conservancy was officially gazetted in 2003 and had 1,097 members as of July 2007. Overall, the conservancy comprises a growing population of more than 4,000 people. At the time of the study, conservancy management was in the process of finalizing contracts with the two tourism lodges within its boundaries: Namushasha Lodge and Camp Kwando. The conservancy earned hunting revenues in US dollars of roughly $27,143 in 2003; $22,143 in 2004; $19,143 in 2005; and $30,829 in 2006 ($1 US = $7 Namibian). The conservancy also earned $2,714 in 2006 from an agreement with Namushasha Lodge.

In 2007, the conservancy employed 16 full-time staff at a rate of $86 a month and 12 part-time staff at $43 per month. This totals $22,704 in annual salary, accounting for the majority of its revenues (68% in 2006).

The two lodges within Mashi Conservancy showed in 2007 that they employed a total of 65 local people, most of whom came from within the conservancy. A lodge directly south of the conservancy, in Mudumu National Park, also employs people who live within the conservancy.

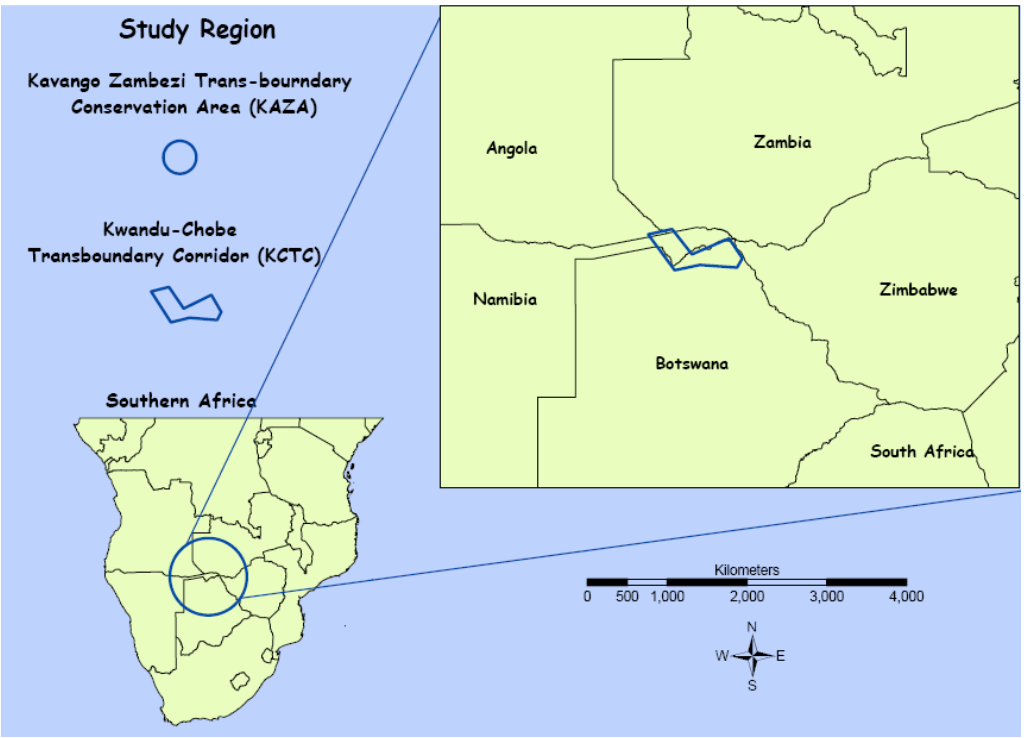

Figure 2-1. Location of study region. The Caprivi region of Namibia juts across southern Africa, bordering Angola, Zambia, Zimbabwe, and Botswana.

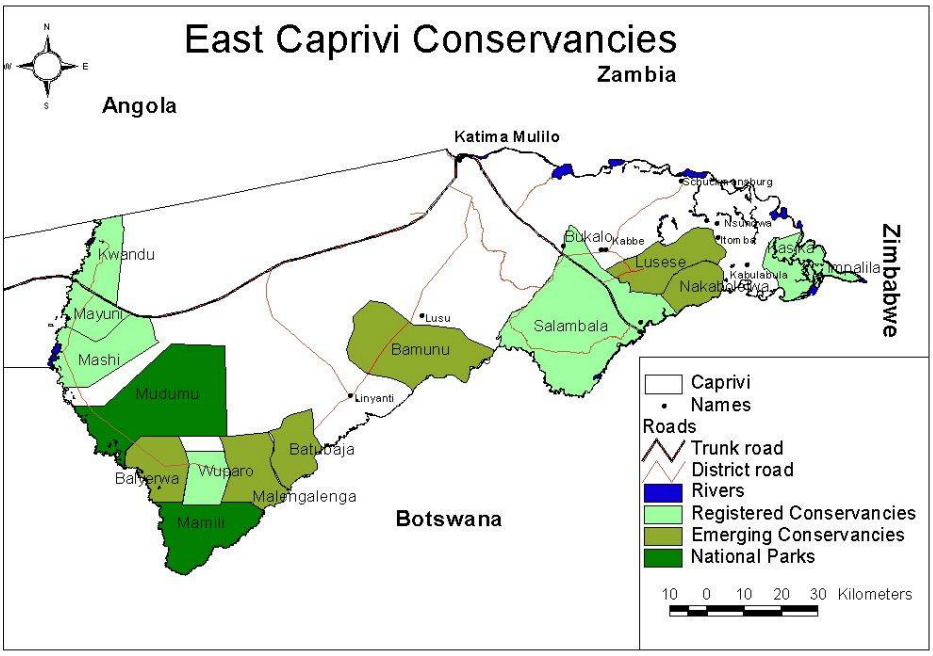

Figure 2-2. Map showing conservancies in Eastern Caprivi. Mashi Conservancy sits above Mudumu National Park, to the west along the Kwando River. The conservancy has since been extended all the way to the border with the national park.

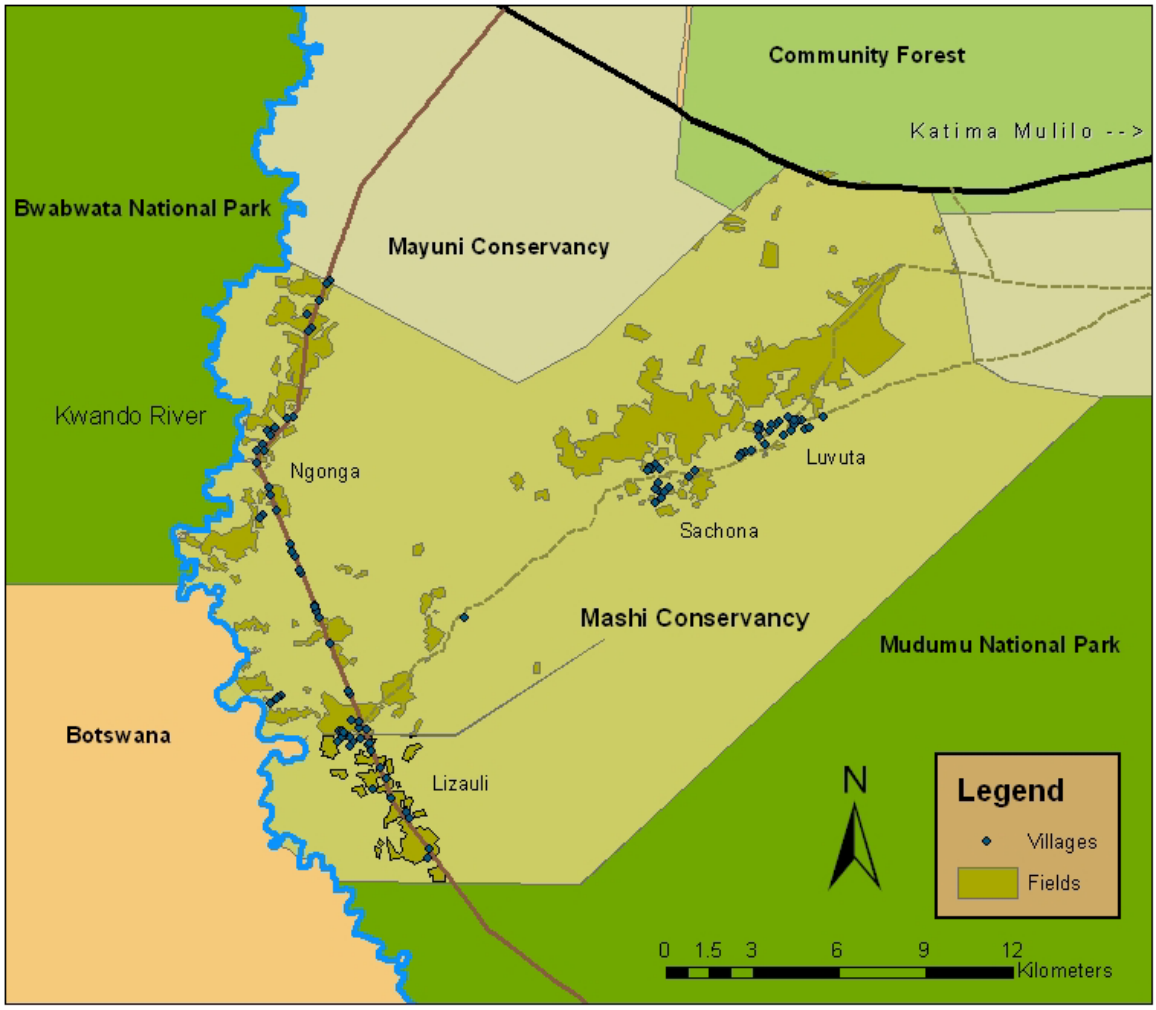

Figure 2-3. Distribution of villages within Mashi Conservancy. This map is based on a village census undertaken by the author and a local research assistant in June 2007. The villages are clustered in two locations: 1) along a graded road that runs parallel to the Kwando River and 2) within the interior. A narrow 4X4 track connects the two locations and ultimately leads to the TransCaprivi Highway. This map also shows agricultural fields in relation to the villages, based on data from the year 2000.

CHAPTER 3
DATA AND METHODS

Mashi Conservancy comprises two spatially distinct populations: 1) riverside villages and 2) interior villages. Interior villages are located 14 km to 20 km from the river along a 4x4 track that cuts through a wide swath of bush. These interior villages, however, are closer to the Trans-Caprivi Highway and Katima Mulilo.

The riverside population can be divided by soil type (Dijkshoorn, 2003). The northern section of the riverside is characterized by eutric arenosols (more than 50% sand with little organic matter). The southern portion contains eutric fluvisols (a sandy clay soil associated with floodplains and former river channels). Eutric fluvisols are also found in the interior. Of the 30 households surveyed along the riverside, 14 were located on the sandy soils and 16 on the more fertile soils to the south (Figure 3-1).

