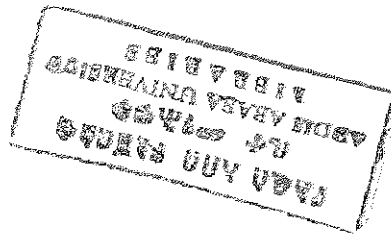


**ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES**

**HUMAN-WILDLIFE CONFLICT AND POPULATION STATUS OF
SWAYNE'S HARTEBEEST (*Alcelaphus buselaphus swaynei*) IN
SENKELE SWAYNE'S HARTEBEEST SANCTUARY**



**A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF
ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE
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SYSTEMATIC ZOOLOGY)**

BY

TEWODROS KUMSSA

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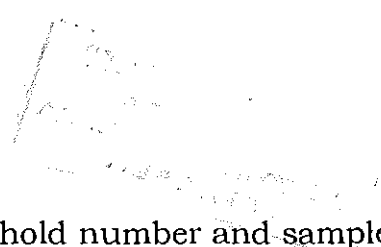
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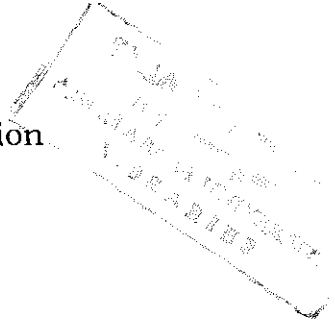
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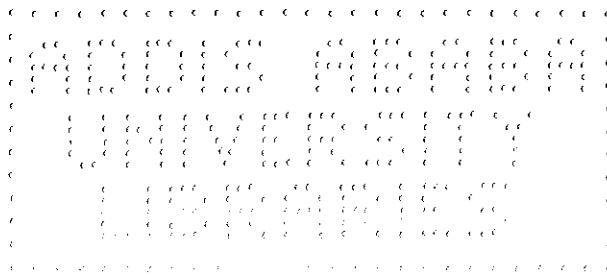
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ACRONYMY

- WCO Ethiopia Wildlife Conservation Organization
- SSHS Senkele Swayne's Hartebeest Sanctuary
- IUCN International Union for Conservation of Nature and Natural Resources
- CSA Central Statistics Authority (Ethiopia)
- CBNRM Community Based Natural Resource Management
- UNEP United Nations Environmental Program
- WCMC World Conservation Monitoring Center

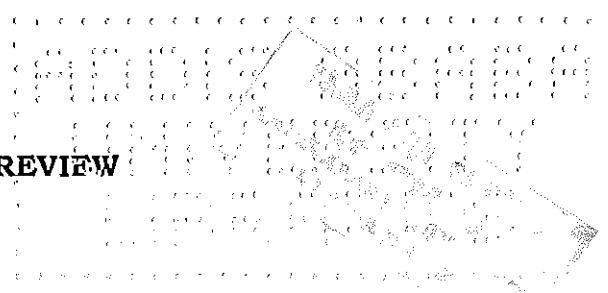


ABSTRACT



The study on the population status of Swayne's hartebeest was carried out in Senkele Swayne's hartebeest Sanctuary. The ground total count was 283 and 351 during the wet and dry seasons, respectively. The population number increased during the dry season because of calving of large number of adult-females. Illegal resource exploitation, loss of wildlife habitat, increasing number of settlers and overstocking rate of livestock are the major problems encountered. Such activities resulted in conflict and wildlife depletion. Four selected Peasant Associations, 220 household samples were identified for interview and group discussion. Overstocking rate of livestock and human pressure in the Sanctuary are the main source of human-wildlife conflict in the area. Among the respondents, 58.18% faced crop damage at various levels. Crop damage was not the primary source of conflict in the area, but the level of damage varying significantly between villages. Swayne's hartebeest, vervet monkey, warthog and porcupine were blamed for the damage. However, warthog was considered as the major notorious pest. Most respondents had a negative attitude towards conservation measures. Lack of free access to grazing area and interest to settle in the wildlife area are the main reasons. Attitudes were significantly related to locally perceived benefits, education, family size and age of the settlers. The perception of the local people in conserving and managing the resources is completely different compared to the views of staff members of the Sanctuary.

