

# Game meat hunting in the Serengeti: a problem of sustainable livelihoods

K.L.I. Campbell<sup>1</sup> and M. Loibooki<sup>2</sup>

<sup>1</sup> Natural Resources Institute, University of Greenwich, ME4 4TB, UK  
(e-mail: k.l.i.Campbell@gre.ac.uk)

<sup>2</sup> Tanzania National Parks, P.O. Box 3134, Arusha, Tanzania

Paper presented at the conference on  
African Wildlife Management in the New Millennium,  
College of African Wildlife Management, Mweka, Tanzania,  
13-15 December 2000

## Abstract

The illegal hunting of resident and migratory wildlife has long been a problem for the management of Serengeti National Park, Tanzania. Poaching has reduced populations of resident herbivores, whilst over-harvesting of migratory herbivores may ultimately threaten the integrity of the Serengeti ecosystem. This paper examines hunting from the perspectives of those arrested and the communities adjacent to the park with a view to understanding some of the factors responsible for promoting game meat hunting as a viable livelihood activity.

Illegal hunting of wildlife in Serengeti National Park is closely linked to poverty. Arrested hunters come from the poorer sections of the community, whilst those questioned in village surveys clearly identify hunting with the poorest people. Wildlife are primarily hunted for economic reasons, to generate cash, rather than in response to a direct need for food, with 75% of arrested hunters indicating that they are hunting for cash or trade. The need to pay taxes, village development contributions and levies and to purchase of clothing were identified as the most important factors, responsible for 79% of the need to generate cash.

Food derived from the park by illegal hunting forms an important contribution to rural livelihoods. Within surveyed villages, hunting was widely seen as a source of food and cash during difficult times, as well as a strategy for coping with problems such as stock theft. Rather than the food value *per se*, the results suggest that it is the ability to sell the meat and to subsequently use the cash proceeds that is the most important contribution of wildlife to rural livelihoods. The data suggest that a change in the age profile of game meat hunters may be related to increasing levels of rural poverty. The paper suggests that livelihood strategies designed to address rural poverty and rural income diversification will provide a key contribution towards the sustainable conservation of the Serengeti.

# Game meat hunting in the Serengeti: a problem of sustainable livelihoods

K.L.I. Campbell and M. Loibooki

## INTRODUCTION

Wildlife conservation has traditionally depended on the creation of protected areas (McKinnon et al. 1986; McNaughton 1989; McNeely 1989). More recently, the concept of sustainable utilization, 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). 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). 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).

The vegetation dynamics of the Serengeti ecosystem in northern Tanzania are dependent on the activities of the migratory herbivores (McNaughton & Banyikwa 1995). It is therefore considered critical for the future survival of the ecosystem that migratory herbivore populations are not overexploited. Hunting of wildlife has already resulted in reduced populations of several resident herbivore species (Campbell & Hofer 1995). Hofer et al. (1996) made an estimate of an annual illegal harvest of close to 160,000 animals from the Serengeti National Park (SNP) and associated protected areas, equivalent to over 12,000 tons of fresh meat. The same amount of meat from domestic cattle was worth approximately US\$14 million per annum at 1997 prices.

The concept of sustainable development was widely disseminated by the Brundtland Report (WCED 1987). Wildlife conservation in general is being brought closer to the general umbrella of sustainable development (Meadows et al. 1992, World Bank 1994). A fundamental pillar of this 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 tenets of sustainable development?

If unregulated hunting is to be reduced to manageable or sustainable levels and wildlife populations in 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 study seeks to start 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 livelihoods sustainable?".

## The Study Area

The study centred on villages adjacent to the western boundary of the SNP (Figure 1). Livelihoods are predominantly based on subsistence agriculture (largely maize, millet, sorghum and cassava), together with livestock (cattle, goats, sheep and poultry) and cotton as a cash crop. Game meat hunting practised in 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). There is a marked seasonal peak in the arrests of hunters in the dry season between August and November (Arcese et al. 1995), when wildebeest (*Connochaetes taurinus*) and zebra (*Equus burchelli*) migrate to the western and north-western parts of SNP and to areas outside the park (Sinclair & Norton-Griffiths 1979). Methods

employed in this hunting are described elsewhere (Turner 1987; Arcese et al. 1995, Loibooki 1997) and predominantly depend on the use of largely unselective wire snares. The resulting game meat is dried for transport and storage, enabling it to reach markets some distance from the park, e.g. the urban centres of Mwanza, Musoma and Kisumu. Although the majority (75%) of hunters arrested in the SNP come from villages up to 15 km from the protected area boundary, significant numbers of hunters originate from villages between 15 and 45 km from the boundaries (Hofer et al. 1996).

## Sustainable Livelihoods

A livelihood comprises the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base. (Chambers & Conway 1992, DFID 2000). The Sustainable Livelihoods (SL) approach has been adopted by a number of organisations, including DFID, UNDP, Care and Oxfam (Ashley & Carney 1999; Carney et al. 1999). One of distinguishing features of the sustainable livelihoods approach is the emphasis on analysis of assets through a framework of five types of capital: natural, human, financial, physical and social (Scoones 1998, Carney et al. 1999). This has the advantage of facilitating a holistic view of the assets of the poor, of stressing the strengths within systems rather than weaknesses and of focusing on the institutions that allow the different types of capital to be substituted for or traded off against each other. These advantages apply as much to an analysis of game meat hunting as other aspects of livelihoods. The overall sustainable livelihoods framework, as adopted by DFID (2000) is shown in Box 1.

