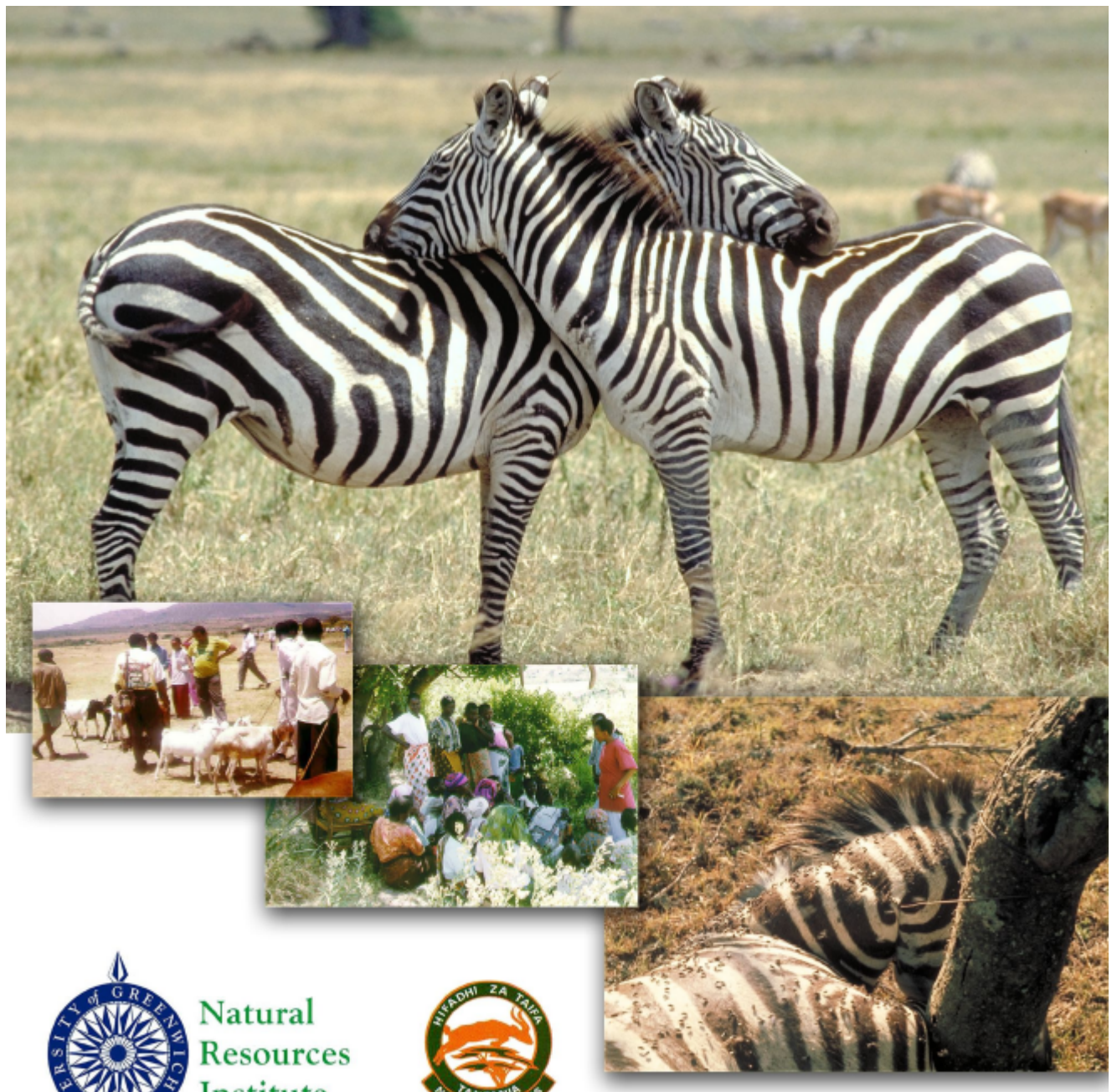# Sustainable Use of Wildland Resources: Ecological, Economic and Social Interactions

An Analysis of Illegal Hunting of Wildlife in Serengeti National Park, Tanzania

Ken Campbell, Valerie Nelson and Martin Loibooki

June 2001   Main Report

Natural Resources Institute

This report should be cited as:

Campbell, K. L. I., Nelson, V. and Loibooki, M. (2001). *Sustainable use of wildland resources, ecological, economic and social interactions: An analysis of illegal hunting of wildlife in Serengeti National Park, Tanzania.* Department for International Development (DFID) Animal Health Programme and Livestock Production Programmes, Final Technical Report, Project R7050. Natural Resources Institute (NRI), Chatham, Kent, UK. 56 pp.

Sustainable Use of Wildland Resources: Ecological, Economic and Social Interactions

An Analysis of Illegal Hunting of wildlife in Serengeti National Park, Tanzania

FINAL TECHNICAL REPORT, 2001

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Executive Summary

A common problem for protected area managers is illegal or unsustainable extraction of natural resources. Similarly, lack of access to an often decreasing resource base may also be a problem for rural communities living adjacent to protected areas. In Tanzania, illegal hunting of both resident and migratory wildlife is a significant problem for the management of Serengeti National Park. Poaching has already reduced populations of resident wildlife, whilst over-harvesting of the migratory herbivores may ultimately threaten the integrity of the Serengeti ecosystem. Reduced wildlife populations may in turn undermine local livelihoods that depend partly on this resource. This project examined illegal hunting from the twin perspectives of conservation and the livelihoods of people surrounding the protected area. The research aimed to improve understanding of factors related to or responsible for the promotion of game meat hunting as a viable livelihood activity.

Illegal hunting of wildlife in the Serengeti was closely linked to income related poverty. Arrested hunters came from the poorest sections of communities in a wide area adjacent to the park and had access to fewer resources than non-hunters. Participatory research indicated that hunting was closely identified with the poorest people and this was quantified by household surveys. Wildlife were primarily hunted for economic reasons – to generate cash through the sale of dried meat – rather than in response to a direct need for meat. A majority (75% or more) of arrested hunters indicated that they were hunting for cash or trade. The need to pay taxes, village development contributions or levies (including education) and the purchase of clothing were identified as the most important factors, and were responsible for 79% of the need to generate cash.

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Food in the form of dried meat derived from the park through illegal hunting formed an important contribution to rural livelihoods. Participatory research and questionnaire surveys identified local perceptions of hunters' motivations and showed that hunting was widely viewed as a source of both cash and food during difficult times by the poorest members of the community. Hunting was also seen as a strategy for coping with problems such as stock theft, or loss through disease. Rather than the food value *per se*, the results clearly indicated that it is the ability to sell the dried meat and to subsequently use the cash proceeds for other goods and services that is the most important contribution of wildlife to rural livelihoods.

Hunting represents a viable and relatively profitable means of generating a cash income. Spatially oriented cost-benefit models showed that a day's hunting was capable of producing an average profit equivalent to over 100 days of a normal villager's potential earnings though employment and that benefits from hunting exceeded its costs over the greater part of the protected area. Based on recorded household consumption, the value of wildlife meat consumed in the area covered by the sample village surveys was estimated to be Tsh 642 million, or US$ 800,000 per annum. Additional meat is traded outside this area, including trade to urban areas and a cross-border trade to Kenya. Initial estimates of the volume of this additional trade bring the estimated total value of the illegal hunting of meat from Serengeti to Tsh. 793 million or US$ 987,000 per annum.

Migratory herbivores constitute over 60% of all wildlife killed by hunters. The majority are wildebeest, which form the bulk of the larger herbivores within the Serengeti ecosystem. Due to seasonal migrations, these species have a *de facto* closed season during those months when the population moves to the Serengeti Plains – where hunting does not occur. This period corresponds with the breeding season. The heaviest mortality occurs naturally during the dry season and it is during this period that the migratory wildebeest and zebra are accessible to hunters. Current indications are that illegal hunting of these species has not had a significant impact on population numbers, although the level of hunting offtake at which such impacts might occur are currently uncertain.

In strong contrast, the smaller populations of non-migratory, or resident herbivore species occupy the Serengeti woodlands throughout the year, and in these areas are accessible to hunters at all times. A decline in populations of resident herbivores was significantly linked to levels of illegal hunting. Species that provide greater potential benefit to hunters, such as buffalo, and/or those that occur closer to the western boundaries of the protected areas have suffered the most severe declines – with some areas now having zero to very low densities of resident wildlife species. Hunters are travelling greater distances to reach remaining populations. Despite these declines, hunting remains a profitable activity due to migratory species.

Results from this research strongly suggest that development strategies designed to address rural poverty and rural income diversification have the potential to provide a key contribution both to sustainable conservation and to rural livelihoods.

Such integrated conservation and development initiatives must be specifically designed and targeted to provide tangible and direct benefits to the poorest members of the community. Without such benefit, illegal hunting of wildlife coupled with the sale of game meat to generate cash will continue to provide vital a means of support for the poorest households. If benefits from development and conservation interventions focus solely on the provision of public goods, such as education and health clinic construction, then this is unlikely to reduce hunting that is driven by a need for cash.

Current levels of hunting are unsustainable in terms of the non-migratory wildlife species and unless hunting pressure is reduced through the development of alternative livelihood support mechanisms, the most likely scenario is one of a decreasing resource base and increasing rural poverty.

Contents

1   Background

Wildlife conservation has traditionally depended on the creation of protected areas. Recently, the concept of sustainable utilisation, sometimes termed the "use it or lose it" philosophy (Swanson 1992, Baskin 1994, Kock 1995), has been applied to wildlife, along with other "renewable" natural resources. This approach considers that the long-term prospects of wildlife within protected areas are poor without the support of communities (Anderson & Grove 1987; Brandon & Wells 1992, Newmark et al. 1994) and that some form of utilisation is required in order to generate this support. Co-operation between protected area managers and local communities (Kiss 1990) is now widely recognised as an important component of wildlife management, along with the wider issues of community based natural resource management (Child 1995, Bourn & Blench 1999). The concept of community based wildlife programmes represents a significant shift in attitudes towards the management of African wildlife. How such strategies can best be achieved remains an open question, particularly when the potential benefits from illegal or unregulated hunting of wildlife can be considerable (Hofer et al. 2000), and when meat from wild sources may form a significant part of household protein intake (Barnett 2000). Protected areas have helped to protect some of Africa's more famous wildlife populations, and still have a crucial role in preserving sensitive habitats, valuable ecosystems and endangered animals. Protected areas also play a vital role in international tourism, contributing significantly to national economies.

The importance of wildlife to the local, rural economy is seldom accounted for by managers and policy makers. Instead wild animals are usually seen in a negative way, e.g. as crop raiders/pests. The value of wildlife has traditionally been seen in terms of its potential to generate revenue though tourism. In Tanzania, photographic tourism by overseas visitors and hunting – "big game hunting" – by both overseas "safari" hunters and in-country resident hunters, are certainly important to the national economy. However, a study by ITC and IUCN, (1989) suggested that the gross value of wildlife to the Tanzanian economy was US$128.5 million in 1989, of which US$99.5 million was attributed to consumptive utilisation and US$33 million to non-consumptive tourism. Illegal wildlife hunting was estimated as the single largest contributor to consumptive utilisation at US$50 million. The same trends and relative contributions were confirmed by a report recently published by TRAFFIC (Barnett 2000, based on 1998 survey data), with by far the largest supply of all wildlife meat being obtained through illegal trade and utilisation of wildlife.

The illegal hunting of wildlife in the Serengeti ecosystem has already resulted in reduced populations of several resident herbivore species (Campbell & Hofer 1995). Hofer et al. (1996) made a preliminary estimate of an annual illegal harvest of almost 160,000 animals from the Serengeti National Park (SNP) and associated protected areas. This was calculated as being equivalent to about 12,000 tons of fresh meat.

Whilst conservation and development may be seen as conflicting agendas attempts are nevertheless being made to bring wildlife conservation closer under the general umbrella of sustainable development (Meadows et al. 1992, World Bank 1994). Ghimire and Pimbert (1997) start from the perspective of conflicting agendas before moving for reorientation of conservation approaches, whilst Granfelt (1998) focuses on the actual and potential for conflict and on security issues in the management of environmental resources. Prins et al. (2000) concentrate largely on sustainable use. Perhaps the greatest challenge is to incorporate political and demographic realities into conservation strategies, whilst recognising multiple influences of poverty, unemployment, world markets and conservation. There is a similar and parallel challenge in building the needs of environmental conservation into strategies for economic growth and development.

A fundamental pillar of the sustainable development philosophy is the recognition that current generations must meet their needs without compromising the ability of future generations to meet their own needs (WCED 1987). To what extent is game meat hunting compatible with the principles of sustainable development? Considerations of inter-generational equity may be difficult, or even meaningless, under conditions of extreme poverty. How realistic is it to ask or to expect people who are close to the survival line to think of future generations?

If unregulated hunting is to be reduced to manageable or sustainable levels and if wildlife populations in the Serengeti National Park (SNP) are to be maintained, then an understanding of the factors driving game meat hunting is required. Similarly, rural development, social and economic advancement of communities living adjacent to the protected areas depends on a clear understanding of the livelihood strategies of those involved. This understanding, moreover, needs to have a multi-disciplinary background. This study seeks to quantify the role of hunting within the local economy, examines the importance of game meat hunting to rural livelihoods and poses the question "are these livelihood strategies sustainable?" Through gaining a greater understanding of the importance of wildlife to livelihoods of the rural poor, the study also aims to identify potential alternative management approaches.

Figure 1   Study Area: Western corridor of Serengeti National Park, Tanzania

Terrain model and village enumeration areas (EA) registered at the 1988 national census (black circles).

Villages sampled by household surveys are indicated by larger yellow circles. (Each EA may represent one or up to 14 or more actual villages/sub-villages).
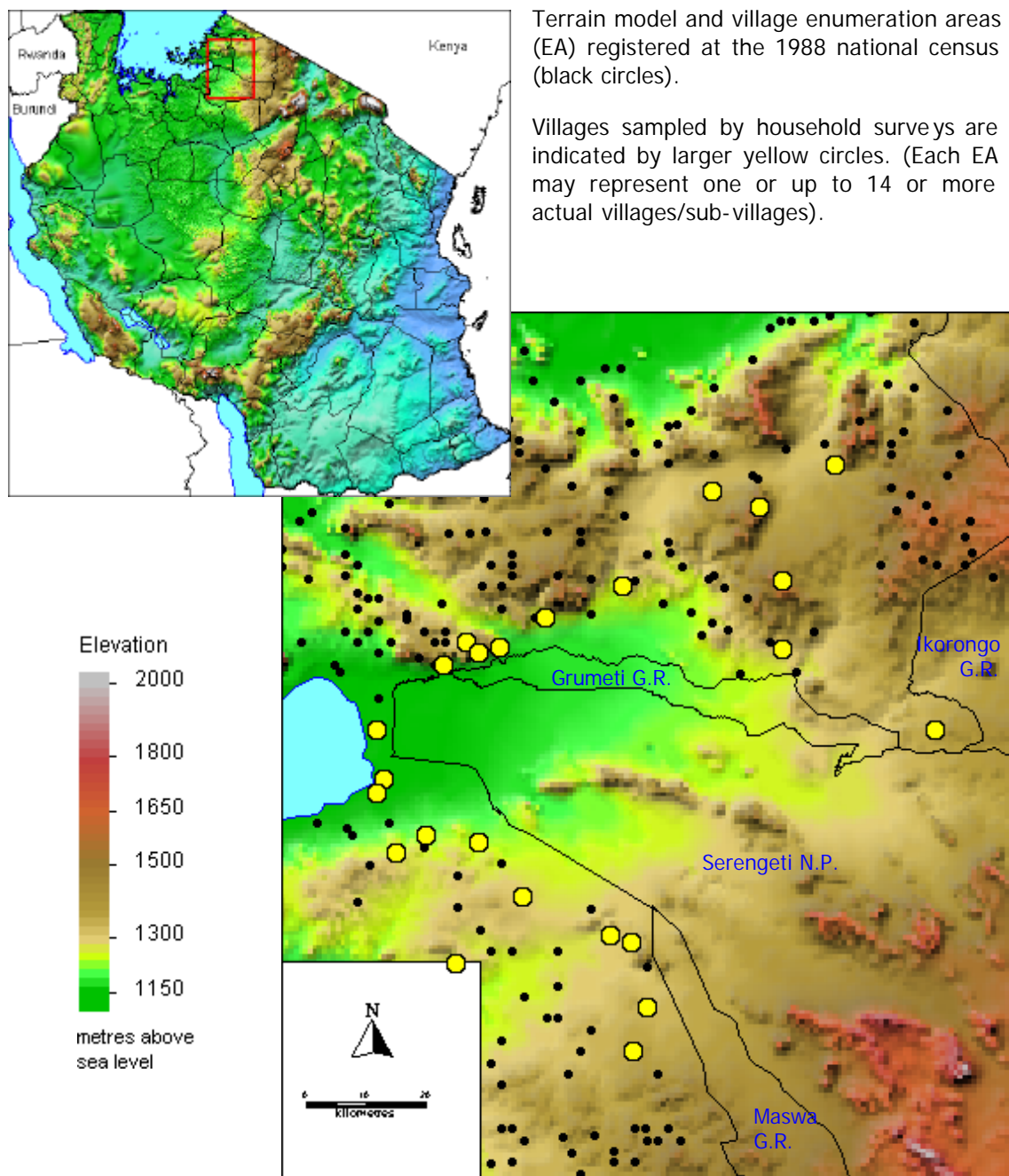
2   The Study Area

2.1   Overview

The study centred on villages adjacent to the western boundary of the SNP (Figure 1). Livelihoods are predominantly based on a combination of subsistence agriculture (largely maize, millet, sorghum and cassava), livestock (cattle, goats, sheep and poultry) and cotton as a cash crop. Game meat hunting practised by these communities. The majority (an estimated 70%) of the annual harvest of wildlife from SNP is composed of migratory herbivore species, but substantial numbers of resident herbivores are also killed (Campbell & Hofer 1995; Hofer et al. 1996). Methods employed in this hunting are described elsewhere (Turner 1988; Arcese et al. 1995, Loibooki 1997) and largely depend on the use of unselective wire snares. Game meat is dried for transport and storage, enabling it to reach markets some distance from the park, e.g. urban centres of Mwanza, Musoma and Kisumu.

2.2   Human and Wildlife Populations

2.2.1   Human Population

Human settlements adjacent to the protected areas can be broadly divided into two categories – pastoralist and agro-pastoralist – and the Serengeti forms a rough divide between these two land use and livelihood patterns. Pastoralist land use is largely confined to the eastern side of the protected areas. For largely cultural reasons, the Maasai pastoralists do not consume significant quantities of meat derived from wildlife. Interactions between wildlife and Pastoralism are outside the scope of this study and are covered in a number of publications including Bourn and Blench (1999), which contains an annotated bibliography. The western and north-western sides of the protected areas have higher population densities (Figure 2) with rural populations engaged in subsistence and cash crop cultivation, or mixed farming. At the time of the last national census in 1988, Ngorongoro District on the eastern side had a population of 69,100 (4.92 /km^2). To the west, the six districts adjoining the protected area had a combined population of 1.49 million (64.5/km^2). This study focuses on the interactions between people and wildlife on the western side of the Serengeti ecosystem, an area where utilisation of wildlife for meat is widespread.