Key words: Human-wildlife conflict, Senkele Swayne's Hartebeest Sanctuary, livestock, attitude, conservation.



1. INTRODUCTION AND LITERATURE REVIEW

1.1 Introduction

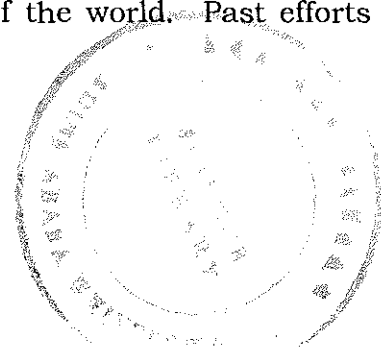
Protected areas are seen as a key to conserving natural resources, on land and at sea globally. About 30,000 protected areas now meet the IUCN definition of conservation (Green and Paine, 1997).

Different groups interpret protected areas differently. For conservationists, they are an effective measure for protecting biodiversity. For the surrounding local communities protected areas can signify restricted access to livelihood resources, forced relocation, or opportunities for income generation through tourism revenues (Hammill and Besancon, 2003).

Human attitudes and values about wildlife vary both among and within different sectors of the society. Differences in wildlife attitudes may also vary among rural agricultural producers. The tendency to get high output becomes more among farmers as the amount of land owned or as the person's economic dependency on the land increases (Messmer, 2000).

In most countries of the world, problems associated with land-use can be diverse. The most important of these are the misuse of land and its living resources and the destruction of species. Ultimately, these result in the loss of the productive capacity of land (Dasmann, 1975). Dispute over land-use between the local people and conservation agencies is becoming a serious problem in Africa (Nishizaki, 2004). One main source of conflict between wildlife conservation and other land use practice in the Senkele Plains is the utilization of resources of the Sanctuary by livestock and humans (Messana and Bereket Netsereab, 1994).

Conflict over land use intensifies if rural poverty and dependency on land increases, or through economic stagnation and rural population growth (Decker et al., 1992). Human-wildlife conflict situations often have a long history. Competition between man and wildlife has been reported from time immorial in various parts of the world. Past efforts to resolve the conflict



may have failed or there may be political issues that exacerbate the situation. No solution will work without site-specific knowledge of what is possible practically, or acceptable in any particular area (Hill et al., 2002). This is because the nature and magnitude of the problem varies from country to country depending on human population growth rate, conservation methods and scarcity of critical natural resources, especially land and water (Rabinowitz, 1986). Human population growth, agricultural expansion, deforestation, hunting and the ramifications of economic development have had profound cumulative impacts on the environment, natural habitats and wildlife populations all over the world (Bourn and Blench, 1999).

The nature of conflict shows an increasing tendency between humans and wildlife over the use of natural resources mainly land, forests and water (Wells and Barandon, 1992). The conflict are manifested as when people are killed or injured by wild animals, loss of livestock through predation, competition for pasture, wildlife invasion of crop farms and inadequate or lack of compensation for losses (Tchamba, 1996). Encroachment on wildlife areas such as forests and protected areas, blocking wildlife migration routes, and poaching of wildlife for food, horns, skins and other valuable products are some of the problems observed (Obunde et al., 2005).

Human-wildlife conflict involves both humans and wildlife. As a result, we need to have a comprehensive understanding of the issues at stake. In order to obtain the necessary information fully, assessing a situation is appropriate to consider the causes of conflict from different perspectives (Hill et al., 2002).

Human-wildlife conflict is one of the major threats to conservation in Africa. They occur in a different setting today. Increasing land scarcity, hunting prohibition and wildlife induced damage to property are factors that may create local hostility towards wildlife and protected areas (Dublin, 1995).

In Africa, the overwhelming trend is that core protected areas (e.g. national parks) are becoming ecologically isolated as people populate the countryside. If this trend continues unabated, one can expect the worst-case scenario (Fiallo and Jacobson, 1995). The core areas deteriorate as the land around them are transformed to a human-dominated landscape. Through time, the wildlife will be lost from the rural areas and the core areas themselves are lost (Hackel, 1999).