## METHODS

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. This single-sheet form obtained information relating to the place and mode of arrest, weapons, wildlife and other items found with the person, 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 used to compare with information obtained through village surveys. Additional information on the home villages and ages of arrested hunters was also available from similar data on 490 hunters arrested between November 1992 and November 1993.

The study sampled villages within districts adjacent to the western boundary of the SNP. Villages in this area have a history of involvement in illegal game meat hunting (Campbell and Hofer 1995; personal observations). 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 shortlisted in Bunda, Bariadi and Serengeti districts, whilst the highest and lowest 3 were shortlisted in Magu district. Final selection was then made from this shortlist to to minimise an uneven spatial distribution and on considerations of the logistics connected with the conduct of surveys themselves, 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 the sampled villages is shown by Figure 2.

Household questionnaires were developed in consultation with national park staff and piloted in villages adjacent to Arusha NP. Based on this feedback, the questionnaires were further modified and tested near to Lake Manyara NP before final versions were used in the study area itself. In each of the selected villages, up-to-date household lists were compiled by village leaders and a sample of 30 households was taken from this list. If there was nobody present at a chosen household, the nearest

adjacent house was chosen instead. In cases where a village included a large number of sub-villages, households were sampled from the central 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, fish or eggs, and park-people interactions.

## RESULTS

Why do people enter the national park? Evidence associated by park rangers with people at the time of arrest is indicated in Table 1. All arrested hunters were male. The majority (90%) of those arrested also freely answered questions on the main reasons for entering the park (Table 2). Hunting for meat is clearly the dominant reason for entry, with 74% of those arrested being identified as hunters at the time of arrest and 80% of those questioned after arrest giving hunting as the reason for entry. Game meat was identified as the main benefit from the park by 54% (N=460) of responses in the household surveys in 24 villages adjacent to SNP. 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 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, or 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.

Data from arrested hunters demonstrate that the main reasons for hunting are 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 tradition (or any combination of these). Table 3 summarises these responses and identifies a 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. 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 an important factor, if not the dominant one, in over 75% of recorded cases.

Hunters saying 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 reasons, 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 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 as a reason on its own or in combination with other reasons, were also asked where the products were sold. Trading in the village or in neighbouring villages was recorded

in almost all cases (99%, N=255), whilst a small amount of trading across the international border in Kenya was also recorded.

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 are related to poverty and to potential development opportunities.

Livestock ownership constitutes a widely recognised measure of wealth. Table 6 demonstrates that arrested hunters in general have fewer livestock than those arrested for other reasons (e.g. for cutting fuelwood or timber). These data 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 had smaller numbers of stock. 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 few or no livestock.

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 in importance by respondents below fish and domestic sources of meat (Table 8), 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 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.

In periods of drought, crop failure or during times that are difficult for other reasons, e.g. stock theft, rural households cope in different ways according to the resources available to them. Thus, within the study area, better off 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. In poorer households the survey data suggest that normal livelihood activities tend to be based largely on agriculture with few livestock. Selling livestock is therefore less likely to be an option and under stresses caused by drought or crop failure there is unlikely to be a disposable surplus of agricultural produce. Under such conditions, the survey suggests that poorer households will tend to seek casual labour within the area or outside the district (migration) or resort to game meat hunting as a coping strategy. The poorest households or individuals are those that may already be partly or largely dependant on hunting for their normal livelihoods and the survey data suggest that an increased intensity of hunting, rather than labour seeking would be the most likely strategy to adopt during difficult periods.

The need for hunting and its role and importance within coping strategies are likely to change over time. One measure of this change may be seen by the age structure of persons arrested within SNP. There is evidence of a statistically significant change in the age profile of arrested hunters. Figure 3 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 a substantial increase in the proportion of people arrested from the 25 to 45 year age groups. The difference between the two age profiles is significant (Kruskal-Wallis one-way analysis of variance, N=727, Chi-square=13.631 with 1 df, P<0.001).

## DISCUSSION

Illegal hunting of wildlife is a problem for the management of Serengeti National Park. The majority of people arrested in SNP are arrested for hunting. There is both a market for the product (i.e. dried

meat) and a relatively profitable means of exploiting the resource. Campbell & Hofer (1995) analysed data derived from questioning hunters arrested in 1992 to 1993 and found that hunters originated from up to 45 km from the protected area boundary. Analysing National Census data, Campbell & Hofer (1995) also showed that, within this zone, there was a population of 1,055,910 in 1988 within 394 village enumeration areas<sup>1</sup> with an average annual rate of increase varying between 2 and 4 % at different distances from the protected area boundaries. More recent census data are unavailable and extrapolating the 1988 census data to the year 2000 results in an estimated population of 1,490,000. At an average household size of 6.6 (from the household surveys), there would be an estimated 225,700 households in the year 2000. Given that trading of game meat from SNP is not limited to this zone, there is a large potential market for game meat. Hofer et al. (2000), modelling the spatial distribution and economic costs and benefits of hunting in SNP, demonstrated that a day's hunting produced an average profit equivalent to between 70 and over 150 days of normal villagers earnings, depending on the criteria used to estimate normal earnings.

It is clear that game meat hunting is likely to play an important role in both the diet and in the local economy of a large number of villages adjacent to SNP. As such, hunting is likely to constitute an important driving force in the dynamics of the Serengeti ecosystem (as has been suggested by Hofer et al 1993, Campbell & Hofer 1995, Arcese et al 1995, Hofer et al 1996, 2000).