2.2.2   Wildlife Populations

Research into wildlife populations in the Serengeti ecosystem have been summarised in a number of publications, including Sinclair and Arcese (1995). The Serengeti ecosystem includes large and significant populations of both herbivores and carnivores and was recognised as one of the first World Heritage Sites to be designated.

The more than 20 ungulate species in the Serengeti ecosystem are dominated by migratory species (wildebeest, *Connochaetes taurinus*, zebra, *Equus burchelli*, Thomson's gazelle, *Gazella thomsonii*, and eland, *Tragelaphus oryx*). During their annual migration, wildebeest, zebra and Thomson's gazelle move twice along a rainfall gradient, between their dry season (June-November) woodland refuges in the north and west of the ecosystem and the short-grass plains in the southeast, the Serengeti Plains (McNaughton and Banyikwa 1995). Serengeti wildebeest population numbers are considered to be regulated largely through density-dependant mortality due to food shortage during the dry season (Sinclair et al. 1985, Mduma et al. 1999). At this time of year they move close to the western and north-western boundaries of the protected area, and to a variable extent outside them, depending on the amount, timing and distribution of rainfall, and are therefore accessible to hunters. During the wet season the bulk of the wildebeest population are located on the open Serengeti and Salei plains within Serengeti National Park and Ngorongoro Conservation Area. These areas are less accessible to hunters, unsuited to the use of snares – the dominant means of hunting – and. moreover, where hunters could easily be observed. As a result, the migratory wildlife are effectively protected from hunting during the breeding season. In contrast, hunting is able to have an impact on the resident wildlife species throughout the year.

Eight species constitute the majority of resident mammalian herbivore biomass (Campbell and Borner 1995): African buffalo, *Syncerus caffer*, giraffe, *Giraffa camelopardalis*, Grant's gazelle, *Gazella granti*, impala, *Aepyceros melampus*, kongoni, *Alcelaphus buselaphus*, topi, *Damaliscus korrigum*, warthog,

Phacochoerus aethiopicus, and waterbuck, *Kobus ellipsiprymnus*. These species are concentrated in the hilly regions in the southwest, west, and north of SNP, areas receiving an average annual rainfall of greater than 800 mm and covered by savanna or open woodland. The flat, drier Serengeti Plains in the southeast of the Park have only low to very low densities of non-migratory wildlife. The overall distribution of non-migratory wildlife is shown by Figure 3 which illustrates the mean densities of all resident wildlife species recorded during three aerial wildlife surveys between 1988 and 1991 (Campbell and Borner 1995).

The western side of the Serengeti, with its relatively large resident wildlife populations, augmented considerably by migratory species during the dry season, and with large numbers of villages close to its boundaries, creates a zone of interaction where hunting of larger wildlife species for meat is widespread.

Figure 2   Dot density map of population in Tanzanian Districts adjoining the Serengeti Ecosystem.
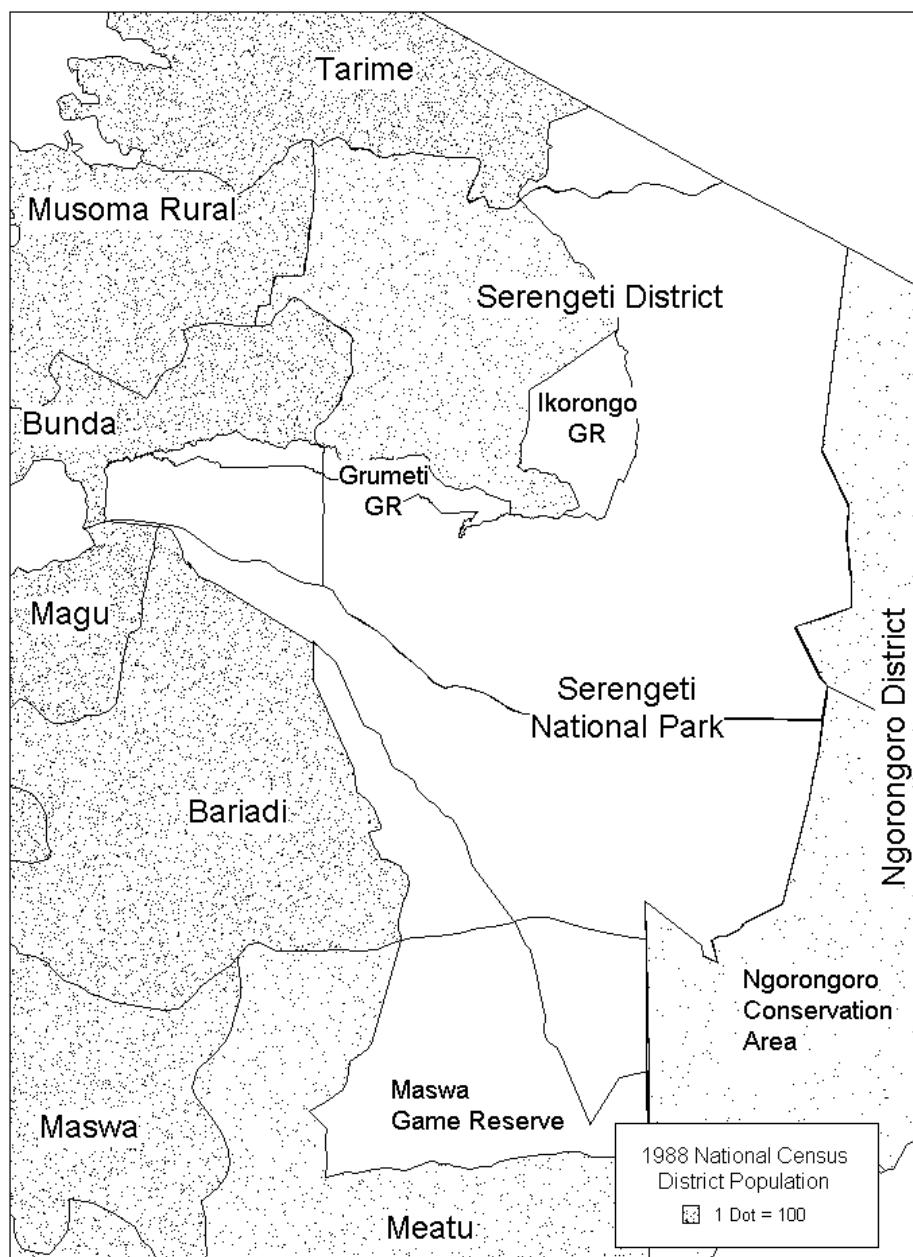
Source: Compiled from 1988 National Census data (Bureau of Statistics, 1988)

Figure 3   Densities and distribution of non-migratory wildlife: mean values from aerial surveys conducted in 1988, 1989, and 1991.
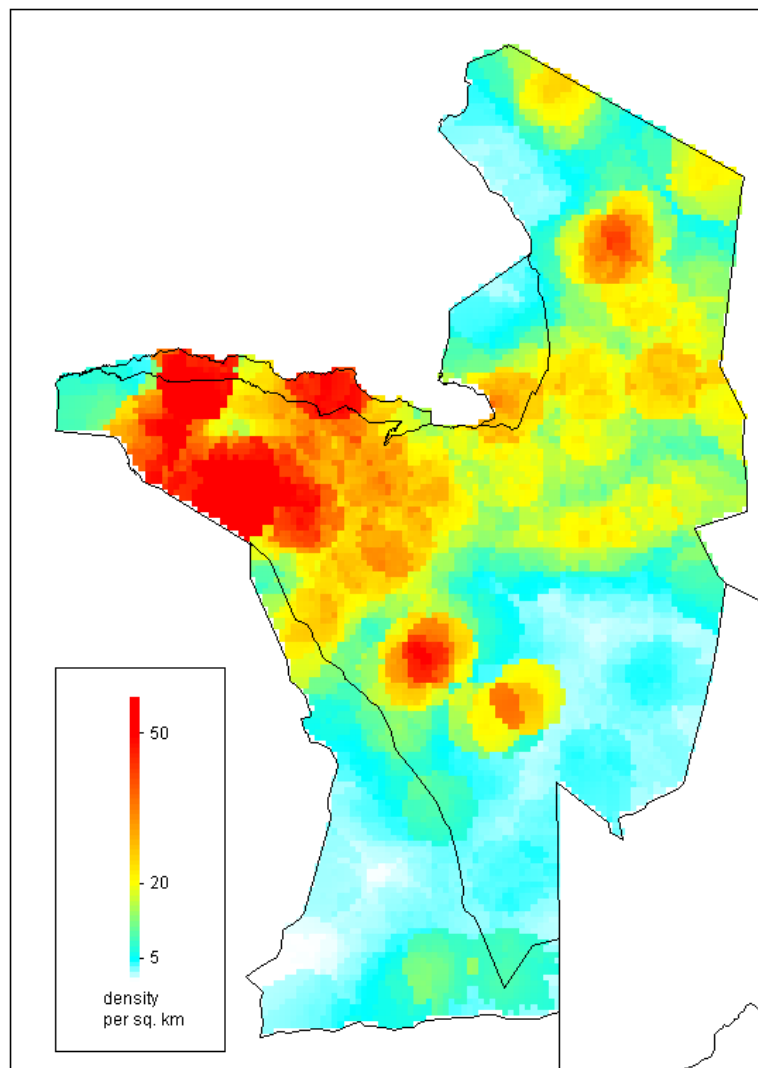
2.2.3   TANAPA Community Conservation Service (CCS)

The Tanzania National Parks (TANAPA) Community Conservation Service (CCS) is a park outreach programme to neighbouring communities. The CCS carries out extension work and conducts a benefit sharing programme. TANAPA's team of Community Conservation Wardens and the tools and methods developed to assist them probably make it the most extensive community conservation programme in Tanzania (Leader-Williams et al. 1996). The objectives of the CCS programme are to improve relations between individual parks and local communities, to ensure that the interests of National parks with regard to natural resource conservation and community welfare are represented at all levels, to facilitate the sharing of benefits to target communities and assist communities to gain access to information, resources, and services which promote sustainable development.

TANAPA's Support for Community Initiated Projects (SCIP) was initiated in 1992 as part of headquarters and park strategic planning (TANAPA 1994). The SCIP programme works with communities bordering or close to national parks and stresses the support for community initiated projects. Approval mechanisms are set at the park level and there is an increasing liaison with tourism related project adjacent to the parks.

The SCIP fund currently amounts to about 7.5% of each park's operating budget. A majority of parks do not receive gate fees sufficient to cover operating costs and these are subsidised by the parks that do – including Kilimanjaro, Serengeti, Manyara and Tarangire.

According to Barrow et al. (2000) community members place a great emphasis on the knowledge that TANAPA is funding this substantially from its own resources. It is unusual for a Tanzanian parastatal to voluntarily spend over $350,000 of its own revenue each year in assisting community projects (Bergin 1998, cited in Barrow et al. op. cit.). Donor support to SCIP has been relatively small.

> TANAPA's CCS Mission Statement
>
> - CCS seeks to protect the integrity of national Parks by reducing conflicts between wildlife and surrounding communities, by improving relations with those communities and by helping to solve problems of mutual concern
>
> - We will enter into active dialogue with local communities, involve them in conservation planning process and create awareness and understanding of wildlife conservation and its benefits
>
> - We will promote the conservation of wider ecosystems by encouraging sustainable land use of practices

In order to access the SCIP fund communities fill out a simple one-page form in Swahili. This proposal is reviewed by a park SCIP committee using a set of established guidelines together with the strategic plan for that park.

3   Project Purpose

The general problem area addressed by this proposal was: "Combining sustainable livelihoods and conservation on protected area boundaries".

Domestic livestock represent a major social, economic and livelihood support factor amongst people living adjacent to many protected areas in Africa. At the same time, wildlife has in many areas been traditionally recognised as a resource. This resource is utilised largely for meat, part of which is consumed by the immediate family and part of which can be sold in order to provide a cash income. In a majority of cases, levels of utilisation have risen to unsustainable levels, resulting in the loss of wildlife from many areas, a consequent reduction in levels of biodiversity, and in turn reducing the natural capital available to local people.

4   Research Activities

Information on game meat hunting within the protected area, and on rural livelihoods in a sample of villages adjacent to the protected area, was obtained through a combination of structured questionnaires and participatory surveys.

4.1   Information obtained from arrested hunters

Questionnaires designed to obtain information from arrested hunters were developed through a participatory process involving national park wardens, law enforcement and community conservation staff, and were based on earlier initial work conducted by K. Campbell between 1992 and 1993.

Questionnaires were developed in Kiswahili and were administered by national park law enforcement staff. Forms were also developed to assist the park management with maintaining records of each law enforcement patrol. A number of GPS receivers were supplied to patrols and training provided in their use. These provided accurate locations for a number of arrests.

The study recorded information from people arrested by law enforcement patrols in SNP. National park rangers interviewed those arrested during 1992-93 and 1998-2000 using standard questionnaires. Questionnaires used during this study were improved and developed from earlier forms used between 1992 and 1993. A single-sheet form obtained information relating to the place and mode of arrest, weapons used, wildlife and other items found with individuals, as well as brief personal details, livestock ownership and reasons for entering the park. Data from 552 people arrested in SNP between December 1998 and March 2000 were compared with information obtained through village surveys. Additional information on the home villages and ages of arrested hunters was also available from earlier data on 490 hunters arrested between November 1992 and November 1993.

4.2   Information obtained through participatory village surveys

Participatory research was conducted in a small sample of villages adjacent to the park in order to identify the main characteristics of each village, village level natural, human, physical and social capital, livelihood activities, and attitudes towards hunting.

The first step of the research involved a five-day training course for the team on PRA methodologies and approaches. A checklist was developed of key issues to be explored and criteria identified by the team for selecting 4 villages. The criteria were based on distance from the boundary of the Protected Area, main livelihood activities (livestock, fishing), distance from the road, and experience with or contact between the "community" and CCS/TANAPA to provide an entry point and possible avenues for follow-up.

Permission was obtained from the village leadership to work in the village and the objectives of the research were explained. The team spent 3-4 days in each village and worked with a cross section of the community either together as a large group or in specific focus groups (e.g. women, or people of a specific age set). During general community meetings, members of communities worked with tools such as mapping, seasonal calendars, historical trends and institutional analyses. Focus groups discussed specific aspects of life such as livelihood activities and in particular issues relating to wildlife, game meat hunting, and livestock keeping.

4.3   Information obtained from village surveys

The design of household questionnaires was based on the results of participatory surveys and on preliminary analysis of information from arrests of hunters apprehended by law enforcement patrols. A workshop was held with national park wardens, law enforcement and community conservation staff to ascertain information priorities and to outline the scope of a village questionnaire. This was subsequently developed and piloted in villages adjacent to Arusha National Park. Based on feedback from this first pilot survey, the questionnaires were further modified and tested near to Lake Manyara National Park before final versions were used in the study area itself. Prior to the questionnaire survey, training was provided to all enumerators, supervisors and other national parks staff involved.

The study sampled villages within districts adjacent to the western boundary of the SNP. Within four districts a total of 24 villages, registered at the time of the 1988 National Census, were selected as follows: villages were ranked according to the total number of arrests in the combined 1992-93 and 1998-2000 data on arrests within SNP (N=1031 arrests). Those villages ranking in the highest 6 and lowest 6 (typically a single arrest) were short listed in Bunda, Bariadi and Serengeti districts, whilst the highest and lowest 3 were short listed in Magu district. Final selection was based on this shortlist and villages were selected in order to minimise an uneven spatial distribution, resulting in 7 villages in Bariadi district, 4 in Magu, 7 in Bunda and 6 in Serengeti district. The distance of sampled villages from the protected area boundary varied between 2 and 33 km. The selected villages fell into three natural groups on the basis of total recorded arrests. "Low poaching" villages (N=9) recorded 3 or fewer arrests per village. "Medium poaching" villages (N=6) recorded between 6 and 9 and "high poaching" villages (N=9) recorded between 13 and 55 arrests. The relationship between distance from the protected area boundary and total number of recorded arrests from individual villages (periods 1992-93 and 1998-2000 combined) is shown by Figure 4. Although these data exhibit a broad spread, especially close to the protected area, the overall trend of increasing arrests of individuals from villages closer to the boundary is clear. The figure also shows several outliers that go against this general trend.

In each of the selected villages, village leaders compiled up-to-date household lists and a systematic sample of 30 households was taken from this list. If there was no person present at a selected household, the nearest adjacent house was chosen instead. In cases where a village included a large number of sub-villages, households were sampled only from the central (main) and one outlying sub-village.

Surveys were conducted by enumerators working in pairs. All enumerators were teachers familiar with the area. A total of 473 men and 242 women were interviewed with ages ranging between 15 and 100 years. Interviews were conducted at home in the presence of another village resident, it was stated that the main purpose of the survey was to understand the background to hunting activities. Questions were asked of household heads or, in their absence, the most senior person present in the household. Interviews were conducted in a friendly atmosphere and nobody refused to participate in the survey. Questions included information on personal details, sources of income, payments, crops cultivated, livestock, constraints to cultivation and livestock, hunting, potential alternatives to hunting, sources and consumption of meat and other protein, and park-people interactions.

4.4 Study of a community-private tour operator partnership in Robanda village.

Robanda village and Sengo Safaris Ltd. have been operating a business partnership since 1993. Under this partnership, the village has contributed its land, on which Sengo has put up a campsite to accommodate tourists (Ikoma Safari Camp). In turn, Sengo pays to Robanda, an agreed rate per tourist. The village leadership, in particular the village council has been actively involved. The council also oversees the management of benefits accrued from the partnership. Besides the village council, some secondary stakeholders facilitated the two parties to reach the agreement.

This type of partnership is uncommon around the protected areas in Tanzania. A study was conducted in order to identify successes, failures and other lessons that might be applied in other locations. The study was conducted during October 2000, and involved meeting and interviewing members of Robanda community, and other stakeholders of the partnership.

Figure 4 Relationship between distance from the protected area boundary and total number of recorded arrests in (A) those villages sampled during the household surveys, and (B) all villages with recorded arrests.