Access to land is a central issue in rural Africa for both farmers and pastoralists. Consequently, rural Africans generally do not want to give up land to wildlife or have wildlife nearby (Newmark et al., 1994). The concern of the local people's around Senkele area is crop loss caused by wild animals, prohibited land access, and personal safety (Fassil Tekle, 1996). This is a major problem for conservation in the area because wildlife and people have increasingly shared the same land or to exist in ever-closer proximity.

In Senkele, the great dependence of a large proportion of the human population for their survival on the land, coupled with the presence of large numbers of livestock led to sources of conflict between people and wildlife (Messana and Bereket Netsereab, 1994). Human population growth has led to encroachment into wildlife habitats resulting in constriction of species into marginal habitat patches and direct competition with local communities (Siex and Struhsaker, 1999). Demographic and social changes place more people in direct contact with wildlife (IUCN, 2003).

The main cause of interference by the local community in the Senkele Sanctuary is due to population growth accelerated by cultural factors (polygamy style of marriage). This resulted in scarcity of land, increased demand for grass and firewood, and foraging land for their livestock (Fassil Tekle, 1996).

With increasing human population and encroachment into areas bordering wildlife reserves, there is an increasing risk of disease spreading from

domestic animals to the wild animals. Strategies to protect valuable wildlife species from introduced disease need to be developed (Bourn and Blench, 1999). Conflict is particularly common in reserve borders, where species that rely on extensive territories encounter human settlements. In effect, border zones of protected areas considered as population sinks: critical zones in which conflict is the major cause of mortality (Woodroffe and Ginsberg, 1998).

Human-wildlife conflict is more intense in developing countries where livestock holdings and agriculture are important parts of rural people's livelihoods and income (Boer and Baquete, 1998). In these regions, competition between local communities and wild animals, for the use of natural resources, is particularly intense and direct. As a result, resident human populations or wildlife is vulnerable (Messmer, 2000).

Until recently, conservationists largely have ignored traditional exploitation as a way to conserve biological diversity. Instead, they preferred to protect the system by excluding people from parks and reserves. In doing so, the indigenous people denied access to vital natural resources leading to grievance (Robinson, 1994).

Growing densities in livestock populations can create an overlap of diets and forage competition with wild herbivores. This results in overgrazing and decline or local extinction in wild herbivore populations (Mishra et al., 2003). Several comparative studies have shown that cattle and hartebeest may have similar diets, although hartebeests tend to be more selective than cattle both on the level of grass species and of grass parts (Casebeer and Koss, 1970). In the Senkele Plain, the diet of cattle and hartebeest often overlap with cattle feeding extensively on both *Cynodon dactylon* and *Pennisetum spachelatum*, which are the two main hartebeest foraging grass species. The hartebeests, therefore, could suffer from feeding competition either by being excluded from important forage resources by cattle or through the depletion of forage resource due to over-exploitation by large number of livestock (Messana and Bereket Netsereab, 1994).

The conservation of natural resources in National Parks, Sanctuaries and nature reserves has always been entangled in multitude of problems. Among these, lack of clear national and international policies, lack of commitment from government officials, scarcity of funds, expansion of large scale agriculture, illegal exploitation of natural resources, and lack of skilled staff are the main ones (Almaz Tadesse, 1996).

Problems of security and instability of government can also have profound effects on the running of conservation areas. Security problems can greatly damage the desire and efficiency of staff in managing parks and other protected areas (Kemf, 1993). A case in point is the devastation caused to the resources of Senkele Swayne's Hartebeest Sanctuary witnessed during the transition of power from the military regime to the present government (Fassil Tekle, 1996).

Community perspectives towards the parks stem from a variety of contributing factors including loss of access to resources and income generated from the parks, crop depredations by wild animal, exclusion from participation in decision-making, planning and management and low levels of awareness about the importance of wildlife conservation (Kiss, 1990).