This study hypothesizes that:

- **H1** - Interior populations engage in fewer livelihood activities than do riverside populations.
- **H2** - Interior populations have greater food security than do riverside populations.
- **H3** - Differences between interior and riverside populations are significant enough to suggest two distinct centers of livelihood activities with different environmental interactions.

Development of Instrument

This study relies primarily on a household livelihoods survey that collected information on demographics, household size and structure; number and kinds of assets; income-producing activities; subsistence activities; livestock ownership; crop production; food security; and human-wildlife conflict.

The survey was modified in the field based in part on a series of meetings with community members, conservancy leaders, NGO representatives, and government officials in Caprivi in

May and June 2007. An interdisciplinary team of researchers from the University of Florida, the University of North Carolina – Chapel Hill, and the University of Botswana's Harry Oppenheimer Okavango Research Center took part in developing and testing the survey with local community members. The process also included community-oriented researchers affiliated with the University of Namibia, the University of Botswana, and the University of Zimbabwe. This survey was part of an interdisciplinary research project that included studies on governance of CBNRM programs; attitudes and perceptions toward national parks; ecological transects; and the collection of training samples for remote sensing analysis.

Random Sampling

Sampling Frame

Mashi Conservancy comprises about 1,000 households in an area of 441 km^2. In order to conduct a random sample, a sampling frame had to be created. The author and a local research assistant conducted a village and household census on the entire conservancy, with the exception of a handful of villages in a distant section bordering the Trans-Caprivi Highway. At each village, the headman or his representative was asked permission to include the name of the village, count the number of households and take a GPS waypoint of its location. Only three villages refused to comply. The sampling frame comprised 103 villages, ranging in size from two to more than 50 households.

Spatial Clusters

Once the census was completed, villages were categorized into spatial clusters for each of the two population areas. The riverside had 63 villages with 517 households and was divided into three spatial clusters. The interior had 40 villages with 444 households and was divided into two clusters. These clusters were determined by sight, informed largely by observations of spatial variation and clear spatial boundaries.

Weighted Stratification

Each village cluster was given a weight based on its proportion of all villages in the population area. This weight determined the number of surveys to be conducted within that spatial cluster. Individual villages, however, were not weighted by number of households. Each village within a cluster had the same chance of being selected for a survey, independent of its population. This was done to avoid sampling bias toward the largest villages.

Selecting Villages and Households

Villages were selected through a random number generator, as were households within selected villages. Duplicate selections of a village were allowed. Alternate villages in each spatial cluster were also randomly selected. Three households were selected for each survey: one primary and two alternates. These households were identified by number, counting clockwise from the left at the entrance into the village. If all three households were vacant, opportunistic sampling was permitted. If the village was vacant of appropriate respondents, the nearest alternate village was selected. This process was strictly followed in order to maintain the integrity of the random sample.

Application of Surveys

Household Livelihood Survey

We conducted 60 household surveys, 30 in each of the two population areas, in June and July 2007. The survey comprised 50 questions that took about 45 minutes to complete. GPS coordinates were taken for each survey.

- **Household demographic information** – Age, gender, education, employment, and conservancy membership for all people living in the household at least nine months a year. Also household tribal affiliation.
- **Infrastructure** – Type of home; energy sources for cooking and lighting; assets owned; access to transportation and cell phones.

- **Livelihoods** – Activities for producing income or in-kind payments (goods or services in lieu of cash); activities for providing household subsistence; formal employment; crops grown and harvested; size of fields; agricultural practices; livestock owned.

- **Expenses** – List of all expenses over a year's time.

- **Food security** – Ability to grow enough food for family over past five years; access to water for household and livestock.

- **Human-wildlife conflict** – Crop raiders; methods for protecting crops; livestock predators; methods for protecting livestock; attacks on household members.

- **Risk perception** – List of problems and concerns for household members; responses to unfavorable events.

See Appendix A for copy of the household livelihoods survey and notes about its use in the field.

Field Survey

A follow-up field survey was administered to 10 of the 60 household livelihood survey respondents. These 10 respondents were randomly selected, five each from the riverside and interior locations. The survey involved GPS tracking from the household to the field in order to accurately measure distance-to-field. The field's perimeter was also measured to get an accurate measurement of field size.

The field survey covered:

- **Plot characteristics** – Topography, slope, soil, vegetation, characteristics of surrounding area.

- **Practices over last five years** – Crop yields; time and money spent on field labor; fertilizer use.

- **Drought and wildlife** – Crop irrigation; crop raiding; crop losses from drought.

- **Soil description** – Perceptions of soil quality; changes to soil quality; erosion.

- **Zonation** – Willingness to move field for irrigation and protection from wildlife; willingness to have certain parts of conservancy zoned for different land uses.

Because of the small sample size, little statistical data analysis was done on the field survey. However, its data helped inform and confirm results from the household livelihoods survey.

Statistical Analyses Used on Data

Data from the household and field surveys were entered into Excel spreadsheets and then imported into NCSS databases for descriptive and statistical analyses. The data presented several challenges for conducting statistical tests:

1. A relatively small sample size of n=60 overall and n=30 for each of the locations.
2. Non-normal distributions
3. Discrete random variables with frequent ties (e.g., number of livelihood activities)

Most of the variables for H1 and H3 were analyzed using two-sample t-tests with location as the grouping variable. This study uses Z-Values from the Mann-Whitney U test to determine whether to reject the null hypothesis (Burt and Barber, 1996). However, this violates the assumption that the variable is continuous rather than discrete (NCSS User's Guide, 2007). The other option would be the Kolmogorov-Smirnoff test, which gives approximate results for discrete random variables (Burt and Barber, 1996). Results from Kolmogorov-Smirnoff showed an inclination toward Type II errors in cases where rejection of the null hypothesis appeared to be highly likely (99% confidence under Mann-Whitney).

The remaining variables, food security (H2) and conservancy membership (H3), were evaluated using proportions tests, specifically two-sided tests of zero difference. Variables with $n \geq 50$ used the Chi-square test. Variables with $n < 50$ used Fisher's Exact test.

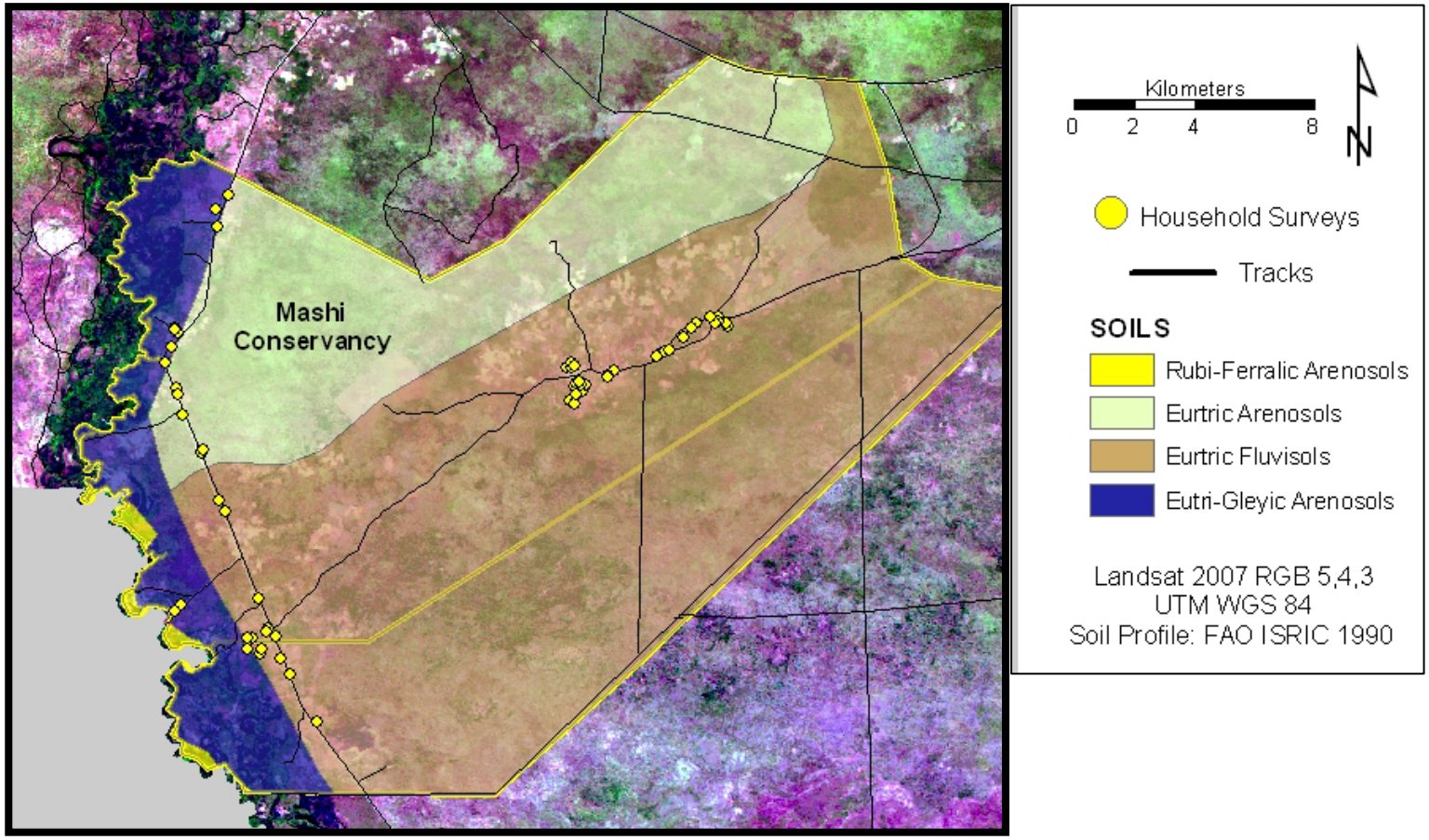

Figure 3-1. Location of surveyed households and soil types. This map shows the spatial distribution of household livelihood surveys in Mashi Conservancy. This study surveyed 60 randomly selected households from the riverside and interior (n=30 for each location). The two primary soil types are eutric arenosols (more than 50% sand with little organic matter) and eutric fluvisols (a sandy clay soil associated with floodplains and former river channels). Map by Andrea Gaughan.

CHAPTER 4
RESULTS

A total of 60 respondents were interviewed (Table 4-1). Respondents ranged in age from 20 to 75. The majority were affiliated with two tribes: Mbukushu (47%) and Mafwe (43%). Households affiliated with the two tribes are evenly distributed among the two main population areas. Respondents were 60% male (50% riverside, 70% interior). Head of household is defined as the husband unless the respondent was a single female.