A.
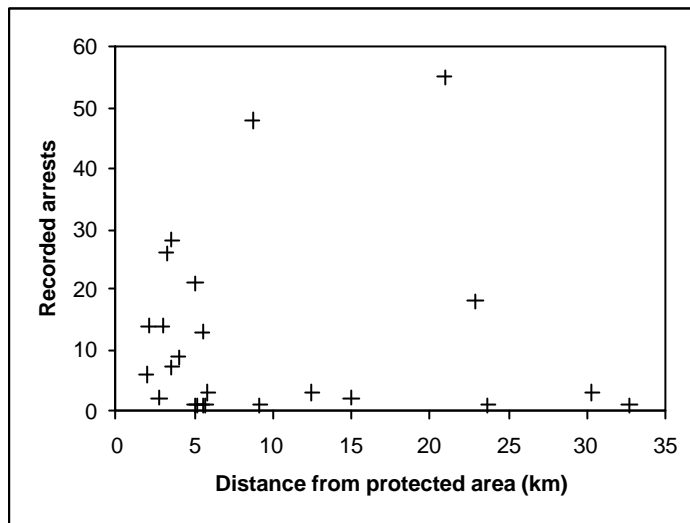
B.
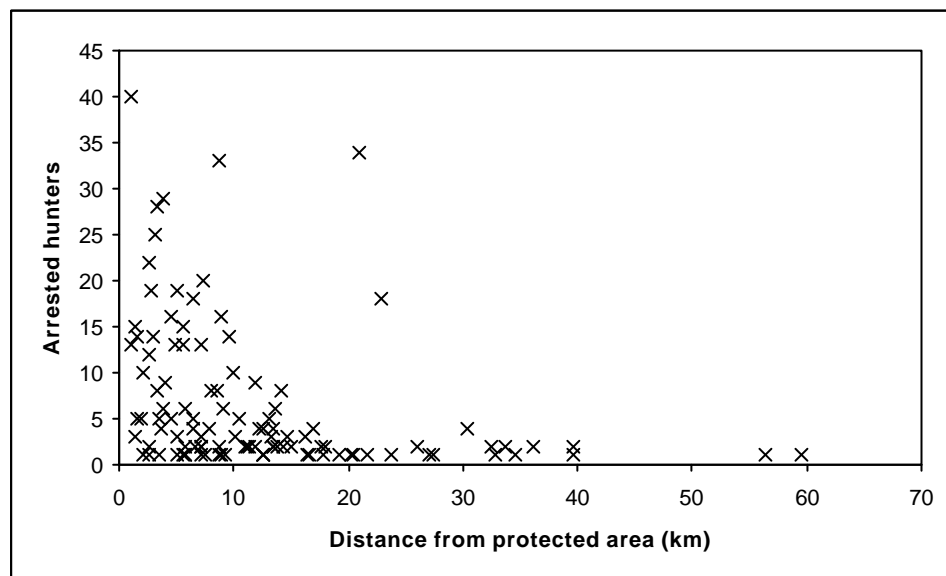
5   Outputs

The nature of the planned surveys which addressed questions where an important topic under consideration was defined as an illegal activity meant that the nature of the results were difficult to anticipate. The outputs were seen as a success and principal findings are outlined below.

5.1 Game Meat Hunting

5.1.1   Reasons for Entering the Protected Area

Why do people enter the national park? Evidence linked by park rangers with people at the time of their arrest is indicated in Table 1. All arrested hunters were male. A majority (90%) also freely answered questions on their main reasons for entering the park (Table 2). Hunting for meat was

clearly the dominant reason for entry, with 74% of those arrested being identified as hunters at the time of arrest and 80% questioned after arrest giving hunting as the reason for entry. Game meat was identified as the main benefit from the park from responses to the household surveys in 24 villages adjacent to the park. Tables 1 and 2 provide a quantitative measure of the demand for resources from the park and both sets of data are in close agreement.

During the household surveys respondents were asked if they themselves were involved in hunting, although it was stated that the question was not important. The majority declined to answer but 24% (N=58) of females and 22% (N=104) of males freely responded to the question. Of those that did respond, 7% of females and 28% of males admitted to involvement in hunting. For villages classified as "high poaching" on the basis of total recorded number of arrests, 54% of males that responded to the question admitted to involvement in hunting, (7.7% of all male respondents, including those who declined to answer this question). The figures for "low poaching" villages were 14% and 2.6%, whilst the figures for "medium poaching" villages were 19% and 2.7% respectively.

Table 1   Products or activities identified with arrested persons at the time of their arrest in Serengeti National Park, October 1998 to March 2000.

	Frequency	% of Total [1]	% of arrests	Females	Males	sex not recorded
Hunted wildlife	403	65.85	74.35	0	389	14
Fish	52	8.50	9.59	4	48	0
Grazing	48	7.84	8.86	18	29	1
Fuelwood	46	7.52	8.49	29	17	0
Building poles	26	4.25	4.80	6	20	0
Honey	9	1.47	1.66	0	9	0
Medicine	6	0.98	1.11	4	2	0
Mining	6	0.98	1.11	0	6	0
Cultivation	4	0.65	0.74	0	4	0
Thatch grass	4	0.65	0.74	2	2	0
Water collection	3	0.49	0.55	3	0	0
Charcoal	3	0.49	0.55	1	2	0
Birds (live)	1	0.16	0.18	0	1	0
Timber	1	0.16	0.18	0	1	0
	612	100.00		67	530	15

[1]   Some were arrested with more than one product. The total is therefore greater than the total number of arrests.

Table 2   Reasons for entering the national park given by persons arrested in Serengeti National Park, October 1998 to March 2000.

Main purpose for entry	Frequency	% total	% of responses
Hunting	400	72.46	80.65
Cutting trees / fuelwood	46	8.33	9.27
Grazing livestock	25	4.53	5.04
Fishing	11	1.99	2.22
Cultivation	4	0.72	0.81
Mining	4	0.72	0.81
Collecting thatch grass	2	0.36	0.40
Collecting medicine	1	0.18	0.20
Water	1	0.18	0.20
Hiding / refuge	1	0.18	0.20
Collecting Honey	1	0.18	0.20
(no response)	56	10.14	(n/a)
Total	552	100.00	100.00

5.1.2 Reasons for Hunting

Data from arrested hunters clearly demonstrated that the main reasons for hunting were economic, rather than subsistence hunting for food. Those arrested who identified themselves as hunters were questioned as to their reasons for hunting and these responses were categorised as food, money, trade or traditional (or any combination). Table 3 summarises these responses and identifies the need for cash in 75% of cases. Examination of responses to other questions also indicates that a proportion of the 25% of hunters that replied that they were only obtaining food were also involved in trading the meat obtained through hunting – meaning that the 75% is likely to represent a minimum figure. Given that a hunter procuring his own meat is highly unlikely not to utilise a portion of the proceeds for home consumption, it is safe to assume that the need for cash is the dominant reason for hunting in over 75% of recorded cases.

Table 3   Reasons given for hunting inside the protected area

Reason for Entry:		% of arrests
Cash requirements	Money only	12
	Trade only	6
	Food & money or trade	57
Food requirements	Food only	25
Other requirements	Tradition only	< 0.5

Hunters who indicated that they needed cash were asked the major reasons for this requirement (Table 4). Payment of taxes, village development contributions and levies, and purchase of clothes together constituted 79% of the reasons given for needing cash. Respondents during the household surveys were asked the reasons why people needed to hunt and were also asked to rank these reasons in terms of their importance (Table 5). These results again emphasise the overwhelming importance of economic factors, with the most important being to "raise cash for domestic needs", to "raise cash for taxes or village contributions and levies" and to "obtain meat to sell".

Respondents giving a need to obtain food as a reason for entering the park were also asked the main reasons for there being a lack of food from other sources. A general "scarcity of food" was cited by 64% of respondents. A further 20% qualified this by saying that poor or late rainfall was the reason, whilst 10% specifically cited a lack of farm implements as a major contributory factor. Those recording "trade" as a reason for hunting, either on it own or in combination with other reasons, were also asked where the products were sold. Trading in the respondent's own village or in neighbouring villages was recorded in almost all cases (99%, N=255). A small amount of trading across the international border in Kenya was also recorded. None of the respondents indicated that they themselves traded in nearby urban areas. It must therefore be assumed that traders purchase meat in the villages from the hunters and that this is then transported to other localities where it is sold.

Table 4   Reasons given by arrested hunters for needing cash

Reason	Frequency of responses	%
Taxes	152	32.8
Contributions, including schools	144	31.1
Clothes	70	15.1
"Poverty" (Umaskini)	39	8.4
Debt	22	4.8
Medicine	16	3.5
Food or Hunger	13	2.8
General purchasing needs	5	1.1
Other reasons	2	0.4

Table 5   Reasons given during household surveys for people needing to hunt

	Frequency of responses
Raise cash to meet basic domestic needs	468
Raise cash to pay taxes/contribution	358
To obtain meat to sell (commercial)	337
For food for the household	443
To barter meat for other items	169
Peer pressure / traditional / habitual	88
To obtain trophies for sale	86
Other reasons	17
Occupation during spare time	24

Arrested hunters were asked what would be needed so that they no longer required to hunt in the national park. Whilst the most common response was simply *"food,"* 17% responded with *"employment,"* 11% said *"reduced taxes or contributions"*, a further 11% simply said *"money"*, 6% said *"improved living conditions or livelihoods"* whilst a further 6% said *"improved harvests"*. Thus over half of these responses were related to income poverty as well as to potential development opportunities.

### 5.1.3   Where do the hunters come from?

Information obtained through responses to the "arrest" questionnaire included the name of village where the person arrested lived. These villages were located and geo-referenced using maps of the area as well as local knowledge. The total number of villages included in this GIS database, excluding sub-villages, was 657. This included a complete coverage of Tarime, Serengeti, Bunda, Musoma Rural, Bariadi and Meatu districts, as well as partial coverage of Magu and Maswa districts.

Game meat hunters were arrested from a total of 79 villages in the 1992-93 data set and from 98 villages in the 1998-2000 data set, with a combined total of 133 villages. It is therefore clear from these data alone that hunting is a widespread activity. The distribution of arrested hunters' villages was examined using the combined data set (Figure 5).

Since the next planned national census in Tanzania was postponed till 2002, population data used by this study was derived from the 1988 national census data, made available by the Bureau of Statistics, Dar es Salaam, at an individual enumeration area (EA) level.

Whilst these data demonstrate a general tendency for villages closer to the protected area boundaries to be more heavily involved in hunting, it is clear that some villages located far from the boundaries are also involved to a significant extent and that other villages close to the boundaries are involved in hunting to a relatively minor extent. The pattern of origins of arrested hunters was further evaluated by interpolation from individual village data points using inverse distance weighting techniques and using the resulting surface to derive zones of low, medium, high and no arrests. These zones are depicted in Figure 6.

Figure 5 **Prevalence of hunting: the distribution of home villages of arrested hunters. Arrests between 1992-93 and 1998-2000 combined.**
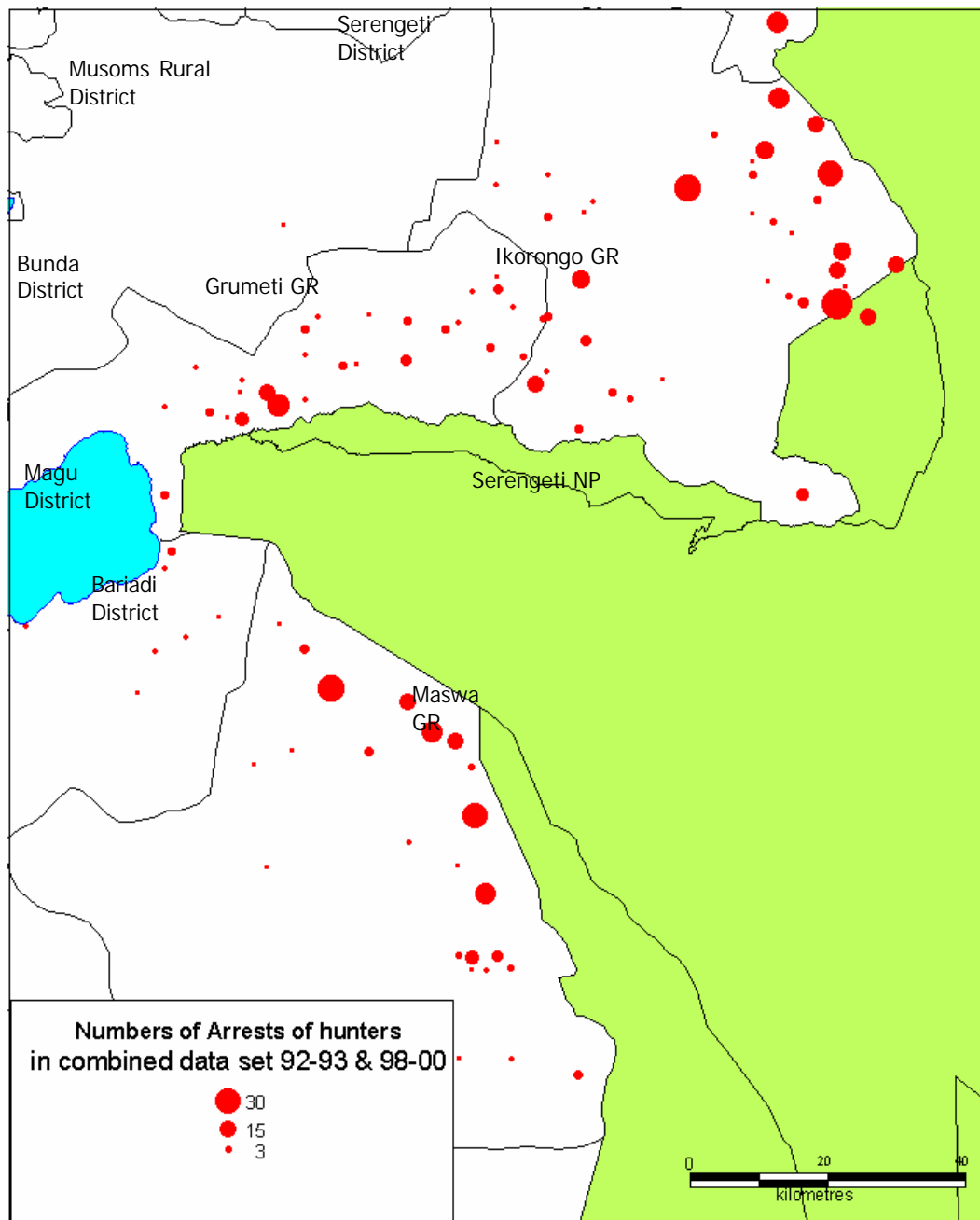
Graduated symbols represent the numbers of arrests from individual villages. For clarity, villages contributing no hunters are not shown.

Note: One village shown as being situated within Ikorongo GR was relocated after the reserve was gazetted between the two time periods represented by this combined data set.

Figure 6   Where do the hunters come from ?
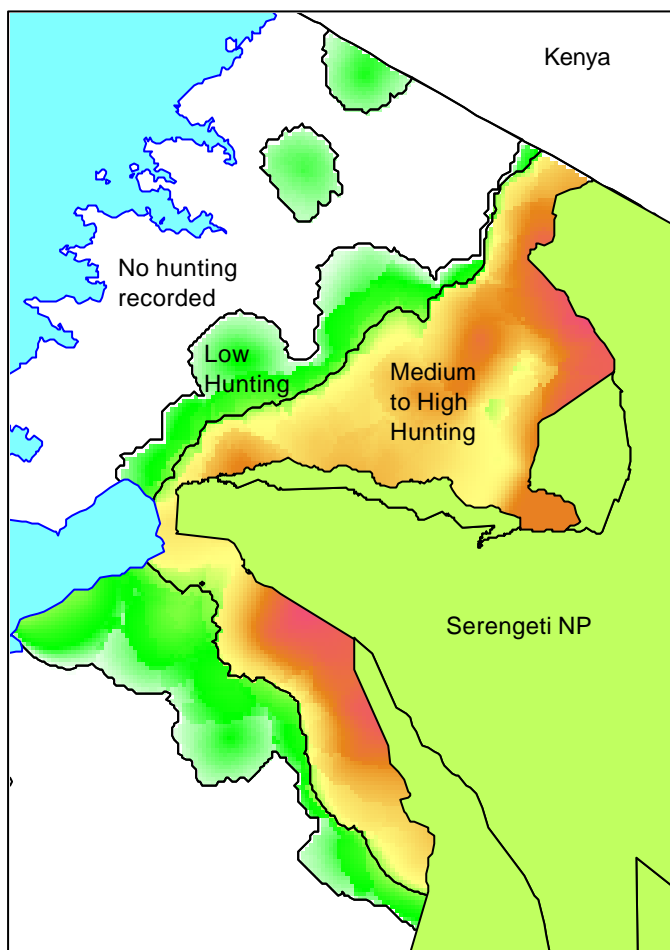
Interpolation of information on the home villages of arrested hunters and illustrating the derived *zones of hunting pressure.*

5.2 Relationship Between Illegal Game Meat Hunting and Poverty

The majority of hunting trips are carried out primarily to generate cash (Tables 4 and 5). If this is the case, it follows that hunters are income poor. What evidence is there for this? The participatory research identified livestock ownership as a widely recognised measure of wealth in this area. Table 6 and Figure 7 demonstrate that arrested hunters have fewer livestock than those arrested for other reasons (e.g. for cutting fuelwood or timber). These results also show that, compared with results from household questionnaires in villages outside the park, arrested hunters had lower rates of livestock ownership and, those that did own livestock owned smaller numbers.

The household surveys asked respondents for their perceptions of the status of hunters in terms of two main, but related, categories: income levels and livestock ownership. These results are summarised in Table 7 and show that, from the viewpoint of people in these villages, hunters tended to come from the poorest sections of the community and had either few or no livestock.

The conclusion is that hunters are income poor.

Table 6 **Patterns of Livestock Ownership:** Arrests in SNP compared with data from 24 villages adjacent to SNP. Percent ownership and median herd size (with interquartile range) of those owning livestock.

	Arrested for hunting		Arrested for grazing		Arrested for other reasons		Household surveys	
	ownership	median	ownership	median	ownership	median	ownership	median
Cattle	21.1	4 (3-7)	100.0	9 (6-19)	59.6	4.5 (3.3-9.5)	30.9	10 (5-20)
Goats	21.6	5 (3-8)	66.0	8 (5-10)	46.8	4 (2-6.5)	29.8	6 (4-12)
Sheep	10.7	3 (2-5)	46.8	4 (2-8)	31.9	4 (3-6)	11.6	5 (2-9)
Poultry	35.1	5 (2-10)	27.7	8 (5-15)	55.3	5 (3.5-7)	60.3	7 (5-12)

Table 7 **Villagers Perceptions of Hunters in terms of income level and livestock ownership**

Villagers perceptions of hunters		Responses	%
Income level	Rich	4	0.7
(N=551)	Poor	50	9.1
	Very poor	497	90.2
Livestock ownership	Many livestock	1	0.2
(N=525)	Few livestock	44	8.4
	No livestock	480	91.4

Figure 7 **Livestock ownership by arrested hunters compared with (A) the average from household surveys and (B) with those arrested for other reasons (largely cutting fuelwood and building poles).**

A.
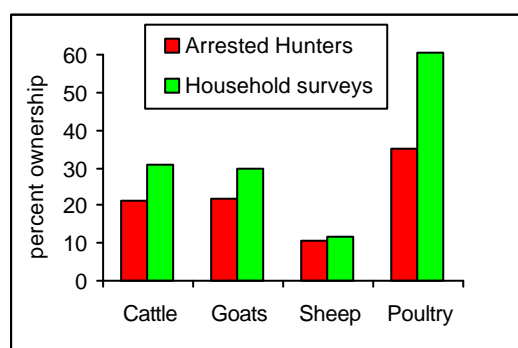
B.
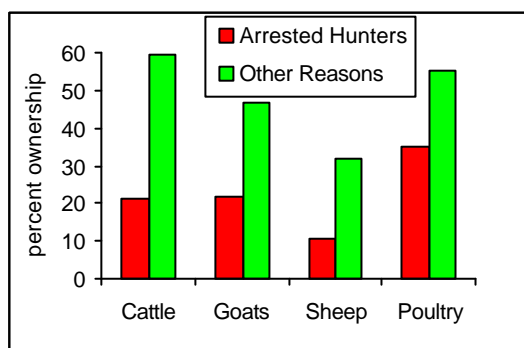
5.3 Consumption of Game Meat

5.3.1 Species Targeted by Hunters

The preferred method of hunting is snaring (Arcese et al. 1995, Turner 1988). Large resident and migratory herbivores either wander into or are driven into snare lines or individual snares. Other wildlife not specifically targeted by the hunters are also caught, some of them (e.g. Hyaena) in significant numbers (Hofer et al. 1993). Campbell and Hofer (1995) examined species specific offtake for those species where aerial survey estimates of population size were also available. Illegal hunting within the protected area was found to be unselective – a result consistent with the largely passive nature of snaring. However, more intensive effort on the part of hunters in certain specific localities is likely to result in the relative overexploitation of some species (Arcese et al. 1995). Table 8 lists species of identified carcasses associated with arrested hunters between 1998 and 2000, and a comparison with data from 1992-93. These data clearly demonstrate the overall importance of the migratory species – chiefly wildebeest. This is not surprising since they dominate total numbers.