The relative impact of wildlife damage on farm production and household income varies greatly according to the amount of land owned and peoples economic dependence on rural activities (Messmer, 2000). Crop raiding is a cause of much conflict between farmers and wildlife throughout the world (Hill et al., 2002). Crop raiding by wildlife is neither a new phenomenon nor a rare one. Until recently, there has been little attention given to vertebrate species that damage crops with the exception of elephants and rodents (Damiba and Ables, 1993). The cause of conflict between wildlife conservation and the local people in the Senkele area is tendency of the wild animals to raid the surrounding plantations during the crop growing seasons (Messana and Bereket Netsereab, 1994). In communities with a subsistence economy, even small losses can be an economic importance and can generate negative attitudes towards wildlife and conservation in general (Oil et al., 1994). At present, crop damage and livestock depredation by

wildlife are major sources of economic losses. As a result, local communities have in turn threatened protected areas by poaching and by causing habitat loss through encroachment of farms into protected areas (Weladji and Tchamba, 2003). The pressure and conflicts between pastoralists and wildlife are likely to increase as long as there is lack of incentive (economic or otherwise) for pastoralists to invest in wildlife conservation (Earnshaw and Emerton, 2000). At the national level, governments need to recognize that most of the benefits from conservation (through tourism) currently accrue outside the host communities (Bourn and Blench, 1999).

Human wildlife conflict has far reaching environmental impacts. Species most exposed to conflict are also more prone to extinction. Because of injury and death caused by humans; as either accidental, such as road traffic and railway accidents, capture in snares set for other species or from falling into farm wells, or intentional by retaliatory shooting, poisoning or capturing (Studsrod and Wegge, 1995). Such human-induced mortality affects not only the population viability of some of the most endangered species, but also has broader environmental impact on ecosystem equilibrium and biodiversity conservation (Ogada et al., 2003). The future control of grazing and livestock numbers will have significant consequences on the park and the herders, who live there. Conservation of wildlife and wildlife habitat should be a priority, but the pastoralists and their cultural heritage cannot be ignored (Erdenebatar, 1996).

Humans can be economically affected through destruction and damage of property and infrastructure (e.g. agricultural crops, orchards, grain stores, water installation, and fencing), livestock depredation and transmission of disease by domestic animals such as foot and mouth disease (Boer and Baquete, 1998). Negative social impacts include absence from school and employment opportunities, additional labor costs, loss of sleep, fear restriction of travel or loss of pets (Hoare, 2001). Unfortunately, human-wildlife conflict situations are often complex and they are unlikely to be resolved quickly and cannot be solved solely by technical means (Adams and Megaw, 1997). Understanding of the actual problem, prior to implementing

any conflict reduction/resolution strategy is indispensable (Naughton-Treves, 1996).

For many years, conservation authorities have used a number of enforcement efforts to force indigenous people out of conservation zones. Sadly, these steps had included arresting and penalizing local herdsmen, fencing of protected areas and digging deep ditches among others. However, none of these measures has been observed to curtail the damage in conservation areas by the previous inhabitants. Rather, they aggravate the conflict between conservationists and indigenous people (Wells and Barandon, 1992). Today, more and more conservationists believe that conservation efforts not supported by the local people living in the surrounding lands are bound to fail (Martinet and McNeely, 1992). Thus, in addition to enforcements of conservation policy by law, a strategy that will stimulate public support for conservation and increase opportunities for the community to share the benefits must be developed (UNEP, 1990). Besides the direct benefits provided, a holistic approach in improving living standards of the local people may help to reduce their dependence on parks and protected area resources (Newby and Wilson, 1993).

In general, conservation requires a perspective that stretches well beyond park boundaries and needs to involve programs affecting the livelihood of local communities (Bond, 2001). This recognition has resulted in community based natural resource management (CBNRM). The aim is to encourage conservation by reconciling the management of protected areas, with the social and economic needs of the local people (Kemf, 1993).