Nearly all respondents (93%) grew crops in 2007, primarily maize, sorghum, melons, and millet (Table 4-2). Farmers practice rain-fed agriculture with little fertilizer use. Only two respondents who farmed in 2007 (3%) reported using commercial fertilizer. Five farmers, all from the interior, reported using cattle manure as fertilizer (8% of all respondents, 17% of interior respondents), . The passive use of manure as fertilizer is likely to be more widespread than found in the survey, especially in the interior, as cattle are allowed to graze in fields after harvest.

Differences in Livelihood Activities: Riverside vs. Interior

Household livelihood activities differed significantly between riverside and interior populations by number and type. Riverside households reported a mean of 3.4 income-producing activities during the previous 12 months (s.d. = 1.5, median = 3.5). Interior households reported a mean of 2.4 activities (s.d. = 1.1, median = 3).

For the number of subsistence-based activities during the previous 12 months, riverside households reported a mean of 5.3 activities (s.d. = 1.5, median = 5.5). Interior households reported 3.3 activities (s.d. = 1.1, median = 3.0).

Mann-Whitney U tests showed a significant difference in the number of income-producing activities and subsistence-based activities between riverside and interior households (Table 4-3).

The null hypotheses that the number of income-producing activities and the number of subsistence-based activities are not significantly different between riverside and interior households can be rejected at the 99% confidence level.

These differences are evident in graphic form. Riverside households report earning income or in-kind payments from a greater number of livelihood activities (Figure 4-1). For riverside households, harvesting of thatching grass (77%), river reeds (73%), and firewood (47%) were the most commonly reported income-producing activities. In the interior, the top two income-earning activities were the collection of pensions (67%) and cash crops (40%). Farm labor was the fourth most frequent riverside activity and third most frequent interior activity, at 43% and 30% respectively.

Interior households reported significantly higher levels of income. Median annual income for riverside households was $89 (N$ 625), with a 95% confidence interval of $37 (N$ 260) to $171 (N$ 1200). Median annual income for interior households was $634 (N$ 4,440 – equal to the annual pension payment per individual), with a 95% confidence interval of $14 (N$100) to $650 (N$ 4,550). The coefficient of variation for household income was high in both locations, 1.33 for riverside households and 0.96 for interior households. Using the Mann-Whitney U test, this difference in median incomes is significant at the 95% confidence level.

Subsistence-based activities also showed differences based on location, with the exception of collecting firewood and growing crops (Figure 4-2). The kind of activities reported by riverside households indicate their proximity to wetland resources such as river reeds and papyrus. Interior households were far more likely to report owning cattle and to own more cattle than their riverside counterparts. Half of interior households surveyed (50%) reported owning

cattle, with a mean of 15.9 heads of cattle per household. By contrast, 27% of riverside households reported owning cattle, with a mean of 2.5 heads of cattle per household.

Food Security: Riverside vs. Interior

Interior households demonstrate greater food security than do riverside households. Respondents were asked whether the household had grown enough food to feed the family for each of five years from 2007 to 2003. Replies for 2007 were overwhelmingly negative in both riverside and interior populations (0% and 7% respectively), indicating the presence of drought in that year. Three of the previous four years show significant differences between the two main population areas (Table 4-4 and Figure 4-3).

The majority of interior households reported growing enough food for their families in each of the other four years: 87% in 2006, 63% in 2005, and 55% in both 2004 and 2003. Riverside households, on the other hand, reported growing enough food for their families less than half the time in all years: 40% in 2006, 33% in 2005, 25% in 2004, and 46% in 2003.

Dividing riverside households by soil type (Figure 4-4) shows a steady decline in food security for households located on sandy riverside soils from 2003 to 2007 (57%, 36%, 29%, 21%, 0%). Riverside households located on soils containing more clay showed more of an upward trend from 2003 to 2006, followed by the drought year of 2007 (36%, 14%, 38%, 56%, 0%).

Figure 4-5 juxtaposes food security for all interior households with food security by soil type for riverside households. For three of the five years, the Chi-Square Test rejected the null hypothesis of zero difference in the proportion of food secure households based on location with a confidence level of at least 95% (Table 4-4). However, the Fisher's Exact test ($n > 50$) did not reject the null hypothesis for riverside households based on soil type. This could be the result of small sample size.

In addition to drought, crop raiding by wildlife also poses a threat to food security. Respondents in both areas expressed concerns about growing wildlife numbers and increased incidents of crop raiding.

Ninety-five percent of households growing crops in 2007 reported crop raiding by wildlife (Figure 4-6). More than three-fourths of households reported crop raiding by elephants (79% riverside, 76% interior). Other top raiders included wild pigs (35% riverside, 59% interior), porcupine (31% riverside, 35% interior) and hippos (52% riverside).

Differences in Land Use

This study finds additional differences between riverside and interior households. These differences involve number of crops grown; years of field ownership; distance to field; size of field; and conservancy membership (Tables 4-5 and 4-6). Interior households grew more crops in 2007 than did riverside households (Figure 4-7). Riverside households grew an average of 2.5 crops (s.d. = 1.4, median = 2). Interior households grew an average of 3.5 crops (s.d. = 1.9, median = 3).

Nearly all households in both location grew maize (87% riverside, 93% interior) (Table 4-2). Fewer riverside households grew millet, a drought-resistant crop, than did interior households (23% vs. 40%). Years of field ownership varied significantly between riverside households (mean= 5.2 years, s.d. = 4.6, median = 4) and interior households (mean = 9.4 years, s.d. = 7.5, median = 6). Further significant differences were found between riverside households on sandy soils (mean = 3.4 years, s.d. = 1.7, median = 3) and riverside households on soils containing clay (mean = 6.7 years, s.d. = 5.7, median = 4.5).

GPS measurements taken during the 10 field surveys found differences between riverside and interior locations in distance to field and size of field (Table 4-5 and Figure 4-8). Riverside households had a mean distance of 0.5 km to the field (s.d. = 0.5, median = 0.4) and an average

field size of 2.5 ha (s.d. = 1.2, median = 2). Interior households had a mean distance of 3.2 km to the field (s.d. = 0.7, median = 3.1) and an average field size of 5.3 ha (s.d. = 2.3, median = 5.7).

In total, 43% of household heads claimed membership in the conservancy. Membership rates were higher for riverside households than for interior households (57% vs. 30%). The Chi-Square Test rejected the null hypothesis of zero difference in the proportion of conservancy membership based on location at a confidence level of 95% (Table 4-6).

Table 4-1. Demographic information for 60 households surveyed

Household Characteristics	River	Interior	All
Avg. age of head of household	40.1	49.9	45
Avg. years of education for head of household	4.8	2.1	3.5
Avg. number of household members	4	3.8	3.9
Avg. number of children under 15 per household	1.7	1.2	1.5
% of male-run households	73%	87%	80%
% of conservancy membership for head of household	57%	30%	43%
% married, head of household	60%	70%	65%

Table 4-2. Percent of households growing crops in 2007

Crop	River	Interior	All
Maize	87%	93%	90%
Sorghum	47%	53%	50%
Melons	33%	50%	42%
Millet	23%	57%	40%
Beans	23%	43%	33%
Pumpkins	17%	33%	25%

Table 4-3. Test for differences in number of livelihood activities per household

Mann-Whitney U Test: Riverside vs. Interior (H_a: Diff > 0)						
Variable	Riverside mean	Riverside std. error	Interior mean	Interior std. error	T-Value	Prob
Number of income activities	3.4	0.28	2.4	0.20	2.72	0.003**
Number of subsistence activities	5.3	0.28	3.3	0.20	5.93	0.000**

** Significant at 99% confidence level

Table 4-4. Proportion tests for food security: riverside vs. interior

Year	Riverside	Interior	Test Statistic	Prob
2007	0%	7%	2.069	0.15
2006	40%	87%	14.067	0.00**
2005	33%	63%	5.41	0.02*
2004	25%	55%	5.39	0.02*
2003	46%	55%	0.436	0.51

** Significant at 99%, * Significant at 95%

Table 4-5. Test for differences in household agricultural practices

Mann-Whitney & Test: Riverside vs. Interior (Ha: Diff > 0)						
Variable	Riverside mean	Riverside std. error	Interior mean	Interior std. error	Z Score	Prob
Number of Crops Grown	2.5	0.25	3.5	0.34	-2.23	0.01**
Years Owned Field - River vs. Interior	5.2 yrs	0.84	9.4 yrs	1.39	2.36	0.01**
Years Owned Field - RivSand vs. RivClay	3.4 yrs (RivSand)	0.45	6.7 yrs (RivClay)	1.43	-1.85	0.03*
Distance to Field - River vs. Interior (n = 10, actual measurement)	0.5 km	0.24	3.2 km	0.32	-2.62	0.00**
Field Area - River vs. Interior (n = 10, actual measurement)	2.5 ha	0.54	5.3 ha	1.03	-1.89	0.04*

** Significant at 99%, * Significant at 95%

Table 4- 6. Proportion test for conservancy membership: riverside vs. interior

Conservancy Membership: Riverside vs. Interior, p1<> P2 (Chi Square)				
Variable	Riverside	Interior	Test Statistic	Prob
Household Member	57%	30%	4.34	0.04*

* Significant at 95%

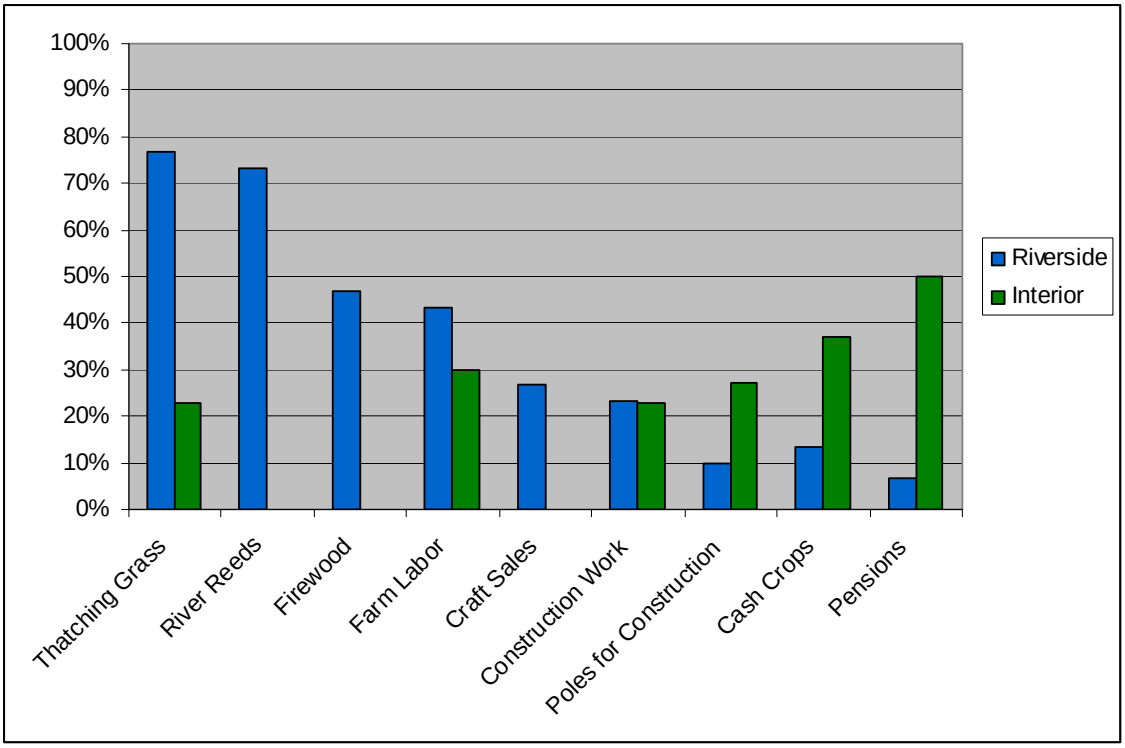

Figure 4-1. Percent of Mashi households earning income from livelihood activities by location