Table 8   Species recorded with arrested hunters during 1992-1993 and 1998-2000.

Species		% 92-93	% 98-00
Migratory	Wildebeest	53.1	53.7
	Zebra	13.7	17.4
	Thomson's gazelle	2.6	1.5
	Eland	1.0	0.8
Resident	Topi	9.1	7.1
	Impala	7.8	8.9
	Warthog	4.8	3.0
	Reedbuck	1.6	1.3
	Buffalo	1.5	4.2
	Giraffe	0.8	0.0
	Ostrich	0.8	0.1
	Waterbuck	0.6	0.7
	Kongoni	0.6	0.4
Other species (including predators)		2.0	0.9

Migratory species are more accessible during the dry season (typically May-June to October-November) than during the wet season when the bulk of migratory wildlife are concentrated on the Serengeti Plains. In response to this change in seasonal availability, overall hunting pressure increases during the wet season and there is also a marked increase in numbers of migratory species killed. However, non-migratory, or resident, wildlife species are killed by hunters throughout the year (Figure 8).

Figure 8   Monthly records of migratory and resident wildlife species found with arrested hunters: 1992-93 and 1998-2000 data combined.
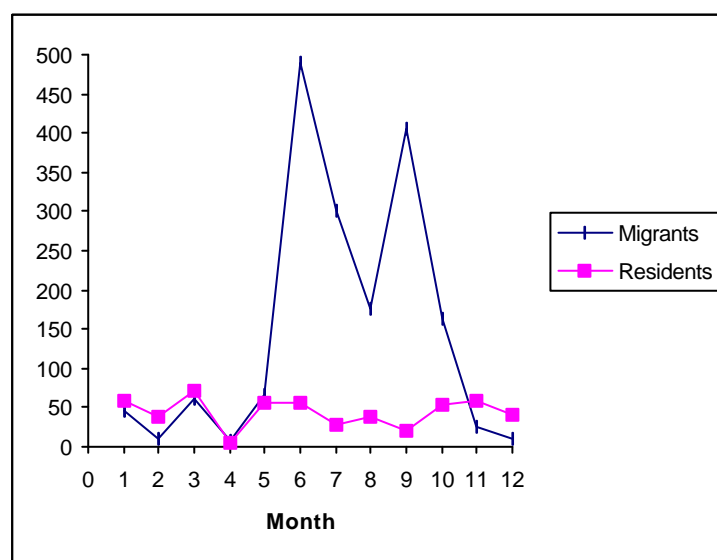
5.3.2 How Many People are Involved in Hunting?

There are no direct methods of obtaining reliable and accurate estimates of the total offtake of wildlife by hunters and indirect methods are required. One of the critical parameters required for these estimates is the number of active hunters, together with the frequency and success of hunting.

In an absence of data from villages, Campbell & Hofer (1995) developed a series of models to provide a rough estimate of the numbers of hunters and amount of wildlife killed. The study used spatial

models and an exponential decline in the proportion of hunters per household with distance from the protected area boundary, based on arrest records, to estimate a total of 31,655 hunters at 1988 population levels, with an overall annual rate of increase of 3.11%. This would be equivalent to 47,136 hunters in year 2001.

One of the problems with this approach lies in the definition of a hunter, or more precisely, the Swahili term *"wawindaji"*. The literal translation is "hunters". However, people who were arrested called themselves hunters when they may have been professional hunters (i.e. hunting being their main source of income), occasional hunters, or working either regularly or occasionally as a porter – carrying the meat out of the protected area back to the village. A reluctance to admit to being "only a porter" may in part be due to a certain amount of status in being seen as a hunter. Since, in practice, there was no reliable means of distinguishing between these different categories, the term hunter used in this report, must therefore be taken to include all of these categories. This also applies to hunters identified during household questionnaires in the villages.

The availability of information on the proportion of admitted hunters (or porters – see above) per household in a sample of villages in the western Serengeti (Loibooki, 1997) enabled an estimate of the numbers of hunters to be made – based on information obtained in the villages (Loibooki et al. submitted – see Annex 1). In these surveys a majority of people interviewed (89%) said that game meat hunting was practised by people living in their area, and 95 people (31.7%) volunteered the information that they themselves hunted wildlife. More men than women[1] admitted to being hunters (36.5% of men, 6.3% of women, χ^2=17.06, $\underline{df}$=1, $\underline{p}$<0.0001). Since, with the exception of migratory wildebeest at short periods during the dry season virtually no wildlife occur outside of the protected area, all of the wildlife hunted can be assumed to originate from the protected areas. Based on these figures, on the age distribution of the respondents, and on an extrapolation of 1988 national census data to 1998, Loibooki et al. (op. cit.) estimated a total of 52,928 hunters. This was considered to be an underestimate of the total number, since approximately 12% of game meat hunters arrested in the park came from villages located 16 to 45 km away from the protected area boundary (Campbell and Hofer 1995) - outside of the area sampled by Loibooki. Including this additional 12%s would boost the total number of hunters to approximately 60,000.

During the village surveys conducted as part of the current study, individuals in households were asked if they were involved in hunting. Answering this question was not obligatory and many respondents chose not to (115 out of 715 responded). Of those that did answer, 54% of males from households in villages with high numbers of recorded arrests declared themselves as hunters compared to 14% of males in the villages with low levels of arrest. Overall, 28.7% of those that responded said that they were hunters – similar to the figure of 31.7% obtained by Loibooki (1997). This suggests that the estimate of 60,000 individuals involved in hunting remains plausible.

Barnett (2000), in a survey of bushmeat in eastern and southern Africa reported that reported that 54% of households in Meatu District included hunters. Again there was no distinction between those who might be considered as hunters and those who were mainly involved as porters. The villages surveyed in Meatu District were situated close to the southern end of Maswa Game Reserve – outside of the current study area – indicating that relatively high levels of participation in hunting are not confined to the study area alone.

5.3.3 Hunting Effort: Group size, Frequency and Duration of Hunting Trips

Greater numbers of hunters are active during the dry season. This is a consequence of the greater accessibility of migratory wildlife at that time of year, and also results from an increased probability of lack of resources at the household level (chiefly agricultural) during the dry season.

Information obtained from arrested hunters provided information on the size of hunting groups and on the number of days they were in the park before being captured. From data recorded in 1992-93,

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[1] Since no women were arrested for hunting during both periods for which data area available (both during 1992-93 and 1998-00) their admitted involvement with hunting could be related to the trade in dried meat rather than in hunting itself. If women were involved as porters the expectation is that some would be arrested.

the average number of hunts per year was recorded on questionnaires of arrested hunters as being 3.2 (N=148). Campbell and Hofer (1995) used a figure of 5 hunts per annum derived from earlier work by Magombe and Campbell (1998). During workshops held at the beginning of this study, participants felt that answers to this question may not be reliable and it was dropped in favour of including different questions.

Re-examining these arrest data from 1992-93 demonstrated a skewed distribution (Figure 9) where the average value was influenced by outliers. As a result there is a greater validity in using the median value of 2.0 hunting trips per year than the average value.
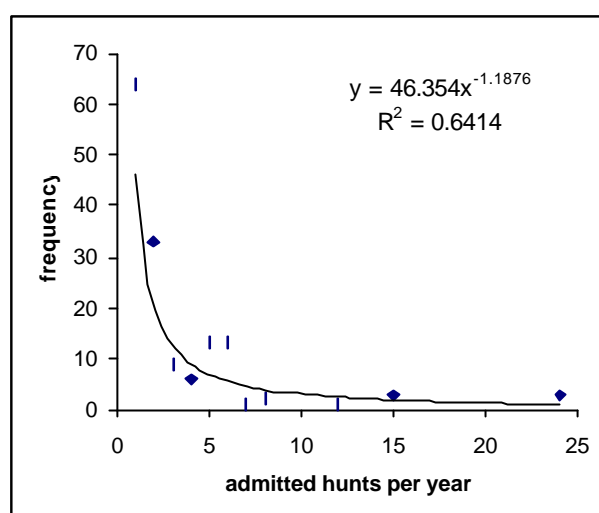

$$y = 46.354x^{-1.1876}$$
$$R^2 = 0.6414$$

Figure 9   Frequency distribution of the number of admitted hunts per year, (data from 1992-93 questionnaires of arrested hunters)

During 1992-93 the number of days in the park before arrest was recorded as 1.96 (N=123). In the 1998-2000 data, this increased to over 3 days (Table 9). Assuming no difference in the manner this question was asked or recorded, this difference is significant (Kruskal-Wallis one-way analysis of variance, $p < 0.0001$, Chi-square = 45.161 with 1 df, n = 506). Hunters are now spending longer periods inside the protected area, or alternatively are being detected later. The average recorded size of hunting groups has decreased slightly, from 4.97 to 4.14, but this difference is not significant ($p = 0.993$, n = 686). There has also been a decrease in the recorded numbers of snares recovered per hunter arrested. The difference is significant (arrest data: t = 3.253, df = 384.7, $p = 0.001$).

The duration spent in the park before arrest indicates that hunting effort per hunter is may have increased between 92-93 and 98-2000. This is corroborated by questions asked in the sample villages where the majority of respondents responded that hunting was now considered to be more difficult – and one can therefore assume that greater efforts may be required to generate the same returns. However, a reduction in snares recovered tends to indicate the opposite. Either hunters are using fewer snares, but hunting for longer periods, or changes in patrol methods have resulted in a reduction in snare recovery.

One is still left with a question as to what proportion of the estimated 60,000 hunters may be active in any given year, how many of them are hunters and how many are porters.

Table 9   Indicators of hunting effort: Size of hunting groups, Duration of stay prior to arrest and numbers of snares recovered.

	1992-1993		1998-2000	
	average	N	average	N
Days in park prior to arrest	1.96	123	3.23	383
Size of hunting group	4.97	318	4.14	368
Numbers of recovered snares recorded per hunter (all observed) [A]	6.8	280	4.9	405
Numbers of recovered snares recorded per hunter arrested [B]	11.3	181	7.6	220

[A] Derived from available patrol records, which record all poachers observed as well as numbers arrested.
[B] Derived from arrest records. Calculated as snares recovered per hunter, excluding those with no snares.

5.3.4 Total Offtake

Estimates of total offtake of wildlife by illegal hunters were made by Campbell and Hofer (1995) who developed a series of models for the Serengeti based on the assumption that hunters tend to maximise returns by minimising the costs of hunting.   Data from arrested hunters provided an estimate of 1.3 animals killed per hunter per hunting trip. Using an estimate of 5 hunts per annum (Magombe and Campbell 1989) resulted in an estimated annual offtake per hunter of 6.5 animals. Combined with the estimated number of hunters this resulted in a total of 75,000 resident and 135,000 migratory wildlife being killed annually by hunters (at 1988 population levels). These earlier estimates were thought to be too high (Mduma pers. com., Hilborn pers. com.) and were higher than indicated by wildebeest population models (Mduma 1999, Pascual & Hilborn 1995) that accounted for recruitment, natural mortality and climatic factors, but not for poaching mortality.

Offtake was calculated as:

> Total offtake = number of hunters x trips per year per hunter x total wildlife killed per trip
> where
> Total wildlife killed per trip = those removed + those consumed during trip + portion wasted + bycatch

The earlier models were re-run using new information. In particular, more recent data, including collected by this research project, that resulted in reduced estimates of the median number of hunts per annum and a reduced offtake per hunter (0.72 animals killed per poacher per hunt, based on data from patrols). These new calculations result in lower estimates of the total offtake: approximately 86,400 total, comprised of 60,775 migrants and 25,625 residents.

These estimates are closer to theoretical models, but continue to contain a number of uncertainties. The recorded carcases represent only those found with hunters or associated with them in poacher's camps and are likely to be an underestimate of the total mortality per hunter. These carcases are also the product of arrested hunters and those that were observed and escaped arrest as well as those that were not observed and therefore not recorded. In addition, the total number of active hunters and the frequency with which they hunt in an average year are uncertain, as is the relative success rate at different times of the year.

5.3.5 Importance of Game Meat in the Diet

Given the number of variables involved in estimating numbers of hunters, hunting effort and total offtake of wildlife, attempts were made to tackle the question of assessing wildlife offtake from a different angle. This involved questioning individuals in villages about the importance and frequency of different sources of protein in the diet. This approach provides an indication of the quantity of game meat consumed and also where it is consumed.

How important is game meat in relation to other sources of protein? Respondents to household questionnaires were asked for their most important sources of meat or protein. Game meat, although ranked by respondents in overall importance below fish and domestic sources of meat (Table 10), was nevertheless included in the diet of 45% of households. On average, across all households sampled, game meat featured as an item of diet 1.7 times per month (or 3.7/mon in those households where it was eaten), more often than sheep & goat at 1.3 times/month.

How do people in the villages obtain meat? Meat from domestic livestock was purchased from sources within the village (51%, N=567), from sources outside the village (26%, N=288), obtained from family members (10%, N=107), or from their own livestock (13%, N=144). Game meat was predominantly obtained direct from hunters (63%, N=267) or from traders (26%, N=110). In the household surveys, 96% (N=546) of respondents indicated that, compared with the past, hunting had become harder.

**Table 10   Average monthly consumption of meat, fish and eggs
in 24 villages adjacent to Serengeti National Park.**

Source	Viewed as important source of meat/protein (N=715)		Relative Importance in monthly diet (N=654)			
	Frequency of Responses	% of households	Frequency of responses	Percent of households	Mean monthly frequency of meals	
					(all households)	(only households eating the source)
Beef	546	76.4	571	87.3	2.3	2.7
Sheep/Goat	448	62.7	392	59.9	1.3	2.1
Chicken	489	68.4	353	54.0	3.2	5.9
Eggs	347	48.5	260	39.8	2.5	6.3
Fish	500	69.9	535	81.8	11.6	14.2
Wildlife	305	42.7	295	45.1	1.7	3.7

5.3.6   Spatial Distribution of Game Meat in the Diet

Within the study area, the frequency of game meat consumption varied. There was an overall relationship between the distance of the village from Lake Victoria and the frequency of game meat meals in the diet (Figure 10). A similar relationship was also demonstrated between the frequency of game meat meals and the frequency of fish based meals in the diet (Figure 11).

Figure 10   Spatial distribution of the monthly frequency of game meat meals per month consumed by households in the villages surveyed.
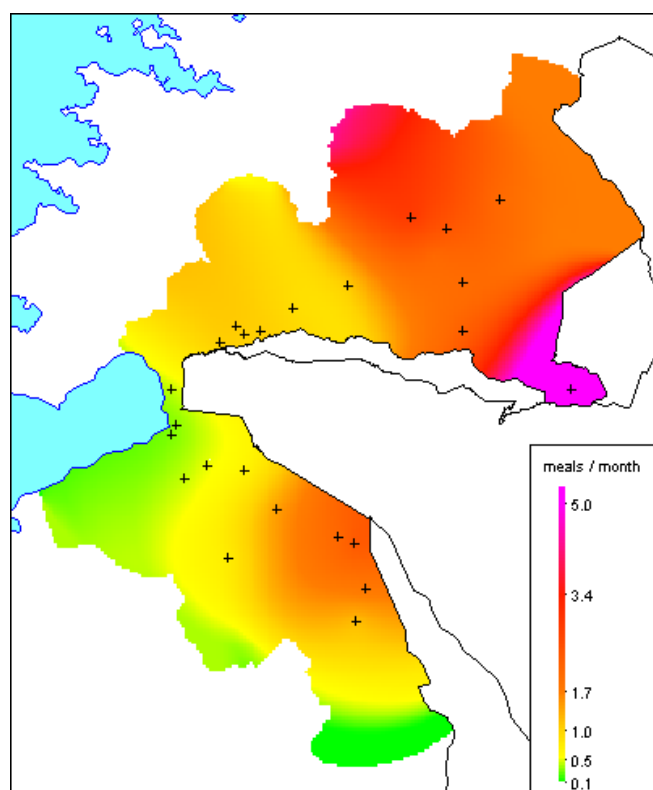
Locations of surveyed villages are indicated by + symbols. The surface was calculated by interpolation using inverse distance weighting and was limited to the area from which hunters were estimated to originate.

Villages with relatively high levels of hunters, as indicated by the numbers of arrests of people from those villages, were expected to also consume greater numbers of meals based on game meat. However, the village survey data showed a greater consumption of game meat by households

sampled in villages with medium levels of arrested hunters (Figure 12). The most likely explanation for this is a trade in game meat from hunters to non-hunters or to infrequent hunters in other areas.

Figure 11 Relationship between the frequency of game meat meals and the frequency of fish-based meals in the monthly household diet.
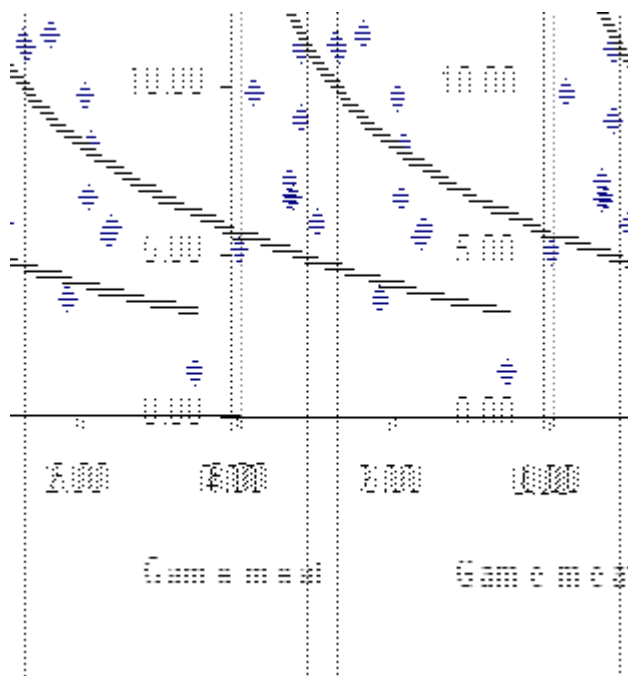
Figure 12 Relationship between the recorded numbers of arrests for hunting and the frequency of game meat meals consumed per month in sampled villages.
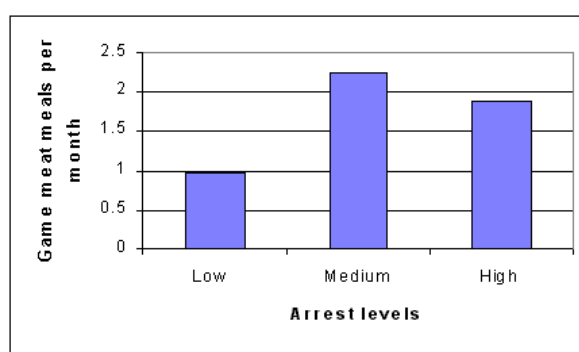
5.4 Rural Incomes and the Value of Game Meat

5.4.1 Sources of Income

Apart from hunting, what are the currently available or utilised sources of income in the sampled villages? Respondents to household questionnaires listed sources of income and also provided estimates of income generated from these sources. Table 11 shows averages for all 24 villages and indicates that agriculture, both subsistence (e.g. maize) and cash crops (e.g. cotton), were the most common sources of income for these rural households, followed by livestock. Whilst the stated

incomes may be under-reported by respondents there was no reason to suspect that the stated sources of income were misreported[1]. These data clearly indicate the relative importance of agriculture and livestock. For the majority of hunters, having either few or no livestock, agriculture on its own would constitute the most important source of income.