The total number of game meat hunters is difficult to ascertain with any degree of certainty. Campbell and Hofer (1995) estimated 31,600 hunters within the 45 km zone adjacent to the western Serengeti on the basis of data from arrested hunters alone. Loibooki et al. (in preparation) estimated 60,000 hunters on the basis of more recent information, including data from surveys conducted during 1997 in 12 villages adjacent to SNP (Loibooki 1997). The present study, includes data from 24 villages and further illustrates the difficulty of providing quantitative information on the numbers of hunters. From information gathered during household surveys game meat hunting was shown to be widespread and game meat widely available in villages adjacent to the park. The relationship between the frequency of arrests of hunters and numbers of respondents in household surveys admitting to involvement in game meat hunting suggests that the frequency of arrests is a valid indicator of the extent of game meat hunting in a village. Importantly, this relatively simple indicator can be used as a monitoring tool by park management. This indicator can be used in two main ways, firstly in targeting community conservation efforts at "high poaching" villages and secondly, in monitoring change, particularly in response to management actions.

In what way is hunting important to rural livelihoods? One way of assessing this contribution is through an assessment of the contribution to each of the 5 "capitals" of the assets pentagon described in Box 1. As a dietary item, game meat featured on average 1.7 times per month per household. Although the actual quantity consumed per meal is uncertain, game meat would nevertheless contribute towards approximately 4.6 million meals per annum in the estimated 225,700 households within the 45 km zone adjacent to SNP, or 8% of all protein meals in the area. This is a substantial direct contribution of "natural capital" to livelihoods and it is significant for both hunting and non-hunting households. Hunting households would be classified as suppliers of game meat. Non-hunting households, by purchasing game meat would be classified as consumers, whilst there is likely to be an additional group that are both suppliers and consumers during different periods. However, for hunting households the main benefits are economic through the sale of game meat by suppliers to consumers. It has been shown by Hofer et al (2000) that hunting can contribute significantly towards total annual income, even accounting for the costs incurred through arrest. Those hunters who were arrested in SNP considered that the three most important cash requirements cover payment of taxes, village contributions and levies, and clothing. These, together with other cash requirements identified by these surveys, contribute towards a wide range of human, natural, physical, and financial capitals, as indicated by Table 4. Furthermore, the contribution of organised hunting towards social capital, especially the social enhancement of individual hunters, cannot be ignored.

---

<sup>1</sup> Each village enumeration area may include several physical villages or sub-villages.

With the exception of the direct dietary or nutritional benefits and those indirect benefits arising from this, such as health, these livelihood contributions are largely realised by the poorest sections of the community. From the perspective of villagers questioned by the household surveys, hunters clearly belong to the poorest parts of the community. Results from questions put to arrested hunters themselves also indicates that in general they have access to fewer resources, e.g. livestock, than was the average amongst the household surveys.

The increased proportion of males in the 25 to 45 year age range arrested for hunting shows that greater numbers of people who might normally be considered as important or main contributors to household incomes were forced to hunt in order to make necessary contributions towards their livelihoods. When viewed in combination with the changed age profiles of hunters, the clear need for cash as the main product from hunting may be indicative of increasing levels of rural poverty in areas within range of the park.

This study also demonstrates that the contribution of game meat hunting to coping strategies is also important, especially for poor households. Coping strategies can be defined as "poor people's responses to declining food availability in abnormal seasons or years" (Titi & Singh 1994). They are characteristic of secure livelihood systems and are often a short-term response to a specific shock such as drought. Coping strategies are distinct from adaptive strategies, which tend to be characteristic of vulnerable social and ecological systems. Adaptive strategies entail a long-term and often permanent change in a mixture of productive activities and evolving processes that will typically require community and institutional changes in order to meet livelihood requirements (Titi & Singh 1994). Results from this study suggest that the poorest households may already be employing hunting as an adaptive strategy in response to poverty and/or lack of available resources in order to sustain their livelihoods, rather than as a coping strategy in response to seasonal food scarcity.

Coping and adaptive strategies both have implications on the composition of the assets from which they are derived, e.g. through depletion or changes in recruitment. Such strategies may not be ecologically or environmentally sustainable if they draw on assets that are critical to future livelihood security. Available evidence (Campbell & Borner 1995, Campbell & Hofer 1995, Hofer et al. 1996, 2000, and this study) suggests that game meat hunting is not sustainable, that hunting is becoming more difficult and that there are increasing numbers of hunters. Hunting may also be linked with a worsening livelihood situation, especially for the poorest households. Through adopting development programmes that seek to increase critical aspects of natural, physical, human, social and financial capital, through means other than by recourse to the consumptive utilisation of wildlife, the currently unsustainable dependence of communities on wildlife might be reduced – perhaps to levels that are environmentally sustainable.

How might such programmes be targeted to the driving forces and pressures that maintain hunting as a viable livelihood option? The Pressure-State-Response framework (OECD 1993, Pintér et al. 2000) and variations on this basic theme adopted by a range of agencies, offers a tool that helps by addressing causes rather than limiting attention on only the symptoms of a particular set of problems. Such a framework, illustrated in Figure 4, emphasises the need to focus on issues that tackle the "driving forces" and "pressures" within the system, rather than on the observed results of these pressures. In this case, the prime focus of attention needs to be on the main driving force (poverty) and on the major pressures (the need to generate a cash income), whilst at the same time ensuring the maintenance of existing stocks of natural capital.