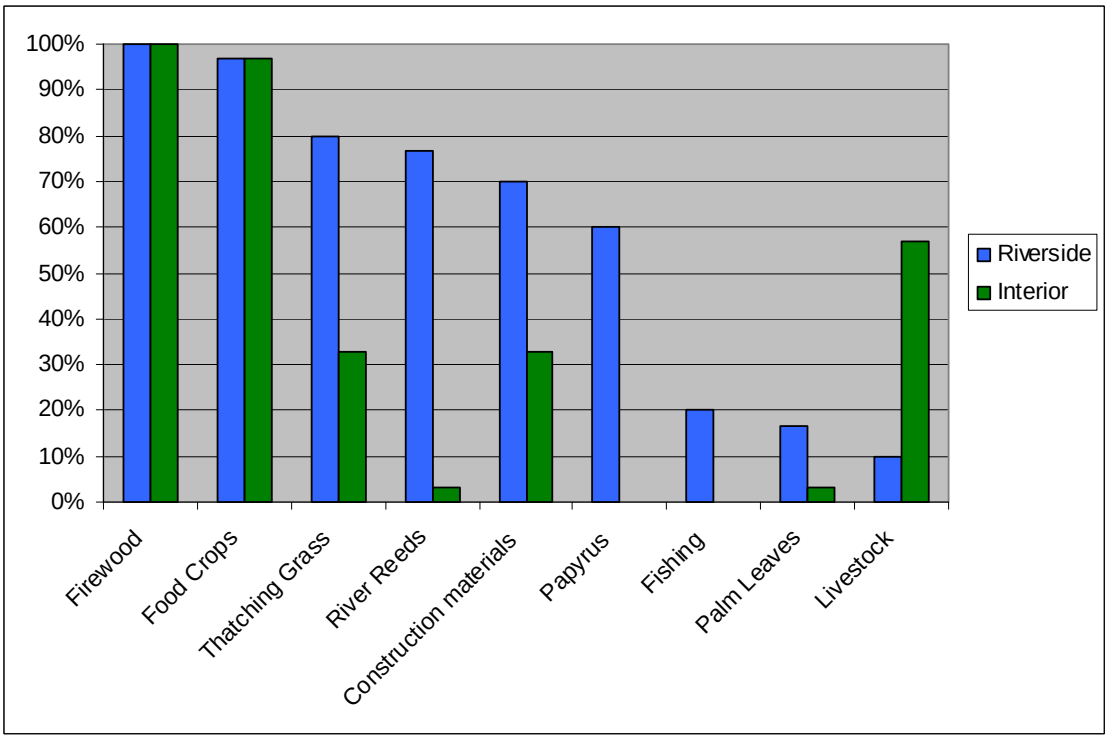

Figure 4-2. Percent of Mashi households getting subsistence from livelihood activities

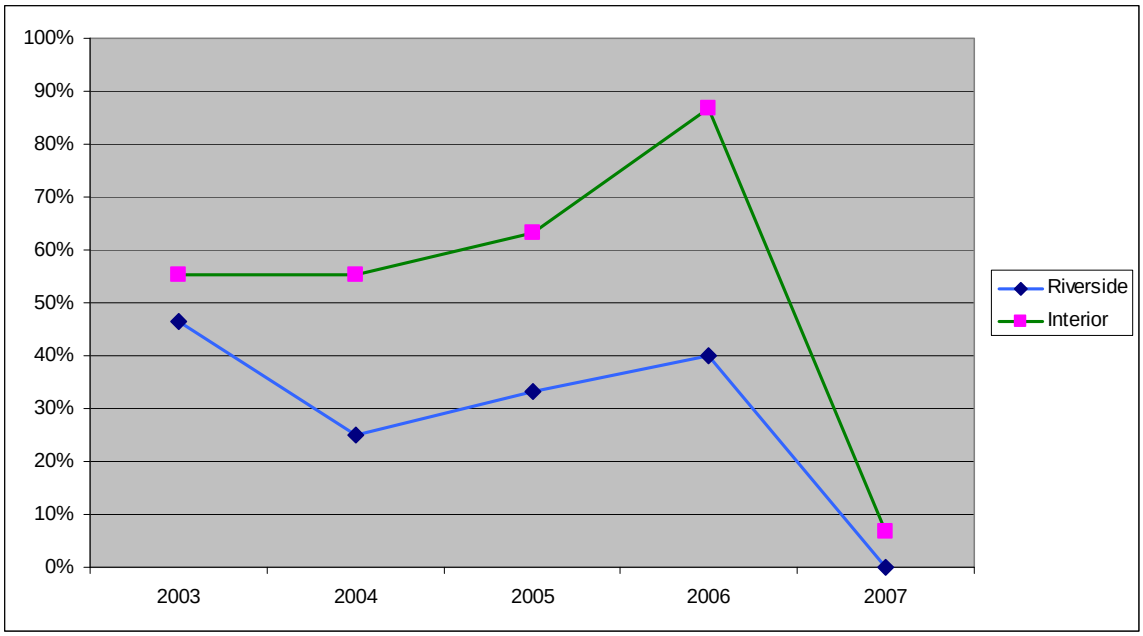

Figure 4-3. Percent of Mashi households growing enough food per year by location

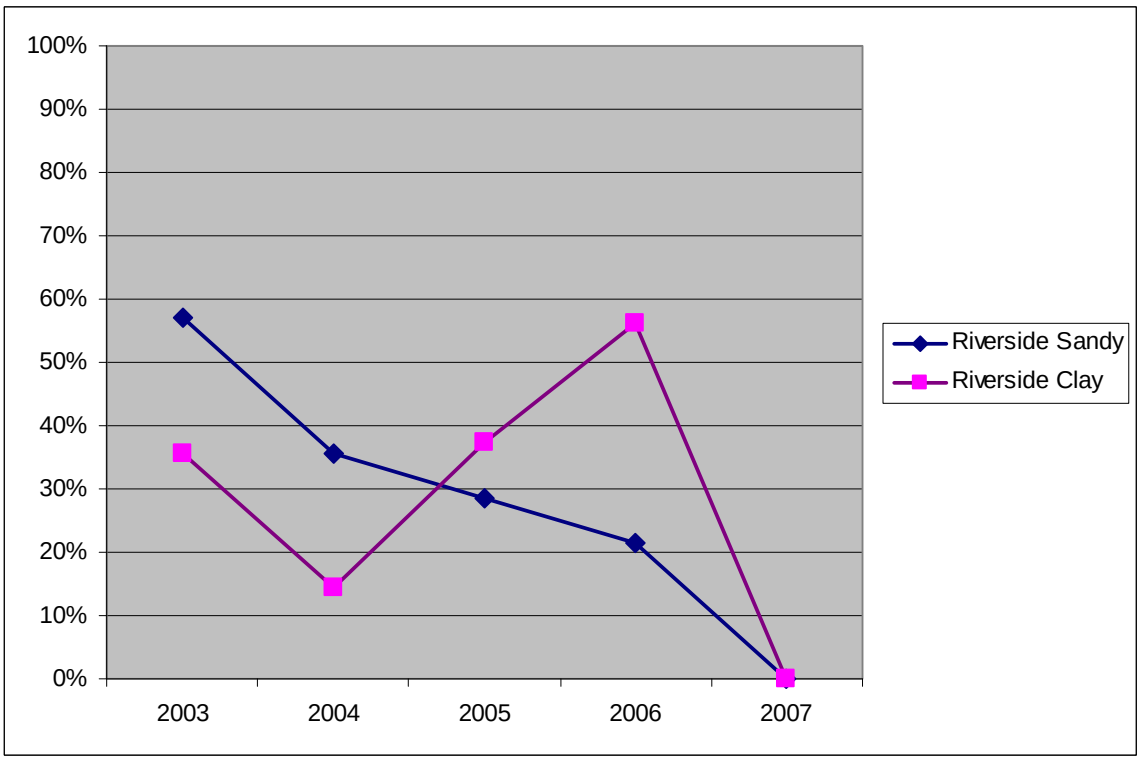

Figure 4-4. Percent of riverside households growing enough food per year by soil type

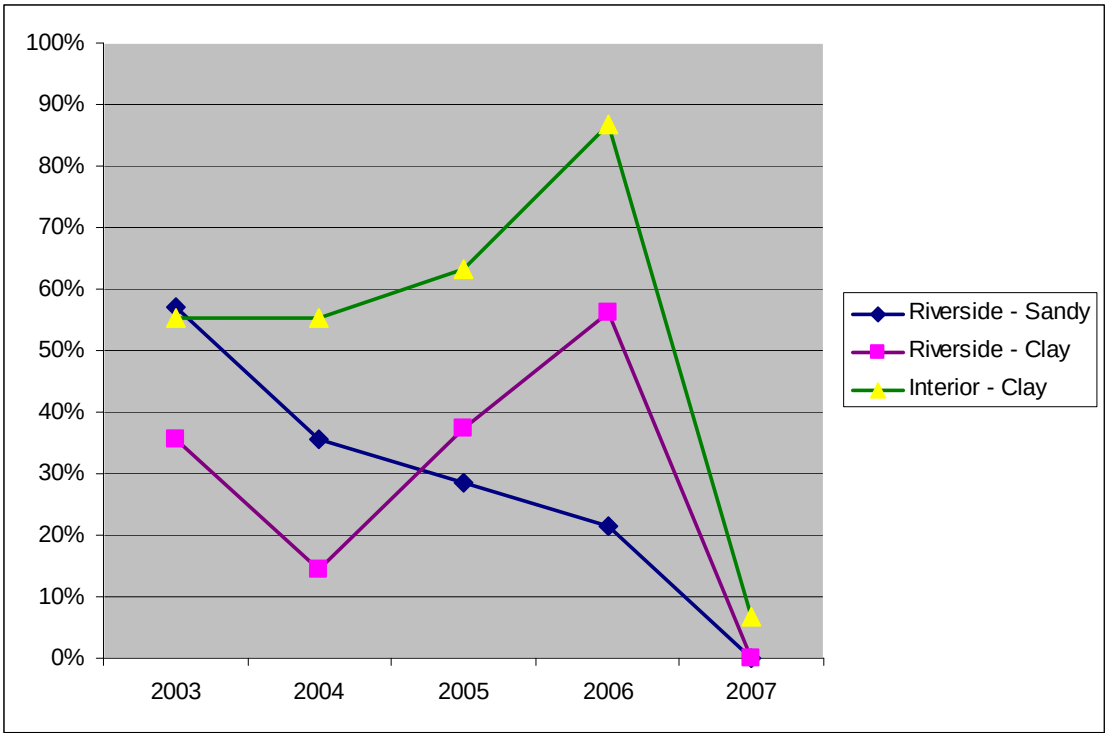

Figure 4-5. Percent of Mashi households growing enough food by location and soil type