Table 11   Annual Income From Non-Hunting Sources

Source of Income	Households deriving income from source		Average reported positive income from source	
	Number of Households	%	(Tsh)	(US$) [A]
Subsistence crops	682	95	80,813	100.56
Cash crops	388	54	105,907	131.78
Livestock	248	35	112,486	139.97
Casual labour	194	27	27,082	33.70
Trade	130	18	86,611	107.77
Fishing	31	4	267,750	333.16
Remittances	31	4	28,545	35.52
Other sources	26	4	62,706	78.03
Employment	14	2	437,750	544.70
Mining	2	< 1	100,000	124.43
Reported Total Household Income:				
Overall average			157,327	195.76
Quintile 1 (poorest 20%)			11,421	14.21
Quintile 2			37,475	46.63
Quintile 3			78,493	97.67
Quintile 4			142,507	177.32
Quintile 5 (better off)			515,787	641.80

[A] Average exchange rate during 2000: Tsh 803.66 to 1 US$

5.4.2   Coping during Difficult Periods

In periods of drought, crop failure or during periods that are difficult for other reasons, e.g. stock theft, rural households were found to cope in a variety of ways according to the quantity and availability of resources accessible to them. The survey results suggested that better off or richer households tended to purchase their requirements and/or sell livestock. Since relative wealth is linked to livestock, disposal of livestock is an option that is more likely to be available to these households during times of seasonal shortage, drought or other problems.

In poorer households the survey data suggested that normal livelihood activities tend to be largely based on agriculture with fewer livestock. Selling livestock is therefore less likely to be a realistic option. At the same time, under conditions of stress caused by drought, crop failure or other problems there is unlikely to be a disposable surplus of agricultural produce. Survey results suggested that poorer households would tend to seek casual labour within the area or outside the district (implying migration and therefore access to the resources to achieve this) or alternatively resort to game meat hunting as a coping strategy.

The participatory research conducted at the beginning of the study clearly identified the important safety role played by wildlife in the survival strategies of poorer people in the villages surrounding the protected area during times of hardship. In an area with frequent poor rainfall, resulting in poor

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[1] These incomes may be compared with 1991 national figures reported by Ferreira (1994) who listed mean total income in better off households as Tsh 411,462, Poor Tsh 20,504, and Very Poor Tsh 13,596.

yields or crop failures, game meat hunting is dearly of major importance as a fallback in difficult times.

The poorest households or individuals are those that may already be partly or largely dependent on hunting for their normal livelihoods. The survey data suggested that an increased intensity of hunting, rather than labour seeking would be the most likely strategy adopted by these households during difficult periods.

5.4.3   Potential Income from Game Meat Hunting

The potential for generating a cash income through game meat hunting was seen as the main driving force responsible for illegal hunting in Serengeti National Park. A realistic assessment of the profitability of illegal activities is difficult to achieve through direct questions. Indirect methods were used and this analysis was included in a paper published by K. Campbell during 2000 in collaboration with other researchers also working in Serengeti National Park (Hofer et al., 2000 – see Annex 2). This paper modelled the spatial distribution of the economic costs and benefits of illegal game meat hunting in the Serengeti using data available from the late 80s and early 90s, including information from arrested hunters, wildlife census data, national park records, penalties incurred, patrolling rates, and a probability of detection depending on relief and habitat structure.

Costs included the capital investment in hunting weapons, the opportunity costs of hunting, penalties incurred if apprehended, as well as the spatially variable components of logistical effort of travel to hunting areas, and probability of detection. Benefit was expressed as the expected income from sale of meat from non-migratory wildlife. The model indicated that hunting resident wildlife was profitable over 68% of the area. In some areas, especially close to the park boundaries, wildlife populations have already been reduced by illegal hunting to the point where hunting is no longer viable – necessitating longer journeys to sites further within the protected area.

How do the benefits compare with "normal" earnings that might be obtained by people in villages adjacent to the protected areas?   Household survey data were not available at the time of this analysis and an estimate of the "normal" earnings of an average individual in villages adjacent to the park was derived by comparing several sources (detailed in Hofer et al., 2000) and taken to be US$0.46 per day. This estimate was to be similar to the estimated income (US$0.54) subsequently obtained from responses to the household questionnaires (see Table 11).

In this analysis of potential income from hunting, the total costs of penalties incurred if apprehended were substantial and equivalent to 252 days of normal villager's earnings. However, rates of arrest were low and across the protected area the model indicated that a day's hunting produced an average profit equivalent to 156 days of normal villager's earnings. In the majority of the protected area, potential benefits were shown to exceed costs. The slightly higher estimate of villagers' average earnings obtained by the household sample surveys results in an average profit equivalent to 133 days of normal villager's earnings – still a substantial incentive to hunt, even if as much as half of the product is kept for household use.

The distribution of sites within the protected area that have a high potential for profitable hunting and those that are unprofitable are shown by Figure 13. This clearly shows the Serengeti plains as being unprofitable (hunting is not practical in these areas and the plains have never been targeted by hunters).   Other major areas that formerly had potential for hunting but which are no longer profitable include the northwest of SNP and more ore less the whole of Maswa Game Reserve.

Figure 13 Spatial distribution of the modelled profitability from illegal hunting of resident herbivores in Serengeti National Park (in US$ per day's hunting).
(Adapted from Hofer et al. 2000).
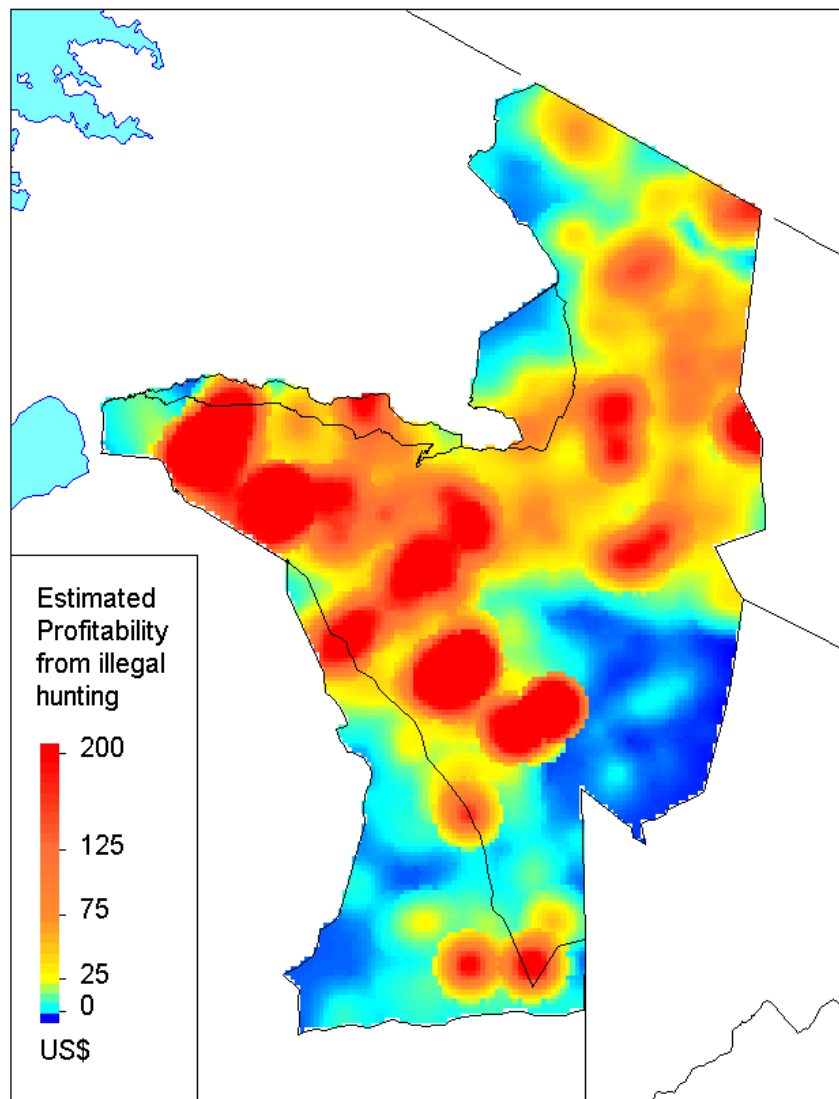
This model, which considers the costs and benefits of illegal game meat hunting as well as wildlife distribution clearly shows the potential offered by hunting for income generation. Low of negative profit (cyan and blue) occur in areas already over-hunted, or on the open Serengeti Plains, an area unsuitable for hunting.

5.4.4 Value of Illegal Game Meat Hunting in Serengeti National Park

Estimates of the value of the wildlife killed by hunters were based on the recorded consumption of game meat and on the local value per piece of dried meat. Information from village surveys indicated that, within the area represented by the sampled villages, game meat was consumed on average by between 43% and 45% of households, 3.7 times per month (or on average 1.7/month in all households sampled, see Table 10). Estimates were made of the total population and numbers of households within this area based on extrapolations from the 1988 national census at an individual enumeration area level, using 1978 to 1988 average annual rates of increase. These estimates

resulted in a population of about 1 million people and 154,000 households in the zone from where hunters originated (zones 1 and 2, see Table 12).

Table 12. Estimated Population in zones adjacent to Serengeti National Park

Zone		Population numbers			Rate of increase (%.p.a.)	Estimated number of households in 2001
		1978 census	1988 census	2001 estimate		
0	No hunters	893,543	1,150,410	1,597,758	2.56	242,085
1	Low numbers of hunters	191,471	315,414	603,521	5.12	91,443
2	Medium to High levels of hunters	205,322	277,491	410,494	3.06	62,196
Total		1,290,336	1,743,315	2,613,773		395,723

The average frequency of 3.7 meals per month in 45% of households within zones 1 and 2 results in the consumption of about 255,000 game meat meals per month in households of an average of 6.6 persons. On an annual basis this comes to over 20 million individual person meals. This figure does not include game meat consumed in the wider area from which hunters were not recorded but where game meat is traded, including urban areas and a cross-border trade with Kenya.

Game meat was sold in pieces of more or less standard size ("*kipande wa nyamapori*") and during discussions it was estimated that one *kipande* could be used for between two and three meals by a single household. On this basis, and conservatively using a figure of 3 meals per kipande, these 20 million meals would have resulted from a total of over 1 million *kipande* per annum.

This survey found that the average cost of wildlife meat in the villages sampled was Tsh 630 per *kipande.* In comparison the average cost of 1 kilo beef was Tsh 684. The total value of the game meat consumed in zones 1 and 2 was therefore calculated to be Tsh 642 million, or US$ 800,000 per annum. However, this only accounts for the meat consumed within the area from which the hunters originate and does not account for meat that is traded and consumed outside that area.

We know that wildlife meat is traded, but the amounts that are traded and the area within which it is traded are currently unknown in any detail. However, it is known that dried game meat reaches Mwanza and Musoma in Tanzania and also Kisumu in Kenya. A recent study by TRAFFIC, reported in Barnett (2000), examined three villages close to the park boundary within the same study area during 1997. Although the names of the villages was not given, the TRAFFIC study indicated that in these villages the hunters traded 61.5% of the meat. Whether this was the amount traded within the village, outside the village or both was not clear from the TRAFFIC report.

How much of this meat is traded inside the zones where hunters originate and how much is traded outside of this area? Few details are available. However, if the figure of 61.5% reported by Barnett (op. cit.) is representative of the area in general, and if half of it is traded outside the areas where the hunters come from, then the total value of the game meat illegally hunted within Serengeti National Park can be estimated at approximately Tsh 793 million or US$ 987,000 per annum – representing a total of 1,258,671 *kipande*. How do this figure compare with estimates of offtake of wildlife derived from records of arrests and patrols? How many *kipande* are represented by the estimated total offtake of 86,400 animals killed by hunters annually (section 5.3.4).

Species vary in body mass and the proportion of useable meat and data presented by Hofer et al. (1996) were used. Estimates of the number of pieces that three species (wildebeest, zebra and buffalo) could be cut into were derived from a pilot questionnaire of 42 arrested hunters in 1988 in the western corridor of Serengeti National Park (Campbell, unpublished data). These data resulted in an estimate of 2.79 Kg fresh weight of meat per *kipande* and a total of 2,499,807 *kipande* from the estimates 86,400 animals killed (Table 13). This value is double the estimate derived from wildlife meat consumed.

Both estimates are sensitive to parameters that are not fully understood or quantified. Possible reasons for this difference in the two estimates include:

- An underestimate of the amount of meat consumed in households outside the park. This estimate used a conservative figure of 3 meals per *kipande* and the estimate is very sensitive to the value chosen. If one *kipande* were to provide on average 2 meals in a household, the estimate would increase to about 1.9 million *kipande* consumed with a similar increase in the total value of the wildlife killed.

- Few details are currently available on the volume of trade in dried game meat that leaves the survey area, and is consumed for example in the urban areas. This amount may be significantly greater than estimated by this report.

- The estimates of number of *kipande* produced from an individual animal may be high. In particular this estimate does not allow for wastage during preparation and does not also allow for the small pieces of meat that, although theoretically useable, can not easily be processed into the final product.

- The total number of hunters (or others involved in hunting – see section 5.3.2) active during any one year is likely to be less than the overall total as some people may only hunt infrequently.

- Some species, particularly the smaller gazelle, may be killed by hunters, consumed in the field and not taken out of the protected areas.

Table 13   Estimated number of pieces of meat, or *kipande*, derived from the illegal hunting offtake

	Percent of offtake recorded 1998-00	Calculated total offtake	Estimated No *kipande* / animal	Estimated total *kipande*
Wildebeest	53.7	46397	26.4	1,227,192
Zebra	17.4	15034	39.4	592,685
Thomson's gazelle	1.5	1296	3.4	4,459
Eland	0.8	691	79.2	54,747
Topi	7.1	6134	21.5	131,914
Impala	8.9	7690	9.3	71,655
Warthog	3	2592	10.5	27,172
Reedbuck	1.3	1123	9.3	10,466
Buffalo	4.2	3629	96.8	351,152
Waterbuck	0.7	605	31.5	19,075
Kongoni	0.4	346	26.9	9,290
Others and Bycatch	1	864		
		86400		2,499,807

5.4.5 Costs of Wildlife to Communities

This study did not set out to document in detail the costs of wildlife to communities. Emerton and Mfunda (1999) examined the negative economic impact of wildlife on landholders around the western Serengeti. They suggested that the revenues from community development initiatives of the Serengeti National Park, through the Community Conservation Service (the SCIP fund), do not provide sufficient economic incentives for local communities to conserve wildlife. These authors presented an analysis of the economic costs and benefits of wildlife for landholders, resulting in a

negative benefit of US$ 1 million per year. This analysis did not include the contribution of wildlife through illegal hunting and if this is factored in, the resulting balance is more or less even with the negative and positive elements cancelling each other.

5.5 Changes in Hunting Pressure

The need for hunting and its role and importance to rural communities as part of coping strategies are likely to change over time in response to short-term climatic fluctuations as well as longer term macroeconomic trends. There are no detailed long-term data sets on illegal hunting that can be used to fully analyse these changes. However, one measure of this change may be seen by the changing age structure of persons arrested within SNP for hunting. Figure 14 shows that, compared with the situation in 1992-93, which was clearly dominated by the 15 to 25 year age groups, the 1998-2000 situation included an increase in the numbers of people arrested from the 25 to 45 year age groups. The difference between the two age profiles is highly significant (Kruskal-Wallis one-way analysis of variance, N=727, Chi-square=13.631 with 1 df, P<0.001).

Figure 14 Change in the age profile of arrested male hunters in Serengeti National Park between 1992-93 and 1998-2000.
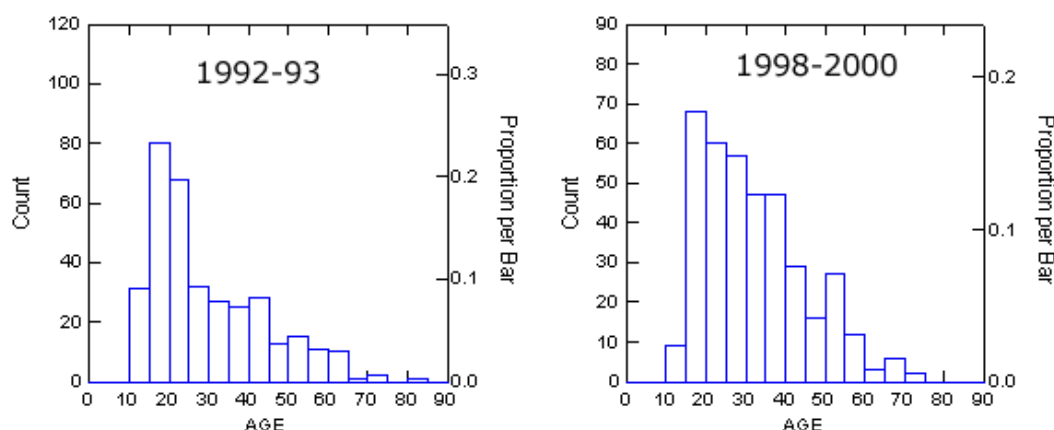
These data, together with the fact that the majority of hunting is carried out to generate a cash income, suggest changes in levels of poverty in rural areas and/or increased difficulty of access to income generating activities. Such a change is likely to have resulted in greater numbers of those males that are responsible for generating household income being forced to hunt in order to generate the income required to pay taxes, village contributions and other basic needs.

Agriculture comprises a large section of the Tanzanian economy, significantly contributing towards both employment and GDP. The International Monetary Fund (IMF) has focused much of its policy intervention on the Tanzanian agricultural sector and structural adjustment programs have therefore had a major impact on agriculture, and especially on small farmers. Hammond (1999) illustrates the impact of structural adjustment in a number of communities elsewhere in Tanzania and reports that Food security, housing conditions and primary-school enrolment have fallen while malnutrition and infant mortality have increased. The effects of structural adjustment within the study area are difficult to quantify, but there are indications that rural poverty has increased as a result. This may be partly due to the difficulties now encountered in marketing cotton, the most important cash crop throughout much of the area.

Nationally, rural poverty is also reported to have increased. The recent Poverty Reduction Strategy Paper (United Republic of Tanzania 2000) includes an analysis of trends in income poverty. Based on the 1991/1992 Household Budget Survey, about 27% of the people were estimated to be in households with total expenditure that was insufficient to obtain enough food to meet nutritional requirements, and about 48 percent of the households were unable to meet their food and non-food

basic requirements. The results of various updated estimates for year 2000 suggest that poverty levels may have increased, to well over 50 percent for Mainland Tanzania (United Republic of Tanzania 2000). The same report also concludes that the incidence of poverty declined during 1991-1993, and rose between 1993-1998. The more recent deterioration in the poverty situation was attributed to worsening income inequality, and relatively low rate of economic growth, particularly in the rural areas.

This national picture of poverty levels reinforces the conclusions that within the study area an increase in rural poverty has led to an increased incidence of and dependence on game meat hunting as a means of support for the poorest households.