Wildlife, if properly managed is a major foreign exchange earner at the national level. However, it is perceived by some disadvantaged communities as a cause of poverty and a source of hunger and disease for livestock (Kagiri, 2003). There is no doubt, therefore, that wildlife related costs, outside National Parks and reserves should be reduced significantly. To overcome or minimize the conflict, community participation in the local land management is important for the long-term success of conservation at



regional level (Bond, 2001). Participation can help to mitigate potential and existing conflict and empower the community to take more active roles in exploring management issue and initiating possible responses (Chambers, 1992).

Governments and conservation agencies need to devise innovative ways and means to protect natural resources. They need to seek ways to meet the needs of humans at local levels so that attitudes towards conservation might change for the good (Nepal and Weber, 1995). Even though there are differences in conflict resolution approaches which are practiced in different conservation areas, most of the cases include of attempts to address conflicts by providing local communities with benefits from the park; attempts to include people in park decision making and management and education. Nevertheless, these should obviously be preceded by information gathering and research to identify the best approach (Lewis, 1993).

During protection of conservation areas, the interest of locals should not be ignored (Gorkhali, 1986). One has to convince the local people the value of wildlife (Bodmer et al., 1990). Different remedial measures have been developed around the world but have not been implemented globally. It is essential to note that although the management strategies have similar goals, they are embedded in different ecological, social, cultural and economic realities. They are also targeted towards different taxonomic groups (Shivik et al., 2003). The different strategies are efficient in the short term while others are more effective with identified geographic regions or specific taxonomic group (Gorkhali, 1986).

Relocation of voluntary human population, where alternative land and incentives are available can be a solution. Relocation of local communities to areas offering better access to natural resources and socio-economic opportunities can be an adequate solution to human wildlife conflict (Madhusudan, 2003). Resettlement schemes aiming to prevent the overlap between wildlife and people, can be successful in the long run if some essential assumptions are met; firstly the villagers should gain substantial benefits, such as better access to resources, secondly they should be

relocated to an area where the risk of losing property is lower and thirdly they should not face any political, social or cultural oppositions (Treves and Karanth, 2003).

Assessing information on such conflicts between people and protected areas is important for designing sustainable conservation and management strategies (Newmark et al., 1994). Human-wildlife conflict is fast becoming a critical threat to the survival of many globally endangered species (Ogada et al., 2003). Ethiopian Swayne's hartebeest (*Alcelaphus buselaphus swaynei*) is no exception to this.

Ethiopia is one of the few countries in the world that possesses a unique and characteristic fauna and flora with a high level of endemic species (World Conservation Monitoring Center, 1991). Nevertheless, the challenges facing the conservation of Ethiopian wildlife today are becoming increasingly formidable. Since the general level of agricultural productivity is very low, increase in food production depended on increasing the area under cultivation and grazing. Usually, these expansions are at the expense of wildlife resources leading to the loss of both flora and fauna together with their habitats (Leykun Abunie, 2000). In an effort to conserve natural resources, Ethiopia has established many protected areas. National Parks and Sanctuaries, which are referred to as principal conservation areas, cover only approximately 2.9% of the country's surface area (Leykun Abunie, 2000).

Senkele Swayne's hartebeest Sanctuary was established in 1976 to save the most viable population of the Swayne's hartebeest, an endemic and endangered subspecies (Hillman, 1993). It is one of the fifteen races of African hartebeest of which two are already extinct and Swayne's hartebeest is critically endangered. Brigadier General Swayne first discovered it in 1891-92 at Jijiga, as a herd of 300-400 and even herds of thousands were observed. Due to the rinderpest outbreak, at the end of the 19th century, the number declined to 880 (Hunting Technical Service Ltd, 1976). This

subspecies which was previously found in both Somalia and Ethiopia is now restricted only to few localities in Ethiopia.

In 1973, Senkele area had the largest population of Swayne's hartebeest (500) near Shashamane. A further herd of approximately 100 individuals was known to inhabit the Nachisar plains to the north east of Lake Chamo. Much smaller numbers managed to survive at sites near the Awash River and in the vicinity of Yavello (Yalden et al., 1984). Recently a known population has been known to exist at Maze.