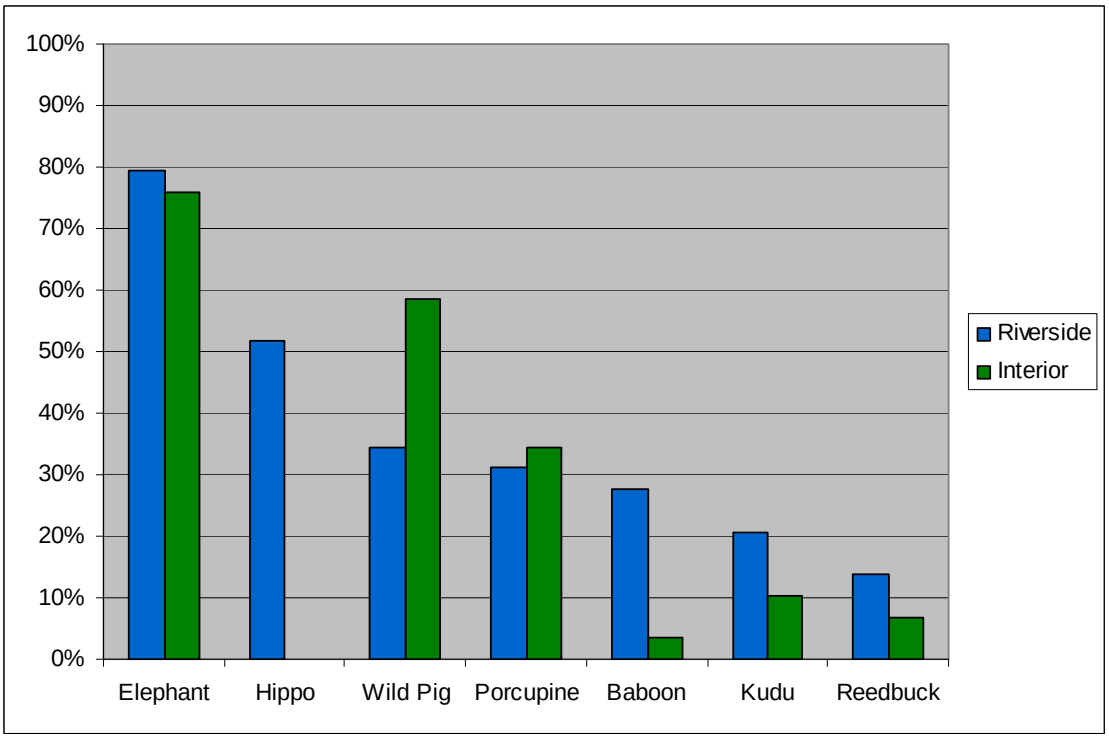

Figure 4-6. Percent of households reporting crop raiders by species

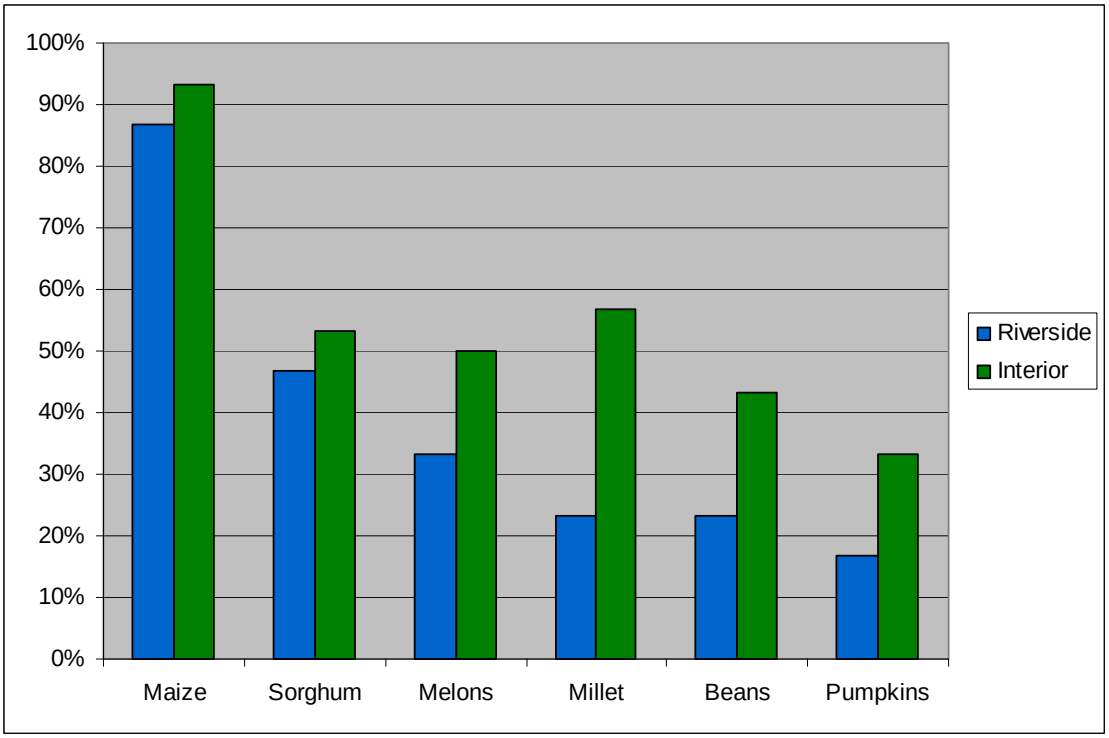

Figure 4-7. Percent of households growing crops by location

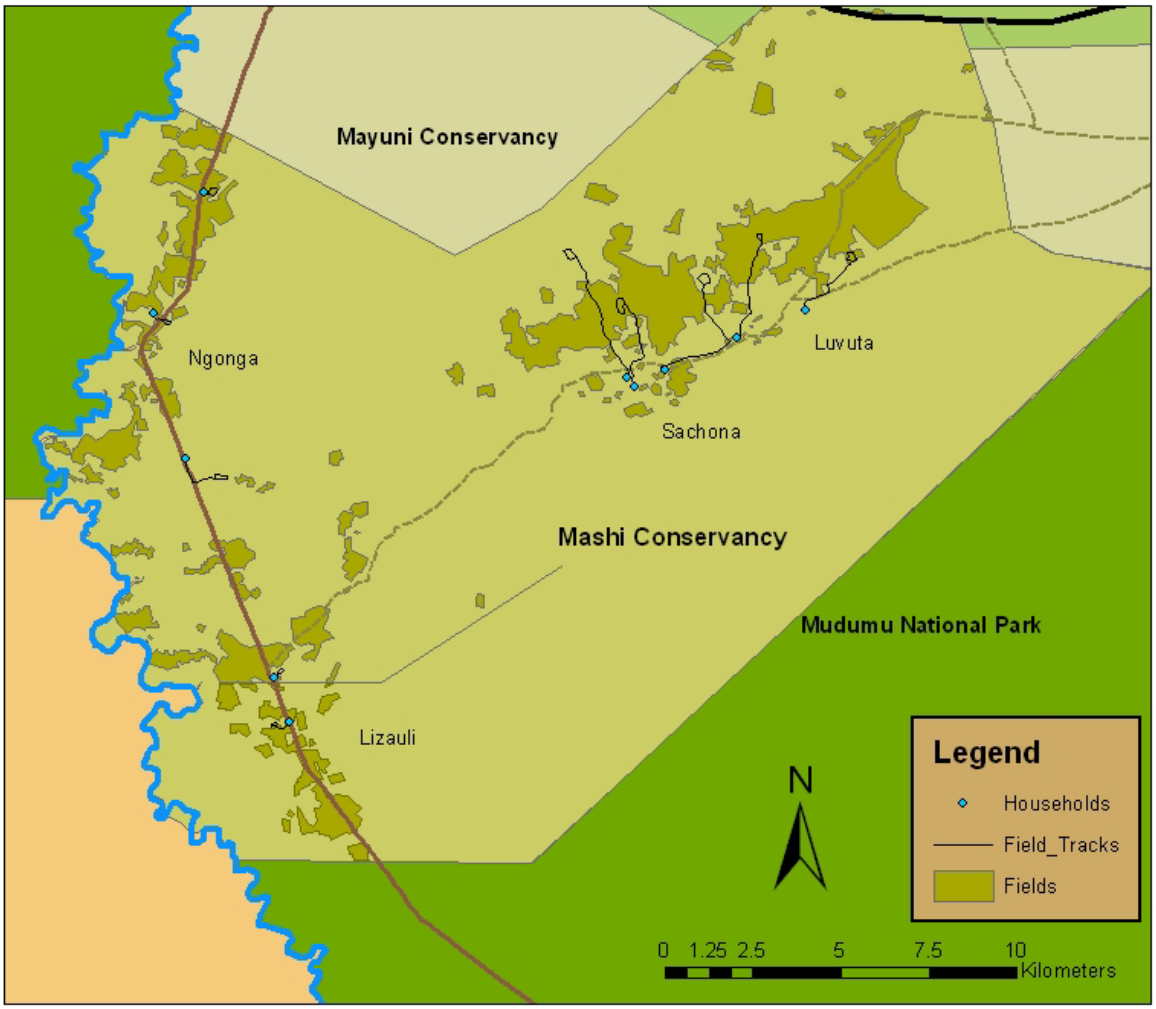

Figure 4-8. Distance to field and field size for 10 households. This map shows field size and location for 10 households randomly selected from livelihood-survey respondents. The fields, which were measured using GPS tracking, suggest an expansion of lands used for agriculture since 2000.