5.6   Changes in Wildlife Populations

5.6.1   Migratory Wildlife

Over the last 20 years significant changes have occurred within the Serengeti ecosystem. Following the disappearance of Rinderpest from the ecosystem, the wildebeest population underwent a dramatic increase starting in the 1960s (Sinclair 1979). This effectively ceased during the late 1970s (Sinclair and Norton-Griffiths 1982) and wildebeest numbers stabilised (Sinclair, Dublin & Borner 1985, Dublin et al 1990, Campbell & Borner 1995). More recent surveys (TWCM 1999b) have shown that the wildebeest population still appears to be relatively stable (Figure 15), although the large confidence limits attached to the population estimates (e.g. 1,296,944 ± s.e. 3000,072 in 1999, TWCM op. cit.) effectively mask all except major changes.

Figure 15   Long term changes in Serengeti wildebeest estimates.
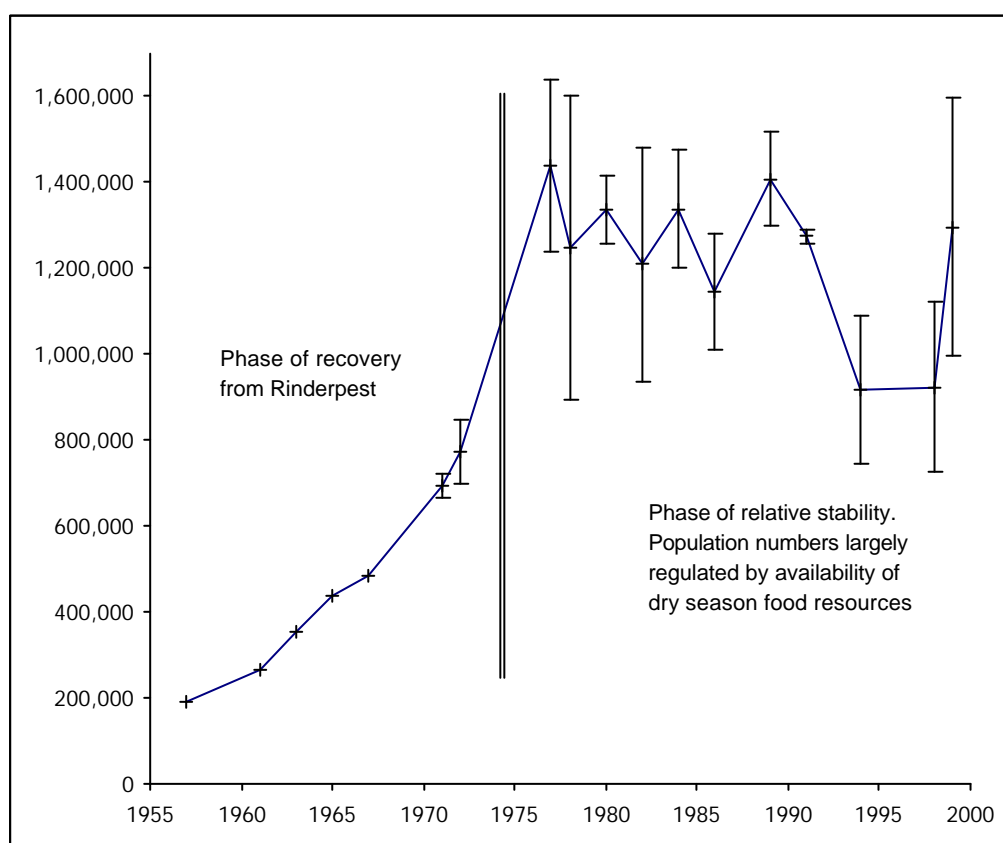
Population estimates and standard errors of estimates from aerial sample surveys.
Surveys prior to 1970 were total counts.

Serengeti wildebeest population numbers are considered to be regulated through density-dependant mortality due to food shortage during the dry season (Sinclair et al. 1985, Mduma et al. 1999). Recent research has shown that the Tanzanian wildebeest population continues to be regulated largely by climatic factors (Homewood, pers. comm.). In contrast the much smaller Kenyan wildebeest population in the Maasai Mara part of the Serengeti ecosystem has suffered a 75% decrease in numbers (1977-97) as a result of core breeding and calving grounds being taken over by mechanised agriculture. Protection of the Tanzanian wildebeest whilst breeding and calving on the Serengeti plains during the wet season has played an important role in conserving this population.

5.6.2 Resident Wildlife Species

In contrast to the migratory species, resident herbivores are accessible to hunters throughout the year. The absence of an effective "off-season" has resulted in both ecosystem-wide and local declines in population numbers. Roan antelope have been almost eliminated and are absent from the park itself. Illegal trophy hunting between 1975 and 1986 drove Black rhino to virtual extinction and significantly reduced the elephant population. Elephant populations have increased following improved protection and the almost complete cessation of trophy hunting in the area (Campbell and Borner 1995, TWCM 1999a).

There has been a steady decline in Buffalo populations within SNP from a count of 63,144 in 1970 to 15,144 in 1998 (Figure 16). This pattern is not related to changed rainfall patterns over this period and a lack of reported disease factors (TWCM 1999a) suggests that hunting may be the main driving force responsible for this decline. These changes have not taken place evenly throughout the area, but have in general happened earlier and have been more severe closer to the western boundaries of the protected area. The pattern of decline in the buffalo population is shown in Figure 18 and is consistent with a mortality caused by illegal hunting – initially concentrating on the most *profitable* areas, closer to the hunters home villages, and subsequently spreading to areas that are less *profitable* and which involve increased travel and perhaps greater probability of detection. It is noticeable that census blocks in Loliondo, outside and to the East of the protected area, although with a low population of buffalo to start with, have shown little or no decline.

Figure 16   Decline in the Serengeti Buffalo Population
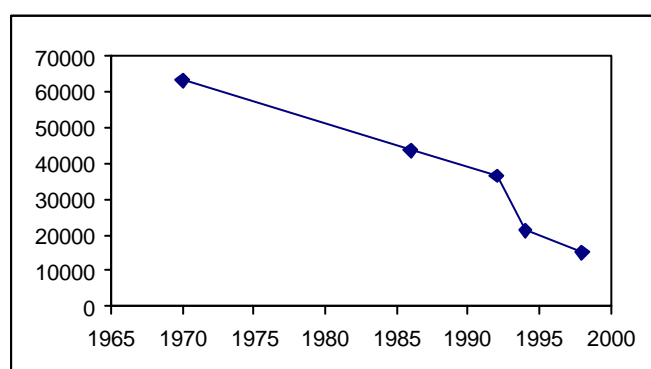
Sources: Campbell and Borner (1995), TWCM (1999a)

A number of zones of potential hunting impact resulted from models of wildlife offtake developed by Campbell and Hofer (1995). The location of villages and national park infrastructure were used together with physical characteristics of the protected area to estimate probable spatial distribution of hunting – assuming that hunters seek to *maximise returns by minimising the costs of hunting*. This *profitability model* identified areas where hunting should be most *rewarding*. Areas with the highest potential rewards from hunting should suffer the greatest impacts.

Comparing the estimated profitability – or costs – of hunting with supply and demand models, and with wildlife distribution data and law enforcement activities resulted in the definition of five "zones of hunting risk" (Figure 19). These were:

(1) The "**over-exploited**" areas: Regions suitable for hunting but containing few wildlife (density of all large resident herbivores <1/km^2). Examples defined by Campbell and Hofer (op. cit.) were parts of the northwest of the Park along the boundary, most of the Ikorongo GR and a majority of of Maswa GR. Hunting in some of these areas may be supported by migratory herbivores during short periods in the dry season.

(2) The "**endangered**" areas: Localities suitable for hunting and containing medium to high densities of large resident herbivores (≥10/km^2). Hunting is likely to concentrate in these areas. Examples were: the western and central sections of the western corridor, the northwestern corner of Maswa GR and adjacent areas in the Park, and the eastern part of Ikorongo GR.

(3) "**Areas of escalation and conflict**": Localities wtih high wildlife densities (≥10/km^2) but which are less suitable for hunting because of the greater chance of being patrolled. These are areas where hunters and patrols have a greater chance of meeting and where hunters may take specific measures to reduce the chances of arrest (larger and better armed groups, small groups moving only at night).

(4) Areas of "**future expansion**": Areas that are suitable for hunting but not yet or only marginally exploited because the existing demand can be satisfied by the available supply in safer grid cells closer to the home village.

(5) The "**untouched area**": An area where wildlife presence is highly seasonal, suitability for hunting is low (or zero using current methods[1]) and where the high chance of detection by patrols (and/or tourists) outweighs benefits from hunting. This area largely encompasses the Serengeti Plains.

This model establishes a framework within which the changes in resident herbivore population can be evaluated with respect to hunting pressure and hunting offtake. If these models are realistic and if, as expected, illegal hunting has made / is making an impact and resulting in reduced population numbers then one can predict that:

1. There should already be a demonstrable decline in the densities of resident wildlife over time in the overexploited zone. Areas of greatest risk should be related to the greatest population declines.

2. A relationship between the suitability, or profitability, of an area for hunting and the densities of resident wildlife in that area.

Campbell and Borner (1995) calculated average densities of resident wildlife species in each of the "risk zones" and found a significant decline in resident wildlife densities in the zone of greatest risk. More recent wildlife census data in a suitable format were not available for these species. However, overall population numbers have not increased whilst some species may have declined further (TWCM 1997). Campbell and Hofer (1995) tested the second prediction and found a significant decline in wildlife density with increased suitability for hunting in a given area.

The observed declines in buffalo populations were also found to be related to these "risk zones". Although many of the buffalo census blocks covered a range of categories of risk, population declines the median category of risk within each census block (Figure 17).

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[1] For example, the use of snares is not possible on the Serengeti plains.
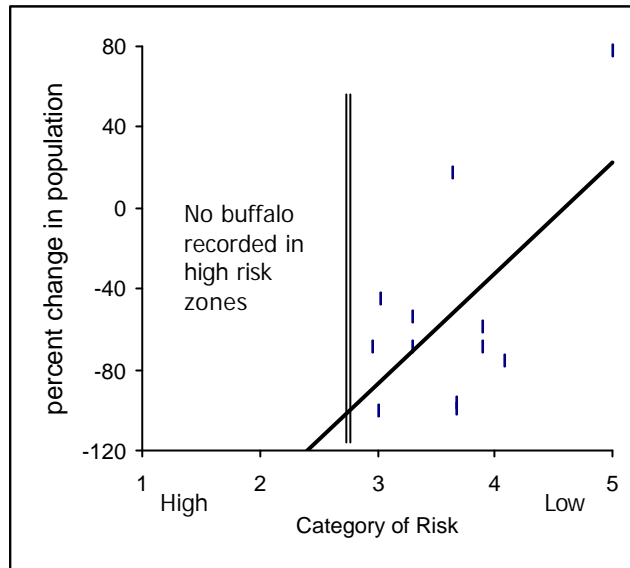
Figure 17 Declines of buffalo populations within individual census blocks between 1992 and 1998 in relation to the median category of risk within each census block.

These findings confirm that illegal hunting of resident herbivores has already had a negative impact resulting in reduced population numbers. Moreover, there is nothing to suggest that the situation will change unless hunting is significantly reduced. Continued hunting in the Serengeti by people from adjacent villages will continue to reduce populations of a wide range of non-migratory wildlife species, including a bycatch of predators.

The unselective nature of the main technique used – snaring, and the fact that populations of migratory wildlife are not demonstrably affected by hunting offtake, but by climatic factors, strongly suggests that rates of offtake will remain greater than can be sustained by the resident wildlife. This scenario is already in place.

Supported by migratory herbivores, hunting is likely to remain a profitable livelihood activity – especially for the poorest people in the community – even where populations of resident wildlife are reduced to unprofitable levels. Unlike the migratory populations, there is no "closed-season" for resident wildlife".

Figure 18   Distribution and changes in Serengeti Buffalo population numbers: 1970-1998.
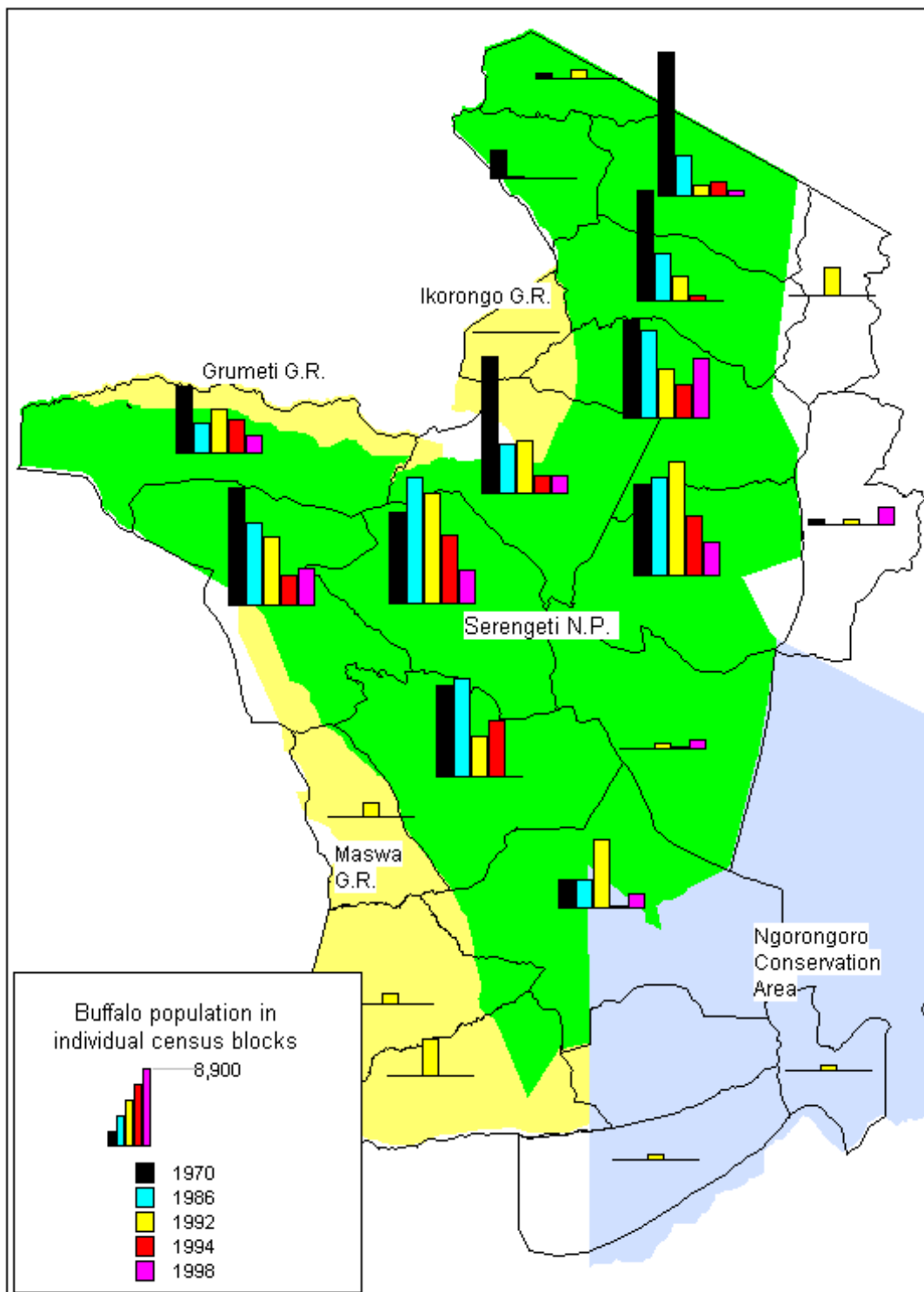
Sources: Campbell & Borner (1995), TWCM (1999a)

All censuses were carried out by total counts from light aircraft. Blocks within Maswa G.R., Ngorongoro Conservation Area and in northern Loliondo were only covered by a single census – in 1992 – and as a result changes in these areas remain undocumented and only the 1992 figures are represented in the above figure.

Figure 19   Zones within the Protected Areas with varying degrees of risk from illegal hunting. Adapted from Campbell and Hofer (1995).
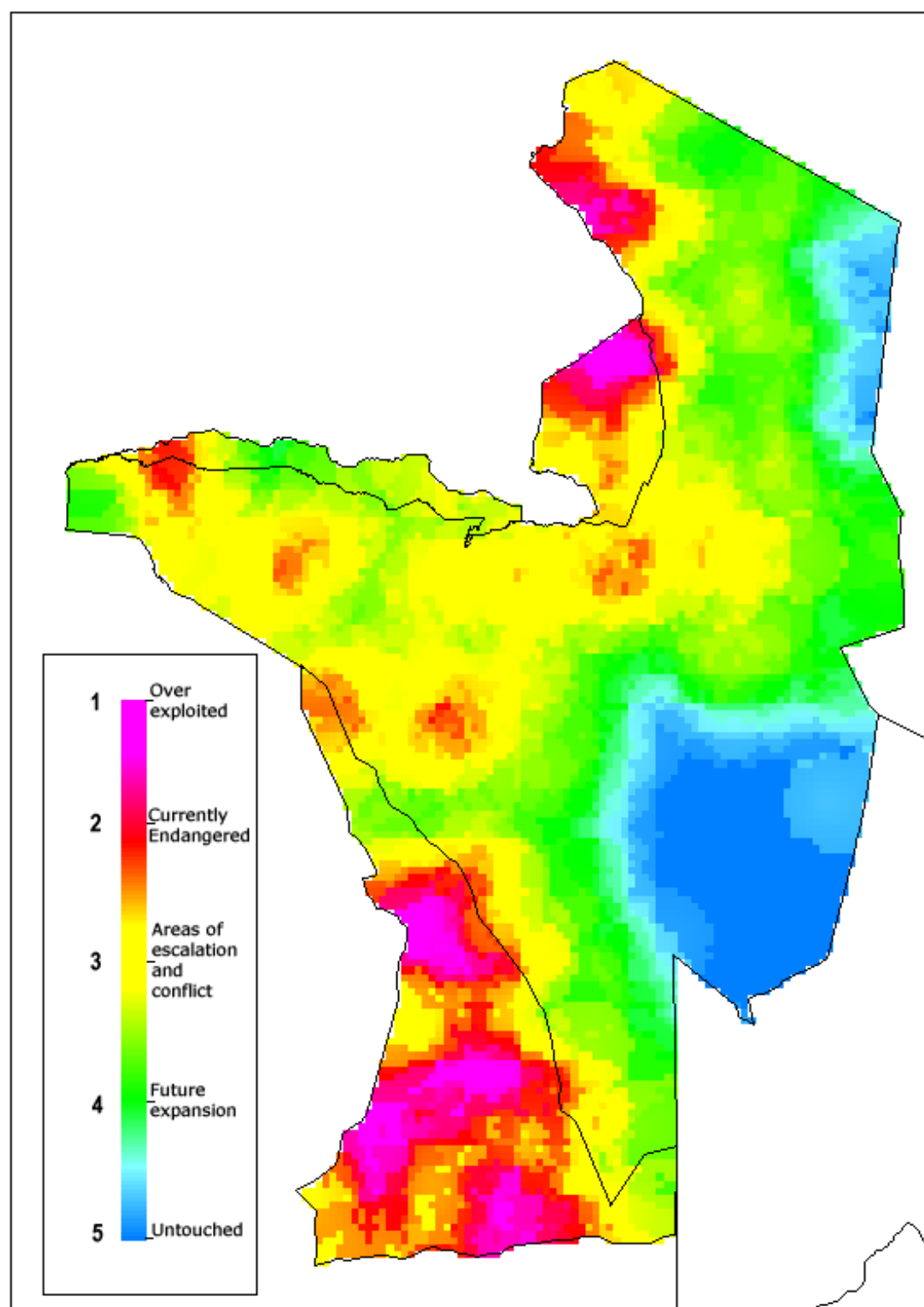
5.7 Community – Private Tour Operator Partnership: Robanda Village

5.7.1 Public – Private Partnerships

Public-private partnerships are currently high on the development agenda. However, their impact has not been extensively researched. This study aimed to understand how such a partnership has functioned and what difference it has made in the eyes of different groups within the local village. A key issue in relation to this study is whether such initiatives can act as a conservation incentive in addition to their positive (or negative) development outcomes.