Tischler (1975) gives an account of the subsequent history to the Senkele population. Between March 1972 and October 1973, the area of undisturbed grassland available to Swayne's hartebeest at this site was reduced from 200 to 50 km² through uncontrolled encroachment by local pastoralists and mechanized farming. In response to this critical situation, 200 individuals were removed from Senkele in 1974 and translocated, half to the Awash National park and the remainder to the Nachisar plains (Yalden et al., 1984).

The Swayne's hartebeests were distributed widely in Ethiopia and Somalia until the beginning of the nineteenth century. The population size has decreased and at present endangered. Most of the Swayne's hartebeests inhabit the Senkele Sanctuary. The population once increased from 448 to 2379 during 1976-1988 (Messana and Bereket Netsereab, 1994).

In May 1991, during the downfall of the military regime, the local people started to destroy the office, houses and vehicles in the Sanctuary. Moreover, they plundered equipment and poached many Swayne's hartebeest in the few days immediately after the change in regime. Two thousand Swayne's hartebeests that were in the Sanctuary at the end of the military regime were drastically reduced to 626 (Messana and Bereket Netsereab, 1994). People explained the reason of large-scale slaughter of hartebeests and the destruction of buildings as a punishment to the warden and scouts. They considered the Swayne's hartebeest as property of the warden and scouts. Only 123 individuals were recorded in 1998 (Nishizaki,

2004). The average population recorded at Senkele Sanctuary in the year 2000 was 161 (Birhanu Gebre, 2000). The Swayne's hartebeest, once abundant, has been greatly reduced in numbers through direct killing and habitat modification by the local people.

1.2 Literature review

Historically, the now evicted locals had been sparsely inhabited in many of the conservation areas for a long time. Upon the eviction, the indigenous people are forced to use resources that are outside the protected areas (Fiallo and Jacobson, 1995). However, as population increased unsustainable land use practices outside the protected areas made life difficult. Thus, demand for resources found people illegally use and then destroy the natural resources inside protected areas and getting into conflict with conservation authorities (Lumprey, 1990).

Complete removal of the local people from using the resources in protected areas at the time of establishment resulted in conflict between the conservationists and the people (Davey, 1993). As a result, different illegal activities were carried out inside the protected areas against the law and regulations of conservation. These activities destroyed the natural resources (Wells and Barandon, 1992). In addition to this, the conflict in protected areas may be related to giving less attention in the involvement of local people in decision-making and park management process (Angeles, 1992).

Traditionally, the Senkele Sanctuary has been regarded and managed as an area completely segregated from the surrounding region, solely devoted to the conservation of the hartebeest population. However, hartebeests depended for their survival on resources that are available within the Sanctuary and, conversely, these resources contained within the Sanctuary are also critical for the economy of the local people (Messana and Bereket Netsereab, 1994). The long-term conservation of Swayne's hartebeest at Senkele closely is linked to the balanced and sustainable economic development of the Senkele region as a whole (Fassil Tekle, 1996).

Community based natural resource management schemes (CBNRMS), where the eco-tourism industry and hunting concessions are potentially valuable for developing the local economy based on wildlife related revenues should be practiced (Bond, 2001). This scheme entails a system of returning benefits to rural communities in order to motivate them to protect wildlife outside protected areas and to discourage poaching. This will have a real potential in mitigating the conflict (O'connell-Rodwell et al., 2000). The conflict between wildlife and local people living adjacent to protected areas can probably never be entirely eliminated. However, the conflict can be mitigated by discouraging agricultural activities associated with high human density on land adjacent to protected areas that attract wildlife (Newmark et al., 1994).

To date, there has been comparatively little systematic research carried out to investigate the pattern of crop raiding by wildlife and its potential impact on the farmer's food and household economic security (Hill, 1997). Majority of the research focused on the issues related to crop damage by elephants and rodents. Yet, other animals such as primates and ungulates are often cited as troublesome 'pests' in agricultural areas (Hill et al., 2002). With increasing human pressure on many wildlife habitats, human-wildlife interactions are becoming more common. In particular, crop raiding is becoming a more widespread and complex problem throughout the developing part of the world (Hill, 1997; Southwick and Siddigi, 1998).