## CONCLUSION

This paper considers illegal game meat hunting in Serengeti National Park from a livelihoods perspective. Only by taking a holistic viewpoint and by analysing the game meat hunting situation within a wider sustainable livelihoods framework can the long-term conservation of the Serengeti ecosystem be ensured. It is clear that rural poverty and a lack of access to alternative resources constitute major driving forces responsible for maintenance of game meat hunting in Serengeti National Park. It is also clear that whilst there is a market for game meat in a wide area adjacent to the park, economic rather than dietary considerations remain the dominant pressures. Hunting is an

important part of the coping and adaptive strategies of people living adjacent to the park. Without the wildlife resource, the burden on other forms of food security and assistance in times of crisis are likely to be considerably greater. Hence, the economic and social value of this resource is wider than its potential for tourism alone. However, the numbers of wildlife are declining in response to the pressures of continued excessive hunting, exacerbated by periodic droughts. Almost all of those questioned in the villages saw hunting as being more difficult now than in the past. At the same time there is evidence that pressures from rural poverty and lack of resources may be forcing increasing numbers of people to rely on hunting – not primarily for food but in order to generate cash. The bulk of this cash is required to pay taxes, contribute towards village development levies, education and purchase clothes.

Taken to its logical conclusion, greater numbers of people will be increasingly reliant on a decreasing wildlife resource. Game meat hunting must be seen as a symptom of the problem, not the cause. The driving forces are primarily economic. Tackling the symptoms of a problem without a clear understanding of the underlying driving forces and pressures is unlikely to result in successful solutions. Through adopting a sustainable livelihoods approach, and by utilising a Pressure – State – Response framework, both conservation area managers and those concerned with rural or district development should be able to optimise resources to tackle the twin objectives of sustainable rural development and environmental conservation.

## Acknowledgments

We are grateful to the Tanzania Commission for Science and Technology for permission to conduct the study and the Directors General of Tanzania National Parks and Tanzania Wildlife Research Institute under whose auspices the study was carried out. We thank the Natural Resources Institute, University of Greenwich and UK Department for International Development (DFID) for financial support during the course of this study. Special thanks are due to Mr. J. Hando, Principal Park Warden of Serengeti National Park, to the SNP rangers who interviewed hunters and completed questionnaires, and to Community Conservation Service staff in SNP who supervised household surveys. Thanks are also due to F. Njoroge who assisted in developing and piloting the household surveys and in training enumerators.

## REFERENCES

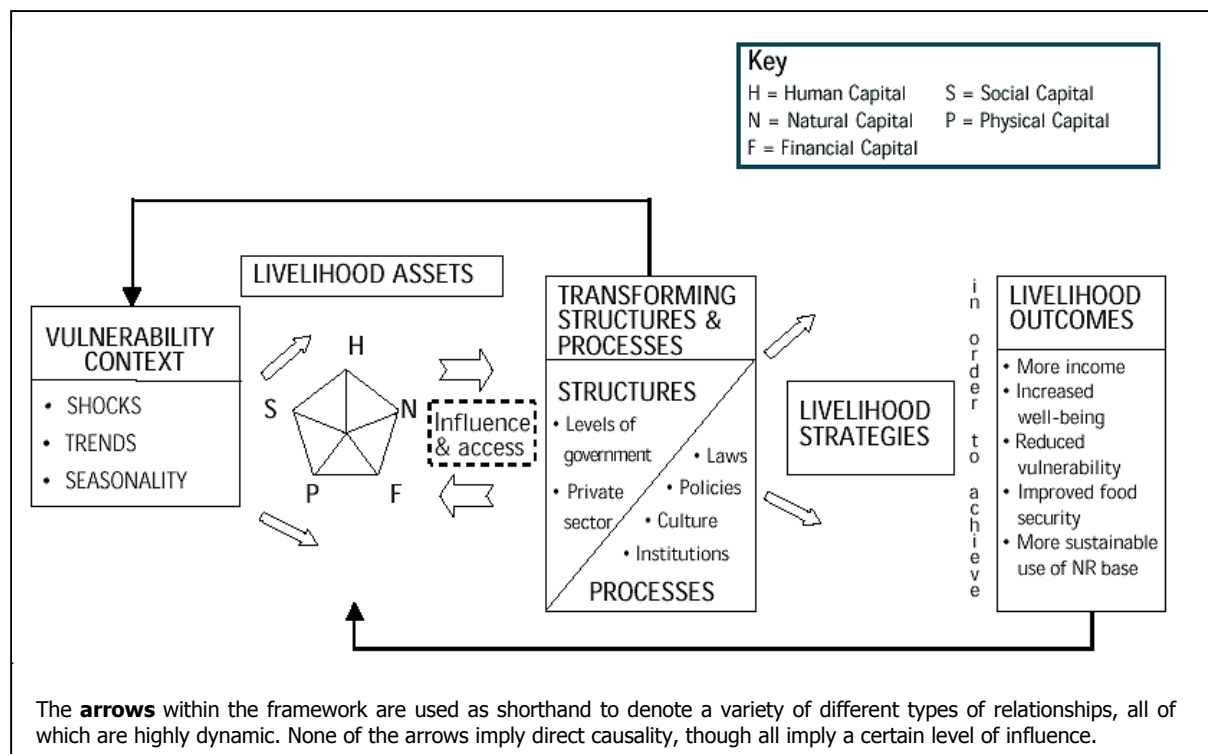
- Anderson, D., and R. Grove. (1987). *Conservation in Africa: people, policies and practice*. Cambridge University Press, Cambridge, UK.
- Arcese, P., J. Hando, and K. L. I. Campbell. (1995). Historical and present-day anti-poaching in Serengeti. Pages 506-533 in A. R. E. Sinclair and P. Arcese, editors. *Serengeti II: research, management and conservation of an ecosystem*. University of Chicago Press, Chicago, USA.
- Ashley, C. and Carney, D. (1999) *Sustainable Livelihoods: Lessons from early experience*. Department for International Development, London.
- Baskin, Y. (1994). *There's a new wildlife policy in Kenya: Use it or loose it*. *Science*, 265, 733-734.
- Bourn, D. and Blench, R. (1999). *Can livestock and wildlife co-exist? An interdisciplinary approach*. Overseas Development Institute. London, UK.
- Brandon, K. E., and M. Wells. (1992). Planning for people and parks: design dilemmas. *World Development* 20: 557-570.