Such partnerships fit within the relevant national policies such as the Wildlife Policy and the TANAPA CCS policy that promotes the "sharing of benefits..[that] may include sharing of the infrastructure and services, cash or in-kind contributions to local projects, and assistance in setting up sustainable income generating enterprises based on non-park natural resources".

A key consideration is how far TANAPA has the experience and capacity to help initiate and accompany the development and implementation of such enterprises. Wildlife Management Areas (WMAs) are a new category of protected area in Tanzania aimed at facilitating effective community based conservation (Severre 2000). Although the WMA guidelines are still to be made public the philosophies of WMA's appear likely to encompass income generating activities and partnerships with tour operators.

The process undertaken in the development of the partnership has been documented and the lessons distilled (see Annex 3). Beginning in 1989 relationships between the local village leadership and external bodies were established by the Serengeti Regional Conservation Programme (SRCP) via their conservation awareness raising activities. Later the TANAPA-CCS staff facilitated the connection between a tour operator (SENGO) that was seeking a potential campsite in the area and the community leadership that were known to be dynamic. A campsite was established in 1994.

In addition to its strategic location near to the park boundary, a number of other factors can been seen as important in the choice of Robanda. The strong leadership of the village was a factor in Robanda being selected for the partnership and is part of the social capital of the village, as is the external exposure to the agendas of different organisations (e.g. TANAPA and the Serengeti Regional Conservation Programme). Physical and natural resource capital endowment is also high (on a key road through the Serengeti from Arusha to Musoma and Mwanza), and the presence of wildlife outside the park for legal hunting as well as within the park (tourist attraction and illegal hunting). Proximity to the protected area and to relatively abundant wildlife may be disadvantageous to the community due to crop damage[1].

5.7.2 Robanda – SENGO Partnership

A contract was developed between the village leadership and SENGO. The key components included the following:

Community

- Allocate a parcel of land within the vicinity of River Romoti, near the boundary of SENAPA,

- The parcel of land will be used solely and exclusively for constructing a safari camp, walking and photographic safaris, and game drives,

- Provide water facilities – unlimited access to and us of a water tank situated in the Barazani area,

- Provide absolute and total co-operation and assistance, through the villagers themselves and through their leaders,

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[1] Much of the crop damage is not caused by wildlife resident within the park, but by nocturnal species such as bush pig and porcupine living outside the park. Migratory wildlife move through the area but normally after crops are harvested.

- Reserves the right to suspend the operation of the agreement until …. the company fulfils its obligation…, provided the village shall not allocate the land to any other person for the duration of the agreement.,

- Shall not…relinquish its right to exercise overall control of the land … and the village council shall have the final decision making power in respect of the land.

SENGO

- Ensures that the land.. shall not be used by any other party in a manner inconsistent with the agreement, and shall guarantee the safety and security of the area,

- Pay the village US$ 10 for non-resident, and Tsh 1000.00 for resident tourists (over 6 years) accommodated at the camp,

- Pay Tsh 1,000,000 annually for the use of the land,

- Pay 15% of the running costs of the water pump (all expenses for repair to be paid by the village),

- Accord the village such financial assistance as may be requested from time to time, for social and economic development,

- Recruit and employ from the village all necessary staff for non-technical/professional duties, provided they are qualified to perform the job,

- Guarantees the villages the right to use the land.

There are differences between the different versions of the contract in Kiswahili and English. The detail of a contract may be relatively unimportant in a relationship of trust, but at the same time if conflicts arise it is often useful to have a written agreement to refer to and for mutual expectations to have been clearly set from the beginning.

Divergences were found between the perceptions of many of the villagers and the tour operator, for example, the village council, SRCP, and some of the villagers feel that the contract was signed for too long a period – 10 years. The tour operator however may feel that such a period is required in order to justify initial investment. At the same time support to villagers at the initial negotiating phase becomes all the more crucial in order to avoid future conflict. The contract left out some details such as the fact that children of 6 years and below are accommodated for free but at the same time SENGO is charging half price for all children under 12). SENGO feels that there are aspects of the agreement that the community is not honouring – such as cultivating too close to the camp. The campsite borders were not sufficiently clarified from the perspective of the tour operator, whereas the village council maintains that since the borders were not specified there is nothing that SENGO can do.

The types of benefits obtained by the community were discussed with different groups of villagers and the village council. These are outline below:

Income

The community has several means of raising income locally, including SENGO Safaris, legal hunting (through SRCP), and taxes raised from the sale of sand harvested in the village and fines from those found selling charcoal. However, proceeds from Sengo far outweigh the others. Table 14 indicates amounts of money that the village raised between 1996 and 2000 (figures for 1997 were not available):

Table 14   Income raised by Robanda village through public-private partnerships: 1996 to 2000

Source of Income	Tsh
Sengo	18,645,000
Legal Hunting	1,764,310
Other	1,378,914
Total	21,788,244

Between 1996 and 2000, SENGO has contributed 86% of village funds, while legal hunting through SRCP contributed about 8% in comparison. This indicates that the partnership with SENGO is highly significant financial contribution. The village council reports that so far the cash obtained directly through partnership with SENGO amounts to 24 million Tanzania Shillings.   Besides this cash, the community also obtained a loan from the tour operator of 4,300,000 Tanzania Shillings to purchase a new grinding machine. This loan has already been repaid in full.

Seven groups (with a total of 21 beneficiaries) have received small interest-free loans of Tsh 50,000 per group. These groups are made up of women and young people. In 1999 a youth group, and two women's groups benefited from the loans. They have already repaid this first loan and are in the process of acquiring a second loan. The women's groups are also making handicrafts, which are then sold at the camp (although this has not been particularly successful as yet).

Twenty-one members of the community have formed a traditional dancers group. The group performs on invitation at the campsite and in the lodges. "*During the high season, we perform 4-5 times per month. For each performance, we - as the entire group - are paid between US $ 100 – 150*", said Kenyatta Mosoka, one of the leaders of the group.

Education

Using some of this cash income 4 classrooms and 2 teachers' houses at Robanda Primary school have been constructed and school desks purchased. The funds have also been used to pay the school fees for 28 children of the poorest households.

The village has contributed 1.1m Tsh towards the construction of the secondary school for the ward. The village council is paying the cash on behalf of the community, and therefore relieving the individual households of this contribution that would otherwise be levied.

Health

The village dispensary has been renovated and a house built to accommodate two nurses. The village council also regularly purchases extra drugs for the dispensary, to top up meagre government supplies. As a result, there is an adequate supply of drugs all year round.

Water

The village council has renovated the water system – including repairing the machine, installing the pipe line and building two water distribution points. SENGO also contributes 15% of the total running cost of the water system. Funds have also been used to rehabilitate 2 dams, which provide an alternative source of water, especially for livestock.   There is sufficient water for the village, and women do not have to walk so far to get water. *"Today, people in the village are starting to demand clean water. Therefore, the efficiency of the borehole and pump has become very important to them"*, said a SENGO employee.

Other Community Services

In 1997, the village bought a new milling machine and replacing an old unreliable one. As a result women no longer have to travel 10 km to the grinder nor use the alternative – the labour intensive

traditional grinding stone. Today, the milling machine operates at a 20% profit and is self-sustaining. The new machine saves the women time and energy to concentrate on other activities.

The village council has constructed an office for use by the Environment and Conservation sub-committee, using funds entirely from SENGO. The office is partly used to store trophy objects confiscated from arrested poachers, or hides and skins of the wild game that SRCP hunts for the village. The village council has spent some of the funds to also construct a village butchery. Village leaders get their safari allowances paid for when they travel to seminars, which may be useful in terms of village human capital capacity building.

Security

The village is in the process of constructing a new police post. In the meantime the village council has rented a building to accommodate the police staff which the council say has helped to reduce crime.

Tax relief

Probably the greatest immediate benefit to villagers has been the occasional payment by the village council of various government taxes on behalf of villagers. Each household may be required to pay three or four different taxes – head tax, school building tax, livestock tax, etc.

Analysis of data on arrested poachers collected between 1998-2000 by this project and information from both the participatory research and larger questionnaire based surveys indicates that payment of taxes is the major contributing factor to illegal hunting. During the PRA exercise conducted in the villages neighbouring Robanda in 1998, people reported that taxes are the heaviest financial burden that they face.

Although the village council has not made this a regular occurrence it considers tax relief as a direct way to benefit all the members of the community at once. In 1996, the village council paid taxes for all 232 households and their livestock. This relieved the community of a heavy tax, and enabled them to meet other basic domestic needs. Besides this tax, the council pays the contribution that is demanded of villagers for the construction of the ward secondary school. As a result of the tax relief, most community members are able to meet many of their basic domestic needs.

> *"These days, our women even have access to cash. You can tell by how well dressed they are – you will find that every one of them buys the newest kanga that comes into fashion"*, said the chairman of the Environmental Conservation sub-committee. *"People no longer have to run and hide to evade taxes because we take care of most of the contributions that they would be demanded to pay"*, said another member of the village council.

Employment

Six members of the community have found employment with SENGO. At the same time, the funds pay for the salary of the Village Executive Officer and the running expenses for the village council office.

5.7.3 Benefits from the Partnership

A livelihoods analysis of the benefits of the partnership is outlined in Table 15. The tour operator also benefits from the partnership. However the head of SENGO notes that his company does not make a huge profit since the camp charges are only US$ 60 per guest (low compared with rates obtained elsewhere around the Serengeti). As yet the camp is not financially viable (normally considered to be 40% occupancy) – with a current occupancy rate of approx. 20%. However, the tour operator expects the camp occupancy rate to increase to a viable level by mid-2001, because more tour companies are now aware of the camp.

The successful elements of the partnership result from the following factors:

- Entrepreneurial village leadership and the village leaderships' links with external organisations

- There is a main account that pools all the funds together and village financial records are well kept and presented to the village council every 3 months.

However factors that hinder the partnership include the following:

- There are several factors that hinder the partnership. Firstly, there is a risk that the village is dependent upon the various external organisations.

- Secondly, there is marked growth in human capital at the level of the village leadership. However, decision making is top-down, with heavy dominance from the chairman. *"When Sospeter is on the war path, you do not want to cross it!",* said Debby of SENGO. The majority of the villagers have not been fully involved in the partnership construction or implementation. Do such partnerships benefit the already powerful whilst further excluding the poorest – in this case the group that is most engaged in hunting.

- Existing village bye-laws were established in 1991 and do not cover tourism partnerships with tour operators. There is need therefore to develop new bye-laws that specifically stipulate how the arrangement with SENGO should be governed.

- The tour operator submits financial reports to SRCP, but the village council and TANAPA do not receive them. It is thus difficult to cross-check and verify the financial potential for a longer-term partnership. As previously mentioned the visitor monitoring system has broken down. This limited transparency in the agreement means that only the leadership within the village are fully aware of the financial transactions occurring.

- The sustainability of tourism development is questionable. Tourism initiatives are vulnerable to rapid changes in visitor numbers as the market changes and the cultural and social consequences of engagement cannot always be foreseen.

The study concluded that the experiences of Robanda demonstrate that development benefits can be derived from partnerships with wildlife tour operators. Such partnerships may act as a conservation incentive although this case has yet to be proved – it is possible that the public and private partnership benefits would need to rise above a certain threshold before hunting would reduce significantly. Crucially benefits would have to accrue to the poorest households in terms of individual income generation as well as the provision of public goods for it to have an impact on hunting.

Analysing livelihood benefits demonstrates that many of the benefits are used for infrastructural and service provision. It may also be necessary to consider whether proceeds can be used to initiate income generating projects such as poultry and bee keeping, improved cropping, planting fruit and other types of trees (to obtain fruits and firewood to sell to the camp and lodges) etc. This will help diversify sources of income for the community, rather than depending solely on tourism.

Dynamic leadership at the village level has played a key role in the success of the partnership in Robanda village. However wider community participation has not been facilitated and there are risks that poorer households are further marginalised.

The role of the CCS and other external organisations has been crucial both in pioneering such agreements in the early stages and/or accompanying the development of the partnership and building capacity on both sides to maximise benefits for all and protect village resource rights.

There is a risk that such arrangements will merely replace previous top-down conservation approaches, with initiatives that are neither development nor conservation oriented. An example is given (Box 1) of a failed community-private sector partnership from this region by IIED (1999).

An overall limitation in relation to community-private partnerships in the Serengeti region is the sheer

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Box 1. Nyakitono hunting concession

A 5000 ha hunting block lies on Village lands which abut korongo Game Reserve. After negotiations with the concession holder, Nyakitono Village Council decided to allow this land to be used by a tourist hunting operator at no charge, envisaging that while hunting activities would give rise to little inference to local livelihoods, tourist development could provide a valuable source of income and employment for villagers.

Having obtained the use of this land, the concessionaire proceeded to close off his concession and bar village access. There is little interaction between the hunting company and the local economy, with such limited temporary employment opportunities as are occasionally offered to villagers being paid at well below the minimum national wage rate. The use of village land for wildlife hunting is widely perceived in the village of Natta Mbiso to have caused more local problems than it has generated benefits.

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scale of population and lack of economic development, the decreasing wildlife populations and the number of tour operators/hotels establishing initiatives or willing to share profits. Even if all tourist hotels or camps established such schemes, this would make little impact over the large number of villages in the area, and moreover to the large number of villages that are involved in illegal hunting. As a result, the potential of such partnerships to reduce game meat hunting is limited but should still be explored within a range of strategies.

The weak bargaining position of communities requires support from external organisations in terms of providing a more level playing field for negotiations to help avoid conflicts over resources and in helping to maximise the potential gains and use enterprise opportunities that exist. Government experience and capacity is limited, although increasing in this respect through involvement in pilot schemes such as Robanda. Additional capacity building of CCS staff in community development is essential. Further learning could be obtained through reviewing experiences further afield within Tanzania and Africa. Equally there is a risk that 'Private sector-community arrangements, although economically valuable, do not self-evidently increase the degree to which landholders control and participate in the management of wildlife on their lands. Like government benefit-sharing arrangements, they run the risk of putting communities in a position where they remain wholly dependent on external agencies to manage, use and share the revenues from wildlife on their lands'. (IIED, op cit).

A risk with any kind of wildlife tourism development is the unforseen consequences for isolated rural communities. Can these villagers interpret the potential changes – social, cultural, economic, political – that may result from exposure to and engagement with 'globalised' tourists and the global economy. Power relations are not explicitly recognised in many of the current joint ventures and public private partnerships in tourism now mushrooming in Africa and elsewhere. Can these villages say no to such tourism developments for example?

Following the success of the farmer-to-farmer type extension and learning networks in Central America, the sharing of ideas between villagers needs to be promoted, extending the current focus on exchanges between researchers, NGO workers, government staff. This might provide villagers with the opportunity to discuss with others who have gone through a similar process of engagement and have identified some of the possible pros and cons.

5.7.4 Conservation Impact

People in Robanda village reported that the economic returns resulting from partnership with SENGO has helped to reduce poaching, and influence the community positively towards conservation.

> *"We do not say that there is no hunting by the members of Robanda, but people now know the value of wild animals, and are therefore careful not to kill them. We estimate that the level of poaching has reduced probably by 75%, both inside and outside of the SENAPA,* said the acting village chairman.

Lewis of SENGO also confirms this view.

> *"When we started this campsite here, we used to collect up to 20 snares per month in the concession area. Now we find only between two to three".*

However, survey data from this project do not show a significant decrease in hunting by residents of Robanda over recent years. It is not clear therefore whether the level of illegal game meat hunting has changed as a result of the partnership or not. Data recorded from arrested hunters during 1992 and 1993 (Campbell, unpublished data, referred to by Campbell & Hofer 1995, Hofer et al 1996) included 5 arrests from Robanda out of a total of 345, before the establishment of the camp. Data collected by this project between 1998 and 2000 included 12 arrests out of a total of 603 hunters – a greater proportion. Tests for statistical significance on the relatively small number of arrests from Robanda are likely to be suspect. However the proportions are similar in each period and there is no empirical evidence to suggest that illegal hunting has reduced as a result of the partnership.

Analysis of the individual cases arrested during 1998 to 2000 shows that all arrests of individuals from the village were of males and that all were hunting within the park. The cases also indicate that all could be classified as belonging to the poorest section of the community. None reported owning livestock, all were arrested with hunting weapons either purchased in Robanda or made by them. Some did not own land and 50% gave financial reasons for hunting.

This suggests that benefits from the partnership may not be reaching the poorest members of the community at levels that are sufficient to stop people hunting in order to meet their needs for cash and/or meat.

Table 15. Livelihoods analysis of benefits from community – private tour operator partnership in Robanda village.

Livelihoods		Robanda Village
PROTECTING & BUILDING CAPITAL ASSETS		
Human capital	Leadership	+ village leaders and sub-committees improved leadership skills/skills in project management + greater confidence of village leaders but possibly to further exclusion of rest of village + funds for attending seminars
	Negotiation skills	+ developed agreement with SENGO although improvements in negotiation skills possible
	Education	+ some school fees paid for (28) children of poorer households
	Health	+ may be health improvements due to year round supply of drugs?/health dispensary construction
Social Capital	*Networks & Connections*	- involvement of majority of villagers in decision-making limited
	Vertical linkages	+ links to private company and CCS +/- support not requested from outside organisations
	Membership of formalised groups	+ e.g. dancers group, women and youth groups

	Trust, reciprocity & exchanges	+ focus on poorer households (e.g. in paying school fees of poorer children)
	Macro level social capital	+ capacity building of CCS staff? + changed attitude of tour operator
Natural Capital	Conserve resources bio-diversity	
	Reduced illegal game meat hunting	+ villagers say there is less hunting, although arrested poacher evidence shows no change
	Provision of services & inputs	
	Access to resources	
Physical capital	Service provision	+ extra supplies of drugs purchased
	Infra-Structure provision	+ school classrooms constructed and teachers houses + contribution to ward secondary school construction + village health dispensary renovated + nurse housing built + new milling machine + office for environment and conservation sub-committee + village butchery constructed + renting housing for police staff while permanent building is constructed + water system renovated (including 2 dams) and 15 % of running costs covered
	Access to affordable credit	+ village loan for grinding machine + women's and youth groups have obtained small interest free loans
Financial capital	Income earning & enhancing provision	+ SENGO pays agreed rate for visitors (so far 24 million T Sh – 2000) + tax relief (1996 paid villagers taxes) + handicraft groups – sale of goods at camp (limited success). + traditional dancers group + limited employment (6 villagers employed at SENGO) and salary of village executive officer paid
TRANSFORMING STRUCTURES AND PROCESSES		
	External consultation with civil society	+ partnership with private sector (win-win situation) + may have further encouraged collaboration with other external organisations??
VULNERABILITY CONTEXT		
	Natural Shocks (disasters)	
	Seasonality of prices/production/health/ employment	+ cash injection to the village may relieve some vulnerability to shocks and seasonal variations
	Conflicts of interest over natural resources	?