The success of wildlife conservation and human wildlife conflict reduction largely depends on the ability of managers to recognize, embrace and incorporate differing stakeholder values, attitudes and beliefs (Messmer, 2000). Traditionally, management decisions have relied more heavily on insight from the biological sciences than social assessments of the human dimension (Decker et al., 1992). A major bottleneck in wildlife conservation is the inadequate direct benefits that local communities derive from wildlife related tourism (Earnshaw and Emerton, 2000). In many parts of Kenya, local communities often live in the vicinity of areas that support even as

high as 90% of wildlife, yet they receive as little as less than 1% of foreign exchange earnings derived from wildlife based tourism (Obunde et al., 2005).

In many parts of East Africa, human-wildlife conflict falls under the jurisdiction of wildlife conservation authorities, which often ends at the boundary. The question of who should be responsible for dealing with the conflict and addressing the issue is not often clear, resulting in unresolved problems (Nyhus and Tilson, 2004). Wildlife managers increasingly recognize that the survival of the remaining wildlife populations in Africa depends upon the willingness and ability of people living in and adjacent to areas inhabited by wildlife to support their presence (Anderson and Grove, 1987).

Africa, compared to other continents, has the largest number of endemic families and genera of big games with high degree of endemism. This is one of the reasons for the African fauna to be so interesting and spectacular (Delany and Happold, 1979).

Ethiopia's geographical location and physical feature has resulted in the diversification of wildlife (Shibru Tedela, 1995). The large altitudinal and latitudinal ranges make Ethiopia an ecological diverse country and home of several unique habitats. Out of the 277 mammalian species known to occur in Ethiopia, 31 are endemic (Hillman, 1993). Swayne's hartebeest (*Alcelaphus buselaphus swaynei*) is one of the 31 endemic mammals of Ethiopia and one among the fifteen forms of *Alcelaphus* (Kingdon, 1982). The first specimen was described by Sclater in 1892 and was classified as *Bubalis swaynei* and later changed to *Alcelaphus buselaphus swaynei* by Ruxton and Schwartz (1929). Sclater and Thomas (1894) recognized eight distinct *Alcelaphus* species, whereas Ruxton and Schwartz recognized nine but ranked them as sub-species (Appendix 1). To date *A. b buselaphus* and *A. b. bubalis* are extinct and the remaining seven sub-species have suffered probably the most dramatic contraction in range among all African ruminants (Kingdon, 1982).

Hartebeests are large sized antelopes in which males weigh between 150 and 180 kg and females on average 5-10% less than males (Kingdon, 1982). Horns are present in both sexes although they are more massive in males. In calves, grow first as straight spikes developing their first twist by the age of twelve months (Messana and Bereket Netsereab, 1994). Pallas first named the hartebeest in 1766. The hartebeest, *Alcelaphus buselaphus*, originally occurred in grasslands throughout the African continent (Batty, 2002). It ranged from Morocco to northeastern Tanzania and, south of the Congo, southern Angola to South Africa. Its range has been drastically reduced, however, due to hunting, habitat destruction and foraging competition with domestic cattle. At present, hartebeests occur only in parts of Botswana, Namibia, Ethiopia, Tanzania and Kenya (Batty, 2002).

The three recognized sub-species that occur in Ethiopia are *A.b lelwel*, *A.b tora* and *A.b swaynei* (Bolton, 1973). Several subspecies are distinguished from each other by coat color, varying from pale brown to brownish gray, and by horn shape. All sub-species have horns in both sexes, which originate from a single pedicel and are 450 to 700 mm in length (Tischler, 1975). Three types of horns can be distinguished in the *Buselaphus* group. U-shaped in extinct North African bubal hartebeest, and in the western hartebeest form Gambia, Nigeria and Cameroon; V-shaped as in the Lelwel Hartebeest (*Alcelaphus buselaphus lelwel*), Jackson's hartebeest (*Alcelaphus buselaphus jacksoni*) and the South African Cape hartebeest (*Alcelaphus buselaphus caama*) had protruded heads and a uniform red-brown color. The third type, shaped like inverted brackets, *Alcelaphus buselaphus tora* from Sudan and Ethiopia, and in Swayne's Hartebeest. Swayne's hartebeest occurred in both Somalia and Ethiopia but at present restricted to Ethiopia (<http://www.ethiopiafirst.com/Endemic-Swayne-hartebeest.html>).