- Campbell, K. L. I., and H. Hofer. (1995). People and wildlife: spatial dynamics and zones of interaction. Pages 534-570 in A. R. E. Sinclair and P. Arcese, editors. *Serengeti II: research, management and conservation of an ecosystem*. University of Chicago Press, Chicago, USA.
- Campbell, K.L.I. and Borner,, M. (1995) Population trends and distribution of Serengeti herbivores: Implications for management. Pages 117-145 in A. R. E. Sinclair and P. Arcese, editors. *Serengeti II: research, management and conservation of an ecosystem*. University of Chicago Press, Chicago, USA.
- Carney, D., Drinkwater, M., Rusinow, T., Neeffjes, K., Wanmali, S. and Singh, N. (1999). *Livelihoods Approaches Compared: A brief comparison of the livelihoods approaches of the UK Department for International Development (DFID), CARE, Oxfam and the United Nations Development Programme*. Department for International Development, London.
- Chambers, R. and G. Conway (1992) Sustainable rural livelihoods: Practical concepts for the 21 st century. *IDS Discussion Paper 296*. Brighton: Institute of Development Studies.
- Child, G. (1995). *Wildlife and People: the Zimbabwean Success*. Wisdom Foundation. Harare and New York, USA.
- DFID (2000) *Sustainable livelihoods guidance sheets*. Web site. <http://www.livelihoods.com>. Department for International Development, London. Accessed 15-Nov-00.
- Hofer, H., Campbell, K.L.I., East, M.L. and Huish, S.A. (2000). Modeling the spatial distribution of the economic costs and benefits of illegal game meat hunting in the Serengeti. *Natural Resource Modeling*. 13:1, 151-177.
- Hofer, H., K. L. I. Campbell, M. L. East and S. A. Huish. (1996). The impact of game meat hunting on target and non-target species in the Serengeti. Pages 117-146 in V. J. Taylor and N. Dunstone, editors. *The Exploitation of Mammal Populations*. Chapman and Hall, London, UK.
- Hofer, H., M. L. East and K. L. I. Campbell. (1993). Snares, commuting hyaenas and migratory herbivores: humans as predators in the Serengeti. *Symposia of the Zoological Society London* 65: 347-366.
- Kiss, A. (ed.) (1990). *Living with wildlife: wildlife resource management with local participation in Africa*. World Bank Technical paper 130. Washington D.C., USA.
- Kock, R.A. (1995). Wildlife utilisation: use it or loose it – a Kenyan perspective. *Biodiversity and Conservation*, 4, 241-256.
- Loibooki, M.T. (1997). *People and poaching: the interactions between people and wildlife in and around Serengeti National Park, Tanzania*. MSc Thesis, University of Reading, UK.
- Loibooki, M.T., Hofer, H., Campbell, K.L.I. and East, M.L. (in preparation) Game meat hunting by communities adjacent to the Serengeti National Park, Tanzania: the effect of alternative sources of protein and income.
- MacKinnon, J., J. MacKinnon, G. Child and J. Thorsell. (1986). *Managing protected areas in the tropics*. IUCN, Gland, Switzerland.
- McNaughton, S. J. (1989). Ecosystems and conservation in the twenty-first century. Pages 109-120 in D. Western and M. Pearl, editors. *Conservation for the twenty-first century*. Oxford University Press, New York, USA.

- McNaughton, S. J. and F. F. Banyikwa. (1995). Plant communities and herbivory. Pages 49-70 in A. R. E. Sinclair and P. Arcese, editors. *Serengeti II: research, management and conservation of an ecosystem*. University of Chicago Press, Chicago, USA.
- McNeely, J. (1989). Protected areas and human ecology: how national parks can contribute to sustaining societies of the twenty-first century. Pages 150-157 in D. Western and M. Pearl, editors. *Conservation for the twenty-first century*. Oxford University Press, New York, USA.
- Meadows, D.H., Meadows, D.L. and Randers, J. (1992). *Beyond the limits*. Earthscan Publications Ltd., London, UK.
- Newmark, W. D., D. N. Manyanza, D. G. M. Gamassa, H. I. Sariko. (1994). The conflict between wildlife and local people living adjacent to protected areas in Tanzania: human density as a predictor. *Conservation Biology* 8: 249-255.
- OECD (1993) OECD Core Set of Indicators for Environmental Performance Reviews. *OECD Environment Monographs* 83. Organisation for Economic Co-operation and Development, Paris.
- Pintér, L., Zahedi, K. and Cressman, D.R. (2000) *Capacity Building for Integrated Environmental Assessment and Reporting*. 2nd edition. International Institute for Sustainable Development (IISD), United Nations Environment Programme (UNEP), Ecologistics International, Ltd.
- Scoones, I. (1998) Sustainable Rural Livelihoods: A framework for analysis. *IDS Working Paper 72*. Brighton: Institute of Development Studies.
- Sinclair, A.R.E. and M. Norton-Griffiths. (1979). *Serengeti. Dynamics of an ecosystem*. University of Chicago Press, Chicago, USA.
- Swanson, T.M. (1992). The role of wildlife utilization and other policies in biodiversity conservation. Pages 65-102 in Swanson, T.M. and Barbier E.B. (eds) *Economics for the wilds: wildlife, diversity and development*. Island Press, Washington D.C., USA.
- Titi, V. and Singh, N. (1994) *Adaptive strategies of the poor in arid and semi-arid lands: In search of sustainable livelihoods*. Working Paper, International Institute for Sustainable Development, April 1994.
- Turner, M. (1987). *My Serengeti years*. Elm Tree Books, London, UK.
- WCED (World Commission on Environment and Development) (1987). *Our common future*. Oxford University Press, Oxford, UK.
- World Bank (1994). *Making development sustainable*. Environment Department, World Bank. Washington D.C., USA.