CHAPTER 5
DISCUSSION

Differences between the two populations show that households located along the river interact in fundamentally different ways with their environment than do households located within the interior. Each population exhibits a distinct set of livelihood activities. This suggests that any management action taken by the conservancy will affect household livelihoods differently based on location. This applies not only to riverside vs. interior households but to riverside households on sandy soil vs. riverside households on soil containing sand and clay.

Livelihood Activities

Differences in livelihood activities suggest that households in the two populations areas will respond differently to stressors and shocks such as drought, flooding, human-wildlife conflict, and competition for land brought on by population growth.

The interior population shows a reliance on government pensions and cash crops, suggesting stability through connections with government agencies and regional markets. The riverside population, on the other hand, relies on a broader range of livelihood activities based on resource extraction. Ten percent of riverside respondents reported having a household member employed by one of the three tourism lodges in the area (two within the conservancy and one in neighboring Mudumu National Park). The survey also found four households with conservancy employees: two each in both the interior and riverside locations.

The more diverse set of livelihood activities for riverside households provides a buffer from environmental shocks such as drought and reflect the need for a greater range of activities given the poor soils for producing crops. It also suggests that the riverside population is better positioned to take advantage of the economic benefits from tourism along the river and in the national parks. This would occur not only through employment opportunities at riverside lodges

but also through increased demand for firewood and construction materials such as thatching grass and river reeds. The graded road leading to the lodges and national parks offers greater potential for livelihoods than do the agricultural fields found near the villages. However, if population growth along the river were to exceed economic opportunities provided by tourism, then greater pressure would be placed on existing natural resources.

Self-reported income levels show large confidence intervals. This could indicate that the data are suspect owing to reluctance to be forthcoming about income earned or inability to accurately recall income over time. Consequently, no inferences are drawn from this data.

Food Security

Results regarding food security raise questions about the strategies households use to survive in years with inadequate harvests. The problem seems especially difficult along the riverside, where both crop production and income are lower.

A 50-kg bag of maize cost about $14 (N$ 100) at the time of the survey. Respondents who were asked how long 50 kg of maize lasted their households reported an average of 12.6 days (n=18; average household size = 4.2). That translates to 29 50-kg bags required to feed the average household over the course of a year, or about $410 (N$ 2,900) in annual food costs for grain alone.

Given the low cash incomes reported by residents in both parts of the conservancy, it becomes clear that methods other than purchasing grains and other food items are necessary for maintaining sustenance within the household. This shortfall could be overcome through a combination of in-kind payments, assistance from relatives, greater reliance on veld products and fishing, and illegal hunting. These kinds of responses in years with low crop production can have a major impact on land and resource use.

This situation is especially problematic for riverside households on sandy soils, where food security is lowest. The steady decline in food security in that particular area over the last five years suggests that crop yields there are being affected by more than variations in rainfall and that soils in the area may have lost their ability to support the population through crop production. While differences in the proportion of food-secure riverside households based on soil did not show a statistical difference, this is likely the result of small sample size (n=16 on clay-containing riverside soils, n= 14 on sandy riverside soils).

Across the conservancy, increased crop raiding by wildlife also must be considered. Caprivi residents perceive that human-wildlife conflicts, mostly in the form of crop raiding, have increased since CBNRM began (Mulonga et. al., 2003). Game species are rebounding in areas where they haven't been seen for years, and elephants are repopulating areas where they were historically distributed. According to Mulonga et. al. (2003), elephants are responsible for three-quarters of reported crop damage in Caprivi, a finding that is consistent with data contained in this study. Human-wildlife conflicts deepen poverty by reducing both food supplies and options for earning cash. The problem worsens as wildlife becomes habituated to deterrent strategies such as drum beating and fire (O-Connell-Rodwell et. al., 2000). Survey respondents report that elephants have become aggressive toward farmers who try to keep them out of fields.

O'Connell-Rodwell et. al. (2000) conclude that because conflicts with elephants will continue as long as rural people practice agriculture, either elephants or humans have to be contained in order to resolve conflicts. Proposals to create a zonation scheme that would consolidate agricultural fields in conservancies along the Kwando River are being discussed within government agencies and NGOs but are likely to encounter resistance from farmers who are reluctant to abandon the fields they now claim. When asked about zonation, nine of 10 field-

survey respondents said they would be unwilling to move their fields. The remaining respondent said she would move her field only if the new location were nearby, an unlikely scenario given that she lived on Mashi's least fertile soils.

Household survey respondents spoke of the presence of elephants in places where none had been found in recent years, suggesting that crop raiding pressures may increase. This could pose a serious problem since the interior lacks the diversity of resources found along the river. On the other hand, people in the interior appear to have more cash and assets, indicating economic linkages that provide resilience in the face of declining harvests from crop raids and drought.

Differences in Land Use

The differences found between riverside and interior households point to different human-environment interactions with different consequences for each location.

Riverside households occupy fields for fewer years than do interior households and have smaller fields closer to their villages. This suggests a quick turnover of land used for crop production as nutrients in the soil are exhausted. This practice could result in negative effects such as bush encroachment as fields are abandoned and taken over by secondary growth. At lower population levels, this strategy might prove effective in dealing with infertile soils, but at higher population levels it could mean that land gets exhausted more quickly as abandoned fields are put into use at a faster rate.

If conservancy efforts to strengthen community benefits from wildlife are successful, riverside populations might turn away from crop production when possible to focus on economic opportunities from tourism and safari hunting. This too could attract population growth and a larger presence of cattle as personal wealth increased, adding to existing land use pressures.

Interior households have larger agricultural fields farther from the village that they've owned for a longer time. This suggests that these fields are productive enough to outweigh the additional costs of travel time and effort to plow, plant, guard, and harvest. The higher number of crops grown in interior fields reinforces the finding that cash crops are a viable livelihood activity there. However, the combination of increased crop raiding by wildlife and human population pressure could change that.

The difference in rates of conservancy membership between the two locations is consistent with these agricultural differences. Interior farmers stand to lose more from crop raiding than they gain from direct financial benefits that the conservancy brings. Riverside households, on the other hand, gain from a number of opportunities created by tourism and safari hunting. The conservancy office, not coincidentally, is located along the river. This also means that Namibian wildlife officers and NGO staff members are more accessible to people living along the river, and this could create a more favorable view of conservancy efforts.

As it stands now, interior households have the stronger economic hand overall. Wealth in Mashi conservancy is relative, but a comparison of the most common assets found at the household level shows that riverside households lag in terms of what they own (Figure 5-1).

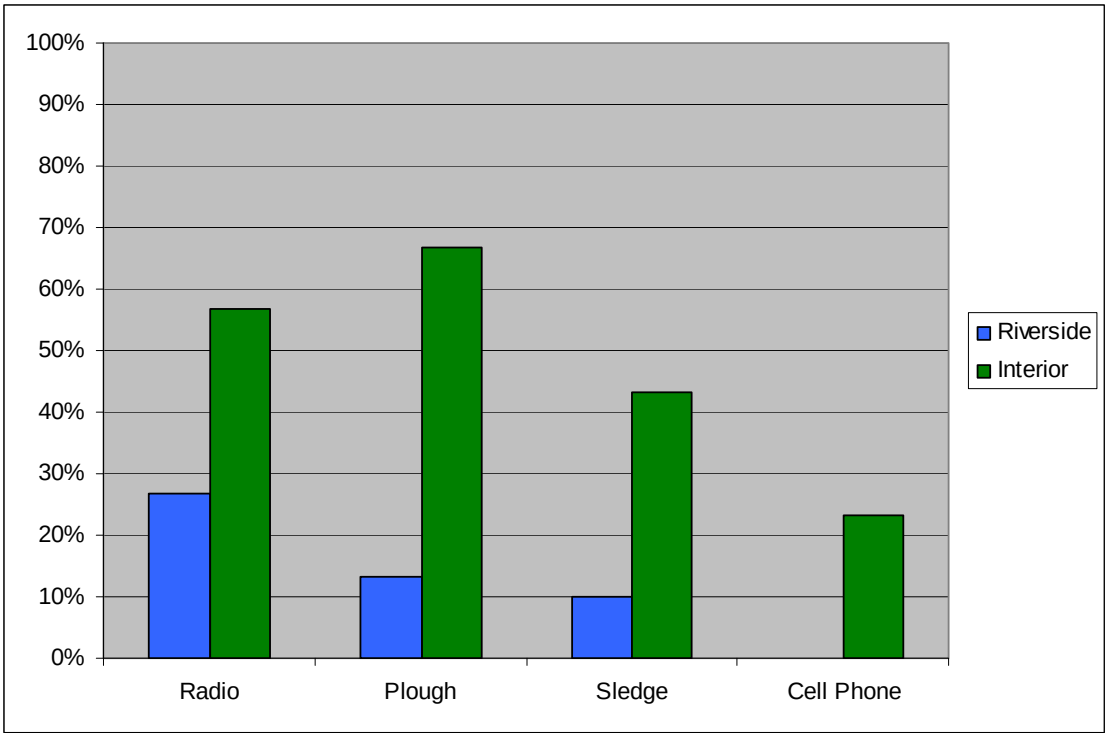

Figure 5-1. Percent of Mashi households owning assets by location

CHAPTER 6
CONCLUSION

As stated previously, the establishment of the conservancy signals a potential shift from a subsistence-based agricultural system to a wildlife-based economy. For some households, this shift represents a boost in income. Conservancy and tourism jobs on average pay better than all other reported income with the exception of pensions (Figure 6-1). The conservancy is also likely to bring other benefits that are difficult to measure at the household level, such as an increase in development projects. However, Mashi comprises two populations with distinct combinations of livelihood activities, and these differences must be taken into account by conservancy management (Table 6-1).

As conservancies succeed at managing for wildlife, they must contend with increasing conflicts between wildlife and humans, most notably crop raiding by elephants (Osborn and Parker, 2003). Most methods to reduce these conflicts have proven to be either too expensive or ineffective and require integrated management solutions that involve local farmers in arriving at effective, low-tech solutions. Only four years into its existence at the time of the survey, Mashi Conservancy had yet to develop an institutionalized approach to reducing these conflicts.

Small-scale community-based conservation programs could ultimately prove to be important for poverty alleviation (Sanderson and Redford, 2003), and a reduction in poverty should help alleviate adverse effects on the environment from livelihood pressures (Kgathi et. al., 2006). But even in cases where tourism and safari hunting provide sufficient incomes for survival, households are likely to continue investing time and effort in diverse livelihood activities for protection against the risk of job loss. Cattle raising in particular is often seen as insurance against unemployment (Berzborn, 2007), as cattle provide plowing, manure for fertilizer, and meat and milk (Barrett, 1991). Cattle grazing occurs on communal land, reducing

costs associated with owning livestock. An increase in cattle production would decrease the amount of land used for wildlife and likely increase the risk of human-wildlife conflicts.