Annex 3, includes a comparative analysis of benefits to Robanda and Ololosokwan villages

5.8 Multivariate Analysis of Factors Influencing Game Meat Hunting and Consumption

Information presented in the previous sections illustrates the wide range of factors that may influence or be related to an individual's decisions on participation in illegal game meat hunting. Similarly, a large number of different factors may also influence the frequency of game meat consumption. The potential importance of over 50 different variables was analysed by multivariate models using procedures for General Linear Modelling in Systat (SPSS Inc. 1998). Factors considered in the multivariate analysis included:

- Recorded arrests in each village (combined 92-93 and 98-2000 data);
- Average frequency of game meat meals per month recorded by household surveys;
- Household survey responses averaged at the village level - incorporating education, diet, livestock ownership, sources and amount of income, household size and period of occupancy, gender and other information;
- Physical data (e.g. distance from the protected area boundary;
- Environmental data such as mean rainfall levels and the nature of the terrain.

5.8.1 Factors correlated with numbers of arrests in sample villages

Groups of factors were evaluated by exploratory analysis and stepwise removal of poor predictor variables. The resulting predictor subsets within each class of variables were then combined in a final regression model. Table 16 lists variables from the sample surveys carried out in villages that were found to have an influence on the recorded number of arrests for hunting in these villages. Taking all of these factors together, they explain a substantial portion of the variation in the pattern of arrests for hunting ($R^2 = 0.626$).

Table 16   Results of Exploratory Analysis: Subsets of variables influencing the frequency of arrests for hunting

Subsets, (N variables considered), and R^2 for all predictors used.	Predictor variables per subset	Std. Coef.	F
Income (18) $R^2=0.303$	Average reported income	-0.265	1.657
	Livestock income > 0	0.079	0.133
	Female cash crop income > 0[1]	-0.432	4.784
	Female trade income > 0	-0.169	0.706
Livestock Ownership (5) $R^2=0.172$	Average poultry owned	-0.302	2.247
	Average sheep owned	-0.340	2.846
Education (8) $R^2=0.192$	Proportion of males without education	0.349	1.748
	Proportion with adult education	0.474	4.260
	Proportion females with Std.7 education	0.270	1.295
Physical and Environmental (8) $R^2=0.416$	Distance from urban areas	-0.427	5.129
	Distance from main roads	0.721	14.673
Protein meals per month (7) $R^2=0.201$	Frequency of Beef meals	-0.304	2.303
	Frequency of Fish meals	-0.409	4.152

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[1] Income from cash crops reported by males was also important but that reported by females was found to have a greater effect on the number of recorded arrests

Although all of these factors were seen to have some influence on the numbers of arrests for hunting, by removing those variables that had the least influence using a stepwise multivariate model (Box 2), the four most significant factors were found to be:

- Distance to urban areas: -   Fewer hunters closer to urban areas due to the increased opportunities for generating a cash income (closely related to the next factor);

- Distance to nearest main road: -   Greater numbers of hunters with increasing distance from all-weather roads;

- Average number of poultry owned: -   As with other livestock, increased ownership was related to a reduced incidence of arrests for hunting. This effect was strongest for poultry;

- Income provided from cash crops: -   The presence of an income from cash crops was related to reduced numbers of arrests for hunting;

Box 2. Results from a stepwise multivariate model on factors related to the incidence of arrests for hunting

Dependant Variable: ARRESTS   N: 24   Multiple R: 0.745   Squared multiple R: 0.555
Adjusted squared multiple R: 0.461   Standard error of estimate: 10.912

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
Constant	22.416	10.591	0.000	.	2.116	0.048
Distance to Urban Areas	-0.519	0.207	-0.433	0.783	-2.505	0.022
Distance to main Roads	0.819	0.347	0.475	0.580	2.362	0.029
Average poultry owned	2.028	1.220	0.270	0.888	1.662	0.113
Income from Cash crops	-22.455	10.473	-0.390	0.709	-2.144	0.045

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	2817.429	4	704.357	5.916	0.003
Residual	2262.196	19	119.063		

5.8.2   Factors correlated with frequency of meals based on game meat

Groups of factors were evaluated by exploratory analysis and stepwise removal of poor predictor variables. The resulting predictor subsets within each class of variables were then combined in a final regression model. Table 17 lists variables from the sample surveys carried out in villages that were found to have an influence on the recorded frequency of consumption of meals containing wildlife meat. Taking all of these factors together, they explain a substantial portion of the variation in the pattern game meat consumption (R^2 =0.477).

Although all of these factors were seen to have some influence on the frequency of consumption of game meat meals, by removing those variables that had the least influence using a stepwise multivariate model (Box 3), the single most significant factor was found to be:

- Distance from Lake Victoria: -   This was found to be highly significant (P=0.001) with an increase in the frequency of game meat consumption with distance from the lake. Although it is only a single variable the distance from the lake is nevertheless closely related to a number of other factors. For example, the close relationship to fish consumption.

The relationship between game meat consumption and the income from cash crops is particularly notable. An increased proportion of sampled households with income from cash crops was related to a decrease in the frequency of game meat consumption. Coupled with the relationship between cash crop income and the incidence of arrests for hunting, this strongly suggests that the promotion and development of cash crops throughout this area is likely to have a positive impact.

Table 17   Results of Exploratory Analysis: Subsets of variables influencing the frequency of meals with a wildlife meat component

Subsets, (N variables considered), and R^2 for all predictors used	Important Predictor variables	Std. Coef.	F
Income (18) R^2=0.003	Income from Cash Crops > 0	-0.584	11.385
Livestock (5) R^2=0.172	Donkeys owned in village	0.329	2.535
	Average number of Goats	0.115	0.309
Education (8)	- Not related -		
Physical and Environmental (8) R^2=0.416	Distance from Lake Victoria	0.685	13.315
	Distance from Urban Areas	-0.138	0.538
Protein meals per month (7) R^2=0.201	Frequency of Fish Meals	-0.507	7.384
	Frequency of Goat Meals	0.206	1.223

Box 3. Results from a stepwise multivariate model on factors related to the recorded frequency of game meat consumption

Dependant Variable: Game Meat Meals   N: 24   Multiple R: 0.624   Squared multiple R: 0.390
Adjusted squared multiple R: 0.362   Standard error of estimate: 1.439

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
Constant	-0.202	0.572	0.000	.	-0.353	0.727
Distance from Lake Victoria	0.045	0.012	0.624	1.000	3.747	0.001

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	29.088	1	29.088	14.038	0.001
Residual	45.585	22	2.072		

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7   Recommendations

The analysis of information examined by this project clearly indicates that the main driving force responsible for illegal hunting in the Serengeti is **income poverty**. As a result, a range of measures designed to reduce income poverty can be expected to have a positive benefit on both wildlife conservation and on the reduction of rural poverty.

The Tanzania PRSP identifies economic growth is a powerful means of reducing income poverty (IMF 2000). The PRSP also recognizes the dependence of the poor on the environment:

> *"The poor in Tanzania are heavily dependent on the environment. Specifically, households in Tanzania are heavily dependent on environmental resources for income generation. For example, as much as 50 percent of their cash incomes in some areas derive from the sale of forest products such as charcoal, honey, wild fruits and firewood. There is evidence as well, that the poorest households are the most dependent on woodland resources."*

The results presented in section 5 of this report clearly confirm the dependence of the poorest members of the community on the wildlife resources within the protected areas of the Serengeti Ecosystem. The data also confirm the importance of the cash income generated through hunting. What is not detailed by section 5 is the additional dependence of some members of the community on other products such as fuelwood and building poles, although Tables 1 and 2 do illustrate the extent of these activities in relation to hunting.

Whilst it is recognised that there will always be a demand for some game meat, the level of this demand can be reduced. The multivariate analysis presented in section 5.8 begins to show the kinds of intervention that should be considered. These include:

Cash crops   The presence of an income derived from cash crops was shown to be one of the most important factors. Those with cash crop income are less likely to be involved in hunting. Individuals and households with cash crop income are also less likely to consume meals that include game meat than those without cash crop income. Cotton was formerly an important cash crop in this area but has declined as a result of structural adjustment programmes. The introduction of new cash crops with a well-defined and saleable product that can be processed at a village scale with appropriate technology, for example sunflower, could provide important income to poor households.

Promotion of small livestock, especially poultry and sheep/goats: There is a clear relationship between hunting and ownership of small livestock – not cattle. Individuals and households with sufficient livestock are unlikely to be involved in game meat hunting. The critical intervention that is required is to enable those that currently have either no livestock, or very few livestock, to begin to own and keep them.

Enhanced production and marketing of dried fish: Dried fish from lake Victoria was found to be the single most important source of protein in terms of the number of times per month it was included in meals. There was also an inverse relationship between fish consumption and game meat consumption. Dried fish is significantly cheaper than dried game meat. Increased availability of dried fish – though improved production, marketing and transport – is likely to result in a reduced demand for game meat.

Bee-keeping   As with cash crops, bee keeping and honey have potential to generate income at the household level. Importantly, the income from honey should be available at a time of year (beginning of the dry season) when other sources of income are not available. Bee keeping may also be combined with some forms of cash crops – e.g. sunflower.

Rural Credit   Trade was shown to be an important factor, with households that had an income from trade being less likely to be involved in game meat hunting. The availability of new and strengthened rural credit mechanisms or micro-credit needs to be considered for both on-farm and non-farm activities. A potentially effective mechanism for delivery of rural credit could involve the existing TANAPA SCIP funds, with additional donor assistance. Such a delivery mechanism would ensure a strong linkage between the benefit and conservation activities.

Rural infrastructure, including roads: Few of the above could operate successfully in the absence of an adequate transport infrastructure. Improved rural roads brings increased access to markets – both from the point of view of the producers and the traders.

Effective safety nets, to assist vulnerable groups: Hunting is currently viewed as one of the most effective coping strategies during difficult periods. Alternative mechanisms are required whereby the most vulnerable groups can generate the required cash incomes.

But will the impacts of development programmes that include one or more of the above elements reach the poorest people in areas adjacent to the protected areas? If not, then there is little likelihood of any impact on either illegal hunting or rural poverty in these areas.

In addition, some benefits may be obtained through innovations in wildlife management and enterprise arrangements with individual villages, and these concepts are explored by Emerton and Mfunda (1999) . The overall scope for this approach is, however, severely constrained by the limited distribution and very low densities of wildlife outside the protected areas – even if Ikorongo, Grumeti and Maswa Game Reserves were to be factored into the equation in the entirety (a total area of 3,900 km^2). These areas are already over-exploited. Overall the potential economic benefits from community wildlife schemes, outlined by Emerton and Mfunda (op. cit.), are small and do not compare with the potential benefits for income generation from illegal game meat hunting.

The community-tour operator partnership detailed in section 5.7 shows that Robanda village is undeniably receiving significant benefits from the relationship and there is the potential for similar arrangements to be made with other villages. However, approaches such as this offer a very limited solution – the potential number of villages for such activities can be numbered in single figures, close to one percent of the villages currently benefiting through hunting. In addition, analysis of recorded arrests does not show any decrease in hunting within Serengeti National Park as a result of this initiative (although there has been a reduction observed in the vicinity of the tourist camp). The benefits accrue to the community and do not provide sufficient income or other benefit to the poorest members of the community – who continue to hunt.

Targeting Development at the Poor

Such integrated conservation and development initiatives need to be specifically designed and targeted to provide tangible and direct benefits to the poorest members of the community. Without such benefit, illegal hunting of wildlife and the sale of game meat to generate cash will continue to be used to provide vital a means of support to the poorest households. If benefits from development and conservation interventions focus on the provision of public goods, such as education and health clinic construction, then this is unlikely to reduce hunting that is driven by a need for cash.

8 Contribution of Outputs

8.1 Contributions towards goals

The outputs of this research have contributed towards DFID's development goals by

- Highlighting the relationships between rural poverty and the illegal hunting of wildlife;

- Establishing a system of quantitative monitoring of the illegal hunting that currently occurs within the protected areas, and encouraging the expansion of this system to cover all national parks in Tanzania and all illegal activities occurring within the parks;

- Analysing factors that are related to poverty and illegal game meat hunting;

- Analysing factors that are related to the consumption of game meat;

- Identifying the nature of the poor within communities adjacent to the protected area studied;

- Analysis of an active community benefit scheme adjacent to Serengeti National Park with the conclusion that the poorest members of the community were not receiving levels of benefit sufficient to stop them generating income through illegal hunting inside the protected areas.

8.2 Promotion pathways identified:

- Tanzania National Parks, through their Community Conservation Service (CCS).

- Generating closer links between national park management and communities surrounding the parks, especially those that are demonstrated to be dependant on the resources within the parks, e.g. through data from recorded arrests. TANAPA CCS are ideally placed to develop these enhanced linkages. Projects designed to facilitate this should be considered.

8.3 Publications and Reports

Hofer, H, Campbell, K.L.I., East, M.L. Huish, S.A. (2000). Modeling the spatial distribution of the economic costs and benefits of illegal game meat hunting in the Serengeti. Natural Resource Modelling, Vol. 13:1, Spring 2000.

Further journal publications are planned following completion of data analysis, including.

Loibooki, M., Hofer, H., Campbell, K.L.I. and East, M.L. Game meat hunting by communities adjacent to the Serengeti National Park, Tanzania: livestock ownership and alternative sources of protein and income

In addition to the final technical report and annual reports to AHP produced during the course of the project the following internal reports were produced.

1. Nelson, V. & Campbell, K. 1998. Sustainable Use of Wildland Resources: Ecological, Social & Economic Interactions. Initial Literature Review, March 1998.

2. Campbell, K. 1998. Workshop proceedings, June 1998

3. Campbell, K. 1998. Workshop proceedings, September 1998

4. Mduma, S. & Campbell, K. 1999. Serengeti National Park. Geographic Positioning Systems (GPS). Matumizi ya Garmin GPS II plus: Maelezo kuhusu Garmin GPS II plus. (a GPS manual produced in Kiswahili for use by national park rangers).

5. Nelson, V. 1999. Proceedings of a PRA workshop and report of fieldwork conducted with Tanzania National Parks (TANAPA), 8 -20 February 1999.

6. Njoroge, F., Loibooki, M. & Nelson, V. 1999. Results from participatory research in Nyamikoma village.

7. Loibooki, M., Nelson, V. & Njoroge, F. 1999. Results from participatory research in Mugeta village.

8. Nelson, V., Njoroge, F., & Loibooki, M. 1999. Results from participatory research in Nyatwali village.

9. Njoroge, F., Loibooki, M. & Nelson, V. 1999. Results from participatory research in Mihale village.

10. Njoroge, F., Loibooki, M. & Nelson, V. 2000. Participatory Research Report.

11. Campbell, K. Sustainable Use of Wildland Resources: Ecological, Social and Economic Interactions. Preliminary Data Analysis. Summary of Data from Arrests Collected between October 1998 and March 2000.

12. Campbell, K. 2000. Sustainable Use of Wildland Resources: Ecological, Social and Economic Interactions. Preliminary Results from Village Questionnaires. August 2000

13. Loibooki, M. & Njoroge, F. 2000. Report of the Study on Community-Private Tour Operator Partnership: Lessons from Robanda village.

14. Campbell, K. Nelson, V. 2001. Sustainable Use of Wildland Resources: Ecological, Economic and Social Interactions. Final Technical Report to DFID.

8.4 Other Dissemination of Results.

1. Presentation to DFID: Sustainable Use of Wildland Resources: Ecological, Social and Economic Interactions. 23 October 1998. Presentation to Workshop on Livestock and Wildlife Co-existence in East Africa. DFID, 94 Victoria Street, London.

2. Papers outlining main research findings and relating these to sustainable rural livelihoods were presented at:

    - Annual colloquium of Tanzania Wildlife Research Institute, in Arusha, Tanzania, 11-12 December 2000.

    - African Wildlife Management in the New Millennium. College of African Wildlife Management, Mweka, Tanzania. 13 - 15 December 2000.

3. A seminar on bushmeat hunting in Serengeti was presented at University College London, during February 2001.

4. A final stakeholder workshop was held during March 2001 in Arusha, Tanzania, to present and discuss the principal research findings of the project.

5. During May 2001 a presentation summarizing results from the project was made at the Department of trade and Industry to the UK Tropical Forest Forum, Bushmeat Working Group (http://www.nri.org/TFF/).

6. Presentation to the TANAPA board members of principal findings of the research project: June 2001.

8.5 Follow-up measures

1. The techniques developed during this study need to be extended to other protected areas and to the other commodities extracted from the protected areas – including fuelwood, timber and grazing resources. For example, the major problem faced in Lake Manyara national park is the removal of fuelwood, whilst in Tarangire it is illegal grazing, and in Mikumi national park timber extraction is a serious problem. Detailed analysis of these problems using the techniques developed by this study is likely to result in novel means of combating these problems whilst at the same time enhancing efforts towards rural development and poverty reduction.

2. There are strong indications that the trade in game meat / bushmeat extends substantially beyond the study area, and includes the urban and peri-urban areas. This requires an in-depth study focusing on the trade in game meat itself. This proposed study needs to focus on the point where the meat is marketed by hunters to the point of consumption by individual households. The research will need to consider range of benefits and the beneficiaries of the trade, including the impacts (positive/negative) on human health (reduction in protein related disease, potential for increase in disease transmission). Given the extent of the marketing and trade in game meat, both in physical and economic terms, such an analysis is required before realistic alternatives to game meat can be more widely developed and promoted.

3. Current levels of deterrent by national park law enforcement patrols are clearly insufficient to substantially reduce levels of illegal hunting. At the same time it is recognised that increased levels of deterrent, e.g. higher levels of fines, may be counter-productive and result in increased poverty. A study is required in which individual hunters arrested in the park during the past can be followed up and information obtained on the impacts of both arrest and subsequent penalties incurred. It is anticipated that more effective measures to counter illegal hunting would be derived from this study as well as measures that are more appropriate to the goals of rural development and sustainable livelihoods.

Annex

Annex 1   Loibooki, M., Hofer, H., Campbell, K.L.I. and East, M.L. Game meat hunting by communities adjacent to the Serengeti National Park, Tanzania: livestock ownership and alternative sources of protein and income

Annex 2   Hofer, H, Campbell, K.L.I., East, M.L. Huish, S.A. (2000). Modeling the spatial distribution of the economic costs and benefits of illegal game meat hunting in the Serengeti. Natural Resource Modelling, Vol. 13:1, Spring 2000.

Annex 3   Community – Private Tour Operator Partnership in Robanda Village

Annex 4   Campbell K.L.I. and Loibooki, M. (2000). Game Meat Hunting in the Serengeti: a Problem of Sustainable Livelihoods. Paper presented at conference on African Wildlife Management in the New Millennium, College of African Wildlife Management, Mweka, Tanzania, 13-15 December 2000.

Annex 5   Questionnaires:

Annex 6   Matumizi ya Garmin GPS II plus. Manual for Garmin GPS II plus Geographic Positioning System (GPS).

Annex 7   Findings from the Participatory Survey: Summary of Information from Four Villages