## Box 1 DFID's Sustainable Livelihoods Framework.



Source: DFID Sustainable Livelihoods Guidance Sheets: Section 2. (DFID 2000)  
[http://www.livelihoods.org/info/info\\_guidance\\_sheets\\_pdfs/section2.pdf](http://www.livelihoods.org/info/info_guidance_sheets_pdfs/section2.pdf)

**Human capital** represents the skills, knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and to achieve their livelihood objectives. At a household level human capital is represented by the amount and quality of labour available and varies according to household size, skill levels, leadership potential, health status, etc. Strengthening human capital is linked to training, schools, access to preventative medical services, etc.

**Natural capital** is a term used for the natural resource stocks from which a wide range of resources and services (e.g. nutrient cycling, erosion protection, food) useful for livelihoods are derived. Natural capital includes intangible public goods such as the atmosphere and biodiversity and assets used directly for production (trees, land, livestock, wildlife, etc.). An important consideration is how natural capital is used to sustain livelihoods, rates of extraction, growth and regeneration, and critical thresholds linked to the maintenance of ecological functions and environmental services.

**Physical capital** comprises the basic infrastructure and goods needed to support livelihoods. Infrastructure includes changes to the physical environment that help people to meet their basic needs and to be more productive. Goods include tools and equipment that enable people to function more productively.

**Financial capital** comprises the financial resources that enable people to achieve livelihood objectives. This includes availability of cash or equivalent, enabling people to adopt different livelihood strategies.

**Social capital** is more difficult to define. In the context of the SL framework it is taken to mean the social resources that provide support for livelihood objectives. These can be developed through: informal networks and connections (enabling people to work together and expand access to institutions, such as political or civic bodies); membership of more formal groups; and relationships of trust, and exchanges that facilitate co-operation, reduce transaction costs. These may provide the basis for informal safety nets amongst the poor.

## Tables

**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 <sup>1</sup>	% 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

<sup>1</sup> A portion of those arrested were recorded with more than one product at the time of arrest. 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

**Table 3 Primary stated reasons for hunting inside the park**

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

**Table 4 Reasons given by arrested hunters for needing cash**

Reason	Frequency of responses	%	Primary contribution to livelihoods
Taxes	152	32.8	Physical capital, with aspects of human and social capitals
Contributions, including school fees	144	31.1	Physical & human capital
Clothes	70	15.1	Physical capital
"Poverty" (Umaskini)	39	8.4	Natural & physical capital
Debt	22	4.8	Financial capital
Medicine	16	3.5	Human capital
Food or Hunger	13	2.8	Natural capital
General purchasing needs	5	1.1	Largely physical capital
Other reasons	2	0.4	Various

**Table 5 Reasons given by household surveys for people needing to hunt**

	Frequency of responses	Ranked importance
Raise cash to meet basic domestic needs	468	135
Raise cash to pay taxes/contribution	358	110
To obtain meat to sell (commercial)	337	104
For food for the household	443	44
To barter meat for other items	169	44
Peer pressure / traditional / habitual	88	39
To obtain trophies for sale	86	17
Other reasons	17	3
Occupation during spare time	24	3

**Table 6 Livestock ownership (percent owning stock) by individuals arrested in SNP compared with questionnaire surveys in 24 village adjacent to SNP: percent ownership and median herd size (plus interquartile range) of those owning livestock.**

	Arrested for hunting		Arrested for grazing		Arrested for other reasons		Average of 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)