It should be noted that a number of survey respondents in both locations expressed concerns about restrictions the conservancy might impose on harvesting of thatching grass, river reeds, and timber products. The conservancy is perceived by many respondents as the responsible entity for all restrictions and problems that they may encounter. However, increases in wildlife numbers would occur regardless of whether the conservancy existed, as would lack of access to the national parks and restrictions on hunting within the conservancy area. Ninety-five percent of all respondents reported that crop raiding by wildlife is increasing, and 43% of them specifically singled out the conservancy when asked why crop raiding had increased.

Weak local opposition to wildlife conservation gets expressed in the illegal use of protected resources (Brockington, 2005). Elephants in particular pose a serious risk to subsistence and cash crops. A majority of respondents in both populations reported crop raiding by elephants. This suggests that distance from the area's only permanent water source, the Kwando River, does not reduce the threat of elephant damage. Most likely this results from the conservancy's location on an elephant migration corridor. But as noted previously, survey respondents who were asked about the zonation proposal expressed a strong reluctance to abandon the fields they currently own even if the new system were to guarantee water for irrigation and protection against elephants and other crop raiders. This could be the result of lingering distrust of government interventions from previous decades, which included the forced relocation of villages (Rice, 1997), and from early conservation efforts that failed to engage communities and focused instead on anti-poaching measures.

Research is needed to understand shifts in rural livelihood strategies in Africa and to evaluate how resource-use policies and practices affect livelihoods (Homewood, 2005). Doubts have been raised about CBNRM's ability to achieve the dual objectives of biological conservation and economic development (Hackel, 1998; Agrawal and Gibson, 1999; Kiss, 2004). Consequently, more studies are needed to evaluate CBNRM outcomes (Blaikie, 2006). Previous studies have found that CBNRM programs have had difficulty improving the livelihoods of local people while also conserving wildlife (e.g., Murphree, 2004). In cases where a CBNRM program does distribute cash benefits to households, some beneficiaries may then invest in land uses that conflict with wildlife, such as field expansion and livestock (Murombedzi, 1999).

Adams and Hulme (2001b) ask how tradeoffs between biodiversity conservation and local livelihoods should be negotiated among the diverse objectives of different stakeholders. CBNRM's benefits at the household level need to be strong enough to keep local people from seeking economic alternatives and land use options that hurt conservation (Hackel, 1998; Du Toit, 2002).

A fundamental problem for people within the study are is the question of survival. How do people with limited opportunities for generating cash survive when wildlife and drought destroy their crops? Who wins and who loses as things now stand? Relevant social-ecological information and decision-support tools improve the chances of success for community-based conservation programs in managing wildlife sustainably (Du Toit, 2002). As part of the largest elephant range in southern Africa, Mashi Conservancy offers a valuable case study in understanding these competing needs.

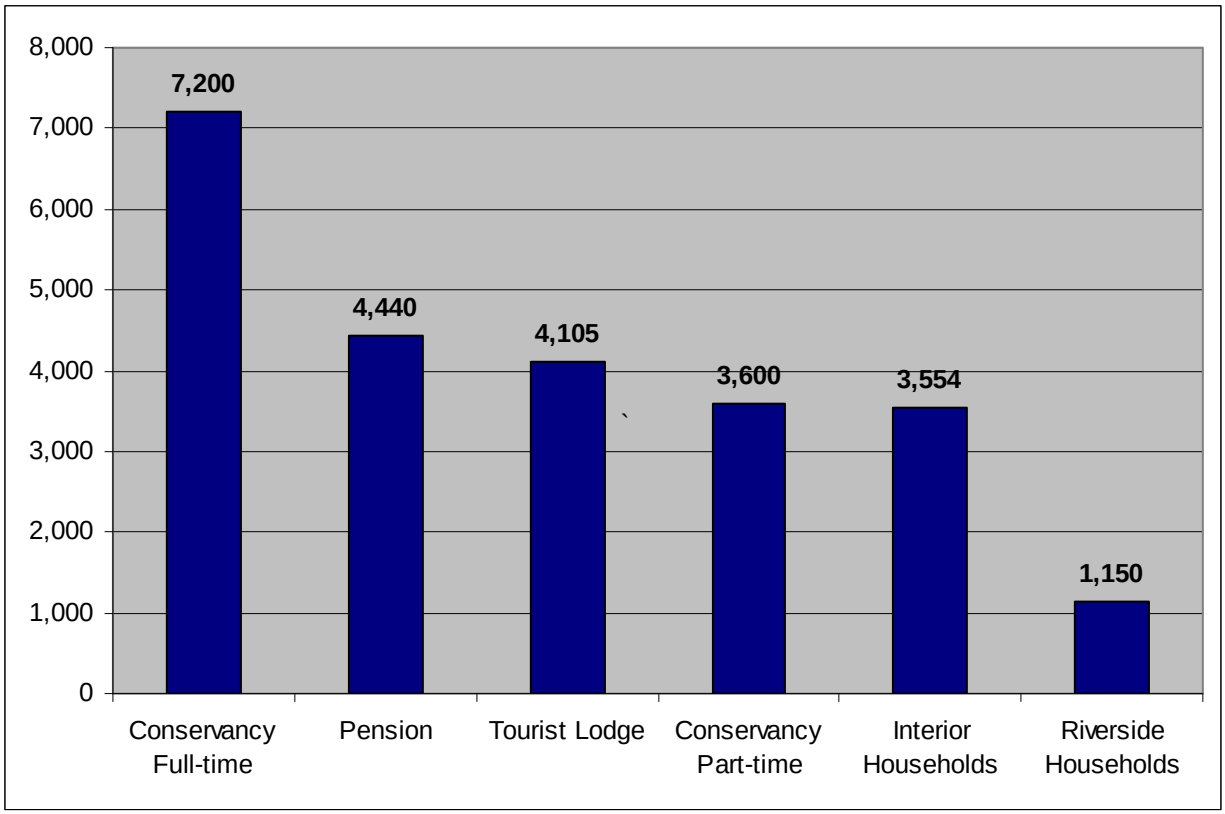

Figure 6-1. Average annual income (N$) of Mashi households (N$ 7 = US $ 1)

Table 6-1. Summary of key findings and management implications.

Variable	Riverside	Interior	Implications
% conservancy membership	57%	30%	Conservancy support is strongest along the riverside, where people stand to gain the most from a wildlife-based economy.
Avg. number of income activities	3.4	2.4	Income-producing and subsistence-based livelihood activities are more diverse along the river and rely more upon the area's natural resources.
Avg. number of subsistence activities	5.3	3.3	
% owning plough	13%	67%	Interior households are generally wealthier than riverside households and are better equipped for crop production.
% owning cattle	27%	50%	
% food secure in 2007	0%	7%	Interior households are better able to grow enough food for their families, a situation that could be threatened by growing wildlife numbers. Poorer soils in riverside areas indicate the need to find alternative means of earning livelihoods. Drought in 2007 had a severe impact on both areas.
% food secure in 2006	40%	87%	
% food secure in 2005	33%	63%	
% food secure in 2004	25%	55%	
% food secure in 2003	46%	55%	
% reporting crop raiding by elephants	79%	76%	Both areas reported an increase in crop raiding by wildlife. Distance from the river does not reduce the threat of crop raiding by elephants. As Caprivi's elephant population grows, crop raiding will continue to increase in both areas.
% reporting crop raiding by any wildlife	97%	93%	
% reporting increase in crop raiding	96%	93%	
% growing maize	87%	93%	Maize, a potential cash crop, is popular in both areas despite its sensitivity to drought. Millet, which is drought-resistant, was planted more frequently in the interior.
% growing millet	23%	40%	
Avg. number of crops grown	2.5	3.5	
Avg. field size (actual, n=10)	2.5 ha	5.3 ha	Values for field size, distance to field and number of years owned were all greater in the interior, confirming that crop production is more valuable there and worth more time and effort.
Avg. distance to field (actual, n=10)	0.5 km	3.2 km	
Avg. years owned field	5.2 yrs	9.4 yrs	

APPENDIX A
HOUSEHOLD LIVELIHOOD SURVEY

The survey found on the following pages is the final revision of the household livelihood survey as administered in the field in June and July 2007. During the course of administering the survey, several questions were dropped in order to streamline the interview process and others refined to capture important information that wasn't anticipated during the creation of the first field version. The data analysis included only information consistently collected for all 60 households.

One question in particular would benefit from further revision: *2) Have you always lived here? If no, when did you move here?*

Respondents consistently gave an affirmative response, even in situations when it later became evident that they had moved to the village at some point in the recent past. In other cases, the village itself had moved, and the survey lacked a formal method for capturing that information. A better set of questions might be:

- How long have you lived in this village?
- Has this village ever moved? If yes:
    - When did it move?
    - Why did it move?
    - Did you live in the village before it moved?
- Were you born in this village?
    - If no: When did you move to this village?

While this set of questions may seem redundant and would likely be refined, it would help get past resistance to this question. It appears that many respondents have concerns that they might be subjected to additional moves ordered by the government or traditional authorities. They also may be concerned that they will miss out on the possibility of future benefits if they self-report as not being a lifetime member of a particular village.

Getting past that obstacle would be beneficial for collecting important data concerning the movement of people into and within the conservancy.

INTERVIEW NUMBER ____

DATE:
TIME:

GPS COORDINATES
NORTHING _____
EASTING _____

NAME OF INTERVIEWER _____

NAME OF INTERPRETER _____

CONSERVANCY _____

KHUTA _____

VILLAGE _____

1. GIVE BASIC IRB INFORMED CONSENT –
a. This survey should take about one hour.
b. You do not have to answer any question you do not feel comfortable with.
c. All Information is confidential and anonymous
d. You can stop the interview process at any time
e. You can ask for clarification on any question at any time

2. POINT OUT THAT THIS QUESTIONNAIRE IS ABOUT THE INDIVIDUAL AND THE INDIVIDUAL'S HOUSEHOLD, AND NOT THE COMMUNITY.

HOUSEHOLD DEMOGRAPHIC INFORMATION

1. For each household member, please tell us the following:

Relationship with head of household	Age or date of birth	Male/Female	Education Level	Salaried Employment	Is person living in household for at least 9 months a year?	If 18, is person a registered member of conservancy?
HEAD						

2. When did you move to this village?

3. Has this village ever moved? If yes … When? Why?

4. What is your tribe?

___ Mayeyi ___ Mafwe ___ Other _____
___ Mbukushu ___ Khwoe
___ Totela ___ Mbalangwe

INFRASTRUCTURE

5. House:

___ Traditional Mud
___ Traditional Reed
___ Cement block ___ Other _____

6. Roof:

___ Thatch ___ Other _____
___ Reed
___ Tin

7. Courtyard:

___ Yes ____ No

8. Main source of lighting in household (tick one):

___ Electric power line ___ Firewood
___ Paraffin ___ Generator
___ Gas ___ Solar
___ Candles ___ Other (specify) _____

9. Main source of cooking in household (tick one):

___ Electric power line ___ Cow dung
___ Paraffin ___ Generator
___ Gas ___ Solar
___ Firewood / charcoal ___ Other (specify) _____

10. Tick the following assets your household owns:

Asset	Tick if own	Asset	Tick if own
Car		Water Storage Tank	
Bicycle		Pit Latrine	
Canoe		Radio	
Donkey Cart		Television	
Sledge		Cell Phone	
Plough		Generator	
Tractor		Fishing Net and Hooks	
Hunting Gear		Other - specify	

11. If you don't own a car and need transport, how would you get to Kongola?

12. How would you get to the hospital?

13. If you don't own a cell phone and need to contact someone, how easy is it for you to get access to one?

LIVELIHOOD STRATEGIES

14. What are the things that you and other members of your household do to make money or receive in-kind services? Please list all activities and what you earn from each in a year's time. Also, please rank their importance to your household, with "1" being most important.