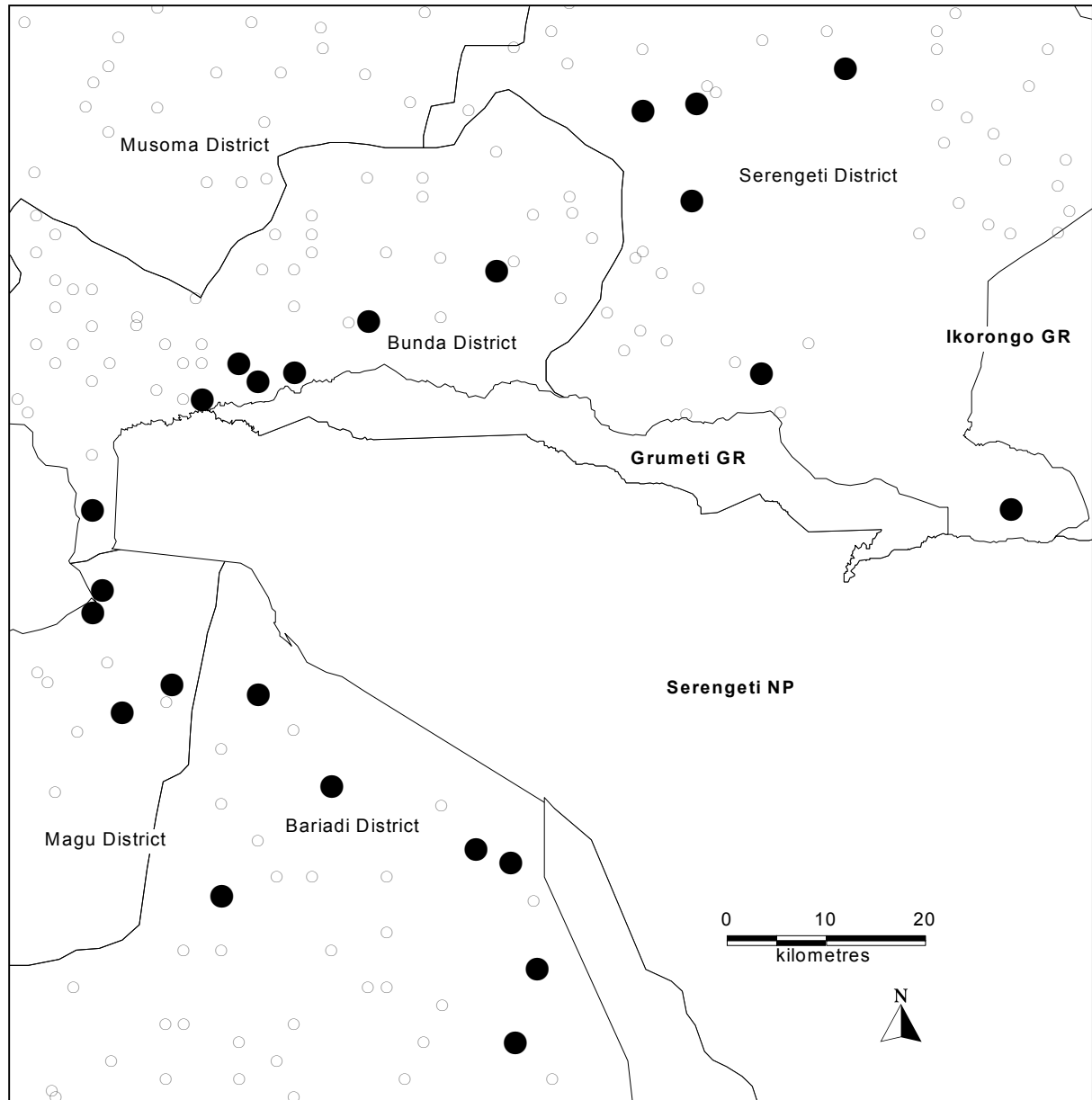
**Table 7 Villagers Perceptions of Hunters in terms of income level and livestock ownership**

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

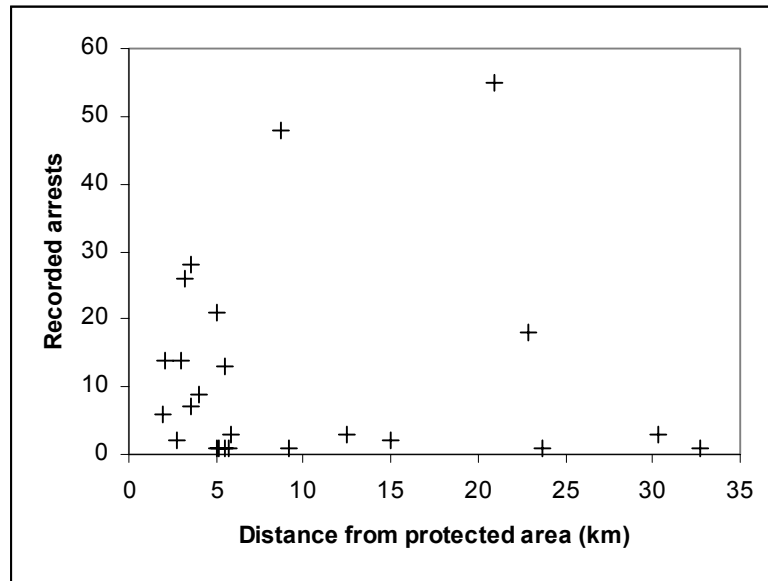
**Table 8 Monthly consumption of meat from different sources in 24 village adjacent to Serengeti National Park.**

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	% of households	Average monthly frequency in meals
Beef	546	76.4	571	87.3	2.3
Sheep/Goat	448	62.7	392	59.9	1.3
Chicken	489	68.4	353	54.0	3.2
Eggs	347	48.5	260	39.8	2.5
Fish	500	69.9	535	81.8	11.6
Wildlife	305	42.7	295	45.1	1.7

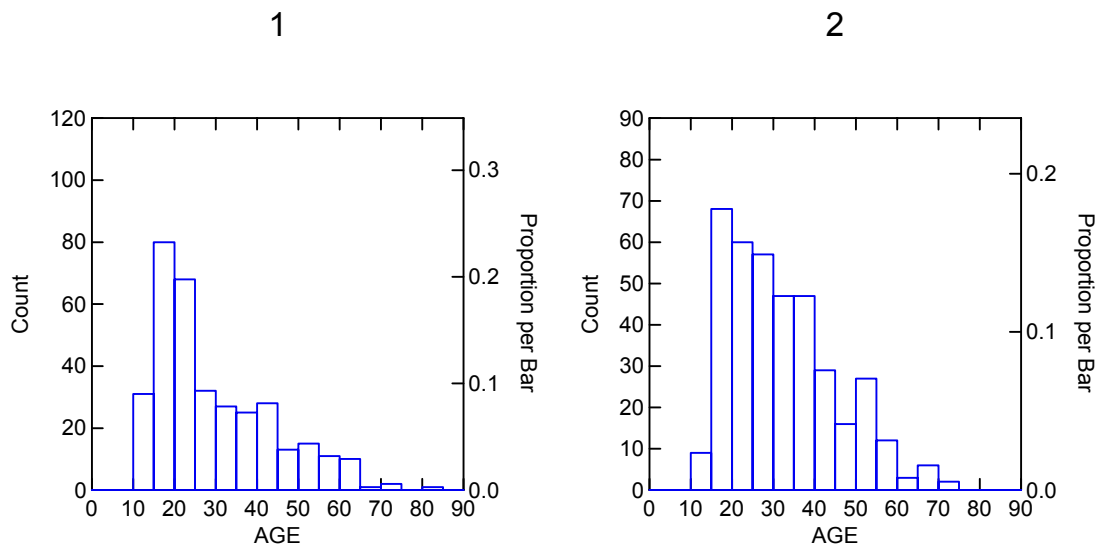
**Figure 1.** The western corridor of Serengeti National Park and adjacent protected areas with locations of village enumeration areas registered at the time of the 1988 national census (small open circles). Villages sampled by household surveys are shown as large filled circles.



**Figure 2. Relationship between distance from the protected area boundary and total number of recorded arrests in those villages sampled during the household surveys.**

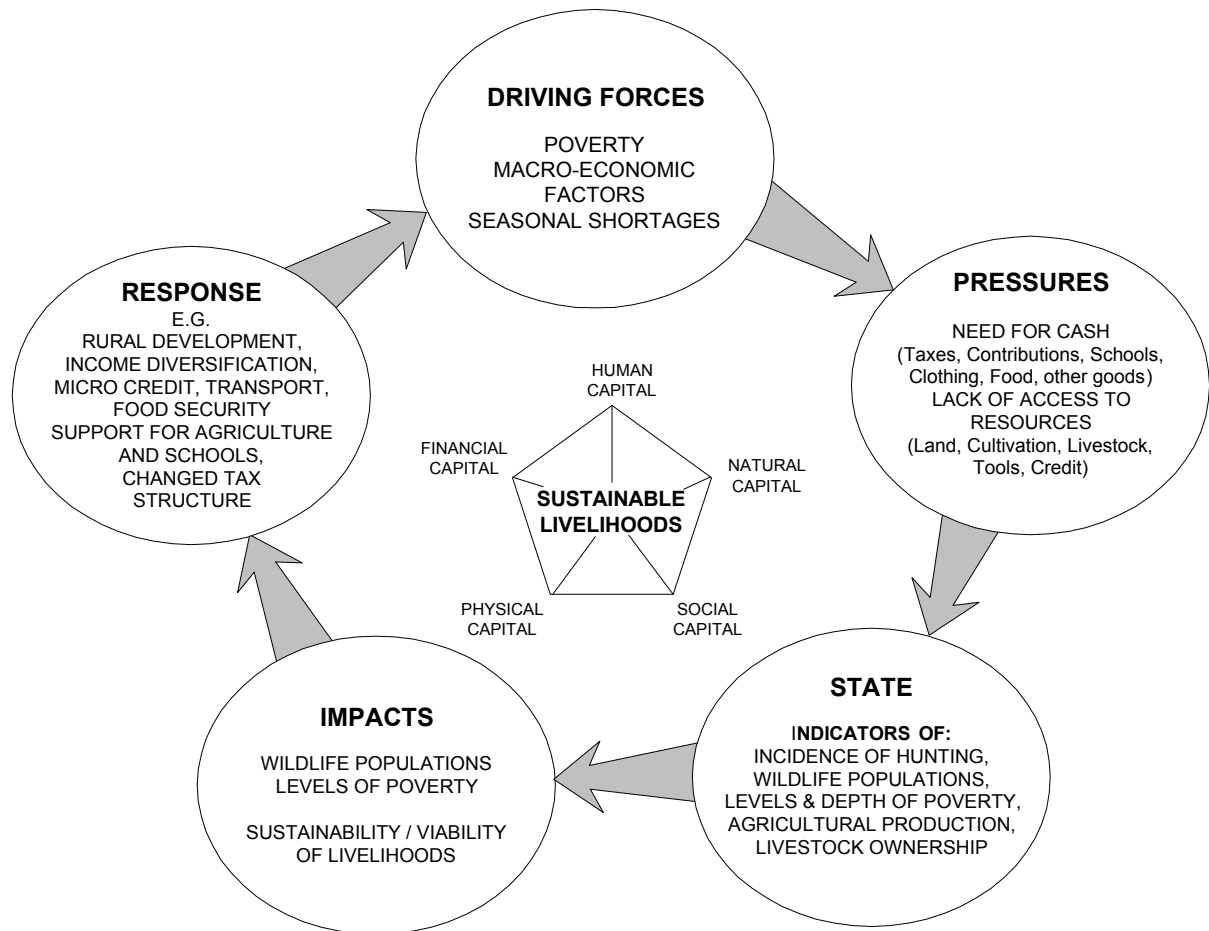


**Figure 3. Change in the age profile of arrested male hunters in Serengeti National Park: (1) 1992-93, (2) 1998-2000.**





**Figure 4. A decision making framework, emphasising that the focus of responses needs to be on the driving forces responsible for promoting game meat hunting as a livelihood option, rather than the observed state or symptoms.**



Adapted from a Pressure-State-Response framework (OECD 1993). The complex of linkages between each component and sustainable livelihoods is omitted for clarity.