Activities or Sources of Income or In-kind Services	Tick if household activity or source	Income (in $N or type of in-kind service)	Rank of Importance
Cash Crops			
Livestock Sales			
Fishing			
Formal Employment			
Pensions			
Remittances			
Farm Labour			
Craft Sales			
Firewood			
Poles for Construction			
River reeds			
Papyrus			
Thatching Grass			
Palm Leaves			
Water Lillies			
Nuts and Berries			
Other:			
Other:			
Fill in additional items on the back of this page			

15 Has the ranking of these activities changed since the creation of the conservancy? If so, how?

16. Aside from earning money, what are the things that you and your household do to provide for yourselves?

Activities or Sources for Household Use	Tick if household activity or source
Food Crops	
Livestock	
Fishing	
Firewood	
Poles for construction	
Reeds	
Papyrus	
Thatching Grass	
Palm Leaves	
Medicinal Plants	
Edible Plants	

17. Have the things that you do for your household changed since the creation of the conservancy? If yes … how?

18. Was anyone in your household employed last year by a tourist lodge, tour operator, safari hunter, conservancy, or national park? If so:

Member of household	Employer	How many months last year?	Salary

19. Did anyone in your household earn other types of income last year from tourists, lodges, tour operators, safari hunters, conservancies or national parks? If so:

Member of household	Product sold or type of work	How many months last year?	Cash earned

20. Please list the crops that you planted and the amount you harvested in the last growing season. How much of each crop do you use for food and how much do you sell? For sales, please include $N per unit.

Crop	Unit (e.g. number of 50-kilogram bags)	Amount used for food	Amount sold for cash	Price in $N per unit sold	Where sold? (local, in town, or both)
Maize					
Sorghum					
Millet					
Pumpkins					
Beans					
Melons					
Ground Nuts					
Additional items on back of page.					

21. Field Information:
    How many fields do you own? _____
    How large are your fields? _____
    How long have you owned these fields? _____
    How far away are your fields? _____

22. How much of your field(s) did you plough last season?

23. How many years do you plough the same field before letting it rest?

24. Do you use any fertilizers? If so, which kind? How much does it cost?

25. How did you get the rights to land for cultivation?

26. Do you have any written records that describe your land or resource rights? If yes, what is it?

27. Who will inherit your field(s)?

28. Please indicate the number of livestock your household owns:

Livestock species	Number
Cattle	
Goats	
Chickens	
Others	

29. Where do you graze your cattle? How does this vary at different times of the year?

30. Has the quality of grazing land changed? If yes … how?

EXPENSES INFORMATION

33. Please list all your expenses for a year's time. How much do you spend on each expense? Example: $N 200 per year or $N 30 per month.

Expense category	Approximate amount (cash or in kind)	Time frame (per year, per month, etc.)
Food		
School		
Transport		
Medical Care		
Clothes		
Labor		
Building Materials		
Household electronics (radio, TV, cell phone…)		
Other		

FOOD SECURITY

34.

Year	Did you grow enough food for your family? (yes or no)	Did you get food aid? (yes or no)	If yes, who gave you the food aid?
2007			
2006			
2005			
2004			
2003			

RESOURCE USE AND AVAILABILITY

35. What is your drinking water source in the dry season?

36. Where is it located? How long does it take to get there?

37. Has your source of drinking water changed? If yes, when? What was your source before?

38. Where is your water source for livestock in the dry season?

HUMAN-WILDLIFE CONFLICTS

39. Did you have any problems with crop raiding this season?

Animal	Crops raided	Number of raids	Amount of damage	Did you report this? To whom?

40. Do you guard your fields? If yes, how do you guard them?

41. For how long do you guard them?

42. Has crop raiding by wildlife increased or decreased or remained the same since as far back as you can remember?

43. If yes, how has it changed? Why?

44. Did you have any problems with predators attacking livestock this year?

Predator	Livestock species	Number of kills	Number of injuries	Did you report this? To whom?

45. How do you protect your livestock?

46. Have predator attacks on livestock increased or decreased or remained the same since as far back as you can remember?

47. If yes, how has it changed? Why?

48. Were any household members injured or killed by wildlife this year? If so, what animals were involved?

RISK PERCEPTION

In some places, people face many problems, including things that are uncertain and hard to predict. For example, in some places people are worried about drought, some people are worried about livestock diseases, and some are worried that other people might take their land. Now we would like to ask you about the things that you are worried about – what things might be a problem for you or your family?

49) First, list these problems in the table below.
50) Then, rank these problems: Which is the biggest problem or the most serious? Which is the next most serious, etc.?

Problem/concern/worry	Rank

Response to unfavorable events: Now we would like to talk with you about your experience with the worries that you have identified. For each of the problems you listed:

51) Who do you know that has experienced this problem or event? (You or someone in your household? Someone in your village? Someone in your conservancy? Someone further away?) If so, what happened? When?

Rank	Risk/concern	Who experienced this?				When?	What happened?
		Someone in house-hold	Someone in village	Others in conserv-ancy	Someone further away		
1							
2							
3							
4							
5							

52. Name of Interviewee (Optional)

53. Would it be OK to contact you again in coming weeks or next year?

APPENDIX B
FIELD SURVEY

FIELD SURVEY NUMBER ____
LIVELIHOOD SURVEY NUMBER ____

DATE:
TIME:

TICK AFTER TRACKING FROM HH TO FIELD _____
TICK AFTER TRACKING FIELD _____

GPS COORDINATES for center of field
NORTHING _____
EASTING _____

NAME OF INTERVIEWER _____

NAME OF INTERPRETER _____

CONSERVANCY _____

KHUTA _____

VILLAGE _____

1. GIVE BASIC IRB INFORMED CONSENT –
a.. This survey should take about one hour.
b. You do not have to answer any question you do not feel comfortable with.
c. All Information is confidential and anonymous
d. You can stop the interview process at any time
e. You can ask for clarification on any question at any time

2. POINT OUT THAT THIS QUESTIONNAIRE IS ABOUT THE INDIVIDUAL AND THE INDIVIDUAL'S HOUSEHOLD, AND NOT THE COMMUNITY.

I. Plot Characteristics – Enumerator Observations

1. What is the topographic position of the plot?

___ Flat upland ___ Flat valley
___ Slope ___ Other

2. How is the plot sloped? Scale of 1 to 5:
Highly sloped = 1, Medium sloped = 3, Flat = 5

3. What kind of water bodies do you see near the plot? Describe.

4. What color is the soil of this plot?

___ Yellow ___ Gray
___ Brown ___ Red
___ Black ___ Other

5. What is the texture of the soil of this plot?

___ Sandy ___ Silt
___ Gravelly ___ Clay
___ Rocky

6a. Is the plot surrounded by similar plots in terms of the characteristics described above?

___ Yes ___ No

6b. If no, briefly describe the differences.

7. What is the vegetation on this plot?

___ No vegetation, bare soil ___ Field Crop (specify) _____
___ Fallow – mostly grass, forbs ___ Vegetable (specify) _____
___ Fallow – mostly bush ___ Tree Crop (specify) _____
___ Fallow – mostly trees

8. Is most of the surrounding land forested?

___ Yes ___ No

9a. Are village houses present on the perimeter of the plot?

___ Yes ___ No

9b. If yes, how many? ____

II. Changes over Last Five Years – Ask Informant

1. In what year was this plot cleared for agriculture?

2. What crops have you been growing on this plot during the last five years? How many kilograms, bags, etc., have you harvested from this plot?

Year	Crops (include "bush" and "fallow" when appropriate	Units of harvest	N$ from crop sales
2007			
2006			
2005			
2004			
2003			

3. What is the total number of hectares for this plot? For all plots?

4. How much N$ did you spend on your crops?

Year	N$ Labor	Your Time - Labor	N$ for guarding field	Time spent guarding field	N$ for harvest	Time for harvest
2007						
2006						
2005						

5. Do you apply manure to this plot?
___ Yes ___ No

6. In the last five years, have you ever applied chemical fertilizer to this plot?
___ Yes ___ No

7. If yes:

Year	Type (N-P-K number)	Amount (bags, kg., or other unit)	Number of applications
2007			
2006			
2005			
2004			
2003			

III. Access to Water Source

1. How do you water this plot?

2a. Has that changed during the last five years?

___ Yes ___ No

2b. If yes, How?

3a. In each of the last five years, how much of your crops have you lost to crop raiding by wildlife?

3b. For the crops that remained, how much have you lost to flood?

3c. For the crops that remained, how much have you lost to drought?

Year	% lost to wildlife	% lost to flood	% lost to drought
2007			
2006			
2005			
2004			
2003			

IV. Soil Description

1. How would you describe the soil on this plot?

2. How fertile do you think this plot is?

___ Very fertile ___ Poor

___ Fertile ___ Very poor

3a. Has the fertility of the soil changed since you started farming this plot?

___ Yes ___ No

3b. If yes, how has it changed? Why?

4. Is soil loss considered to be a significant problem for this plot?

___ Yes ___ No

5. In which of the last five years did this plot lose a significant amount of soil? What was the cause (wind, rain, other)?

Year	Tick if soil loss	If yes
2007		
2006		
2005		
2004		
2003		

V. Zonation

1a. Would you be willing to move to a new field if it meant that your crops had greater protection from wildlife and water on site?

___ Yes ___ No ___ Don't Know

1b. If yes, how far (in distance or time) would you be willing to travel to plough and harvest your crops if it meant that they had greater protection from wildlife?

1c. If no, why would you be unwilling to relocate?

2a. Do you think that it would be a good idea to allocate certain parts of this conservancy as "wildlife only" and other parts as "agriculture only" and "grazing only"?

___ Yes ___ No

2b. Why?

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