Swayne's hartebeests are distinguished from other hartebeests by the presence of darker body color (Plate. 1). It is deep red chocolate brown or bright reddish brown with a fawn or yellowish brown-collared rump, tail and lower half of legs (Bolton, 1973). Swayne's hartebeest is the most attractive and colorful of the three sub-species of hartebeests (Tischler, 1975).



Plate 1. Physical characteristics of Swayne's hartebeest

Hartebeests are social animals living in organized herds of up to 300 animals. They formed aggregations of up to 10,000 animals. Within a herd, there are four types of social groupings. Territorial adult males, non-territorial adult males, group of young males, and groups of females and young. Females, within a herd, form groups of 5-12 animals with up to four generations of offspring in their group (Kingdon, 1989). Male offspring may remain with their mother for up to three years, but usually leaves his mother at about 20 months to join groups of other young males. At 3 to 4 years old, males may begin to attempt to take over a territory with the

females within it (Batty, 2002). Hartebeests are usually conspicuous, non-aggressive and sedentary. They may have a sentinel to warn the herd of predators. Although appearing slightly awkward, they may reach speeds of 70 to 80 km per hour (Batty, 2002). The hartebeest has a lifespan of 11 to 20 years (<http://www.awf.Org/animals/hartebeest.html>).

Reproduction varies seasonally depending on the population or subspecies of Hartebeests involved. Birth peaks vary from October to November in South Africa, December to February in Ethiopia, and February to March in Nairobi National Park. Gestation lasts from 214-242 days and usually a single calf is born. Females isolate themselves in scrub areas to give birth (Batty, 2002). Then leave their young hidden in the scrub for a week, frequently visiting only to suckle. Young are weaned at 4 months (Kingdon, 1989).

In the hartebeest at Senkele, reproductive seasonality ensures that the months of peak lactation, January to February, coincide with the most favorable period of the year in terms of grassland structure and protein and energy content of the main forage grass species. The early wet season peak in the potential intake of metabolizable energy appears to be important in meeting the increased protein and energy requirements of lactating females (Owen-smith, 1982). Moreover, the weaning of calves in the wet season, at the age of three or four months, when high quality forage is still available, is likely to enhance calf survival by allowing a long period with abundant food supply before the lean months of the dry season approach (Gosling, 1969).

The hartebeest has been classified as a roughage grazer (Hofmann, 1968). These antelopes feed on selectively on medium to long grass communities, preferably in ecotone areas (Gosling, 1974). Hartebeests are well adapted to hot and dry climates and are relatively independent of water (Maloiy and Hopcraft, 1971). The Senkele Swayne's hartebeest survive in the absence of free standing water.

Many nations accept the desirability of protecting their natural heritage to contribute for the protection of natural resources and conservation of the biological diversity of the world (Mackinnon et al., 1986). Realizing the need of conserving and protecting its biodiversity, Ethiopia has become one of the nations of the world that ratified the Convention on Biodiversity. The country commenced its wildlife conservation and development program in 1965 (Andebrhan Kidane, 1992; Hillman, 1993). Most of the African wildlife institutes were established around the same period, i.e., in 1950's. Some of them started conservation practices late, during 1970's. However, the African wildlife institutes are successfully managing and utilizing their wildlife resources. Wildlife in Kenya for instance is the country's principal source of foreign exchange, exceeding the revenue from coffee and tea combined in 1989 (Kenya Wildlife Service, 1991).

Ethiopia's conservation and protected areas program has different setbacks. Many of Ethiopia's protected areas exist on paper only, while others have declined in size or quality (Schloeder and Jacobs, 1993). Senkele Swayne's Hartebeest Sanctuary is one of the protected areas that faced decline in size. During the 1990's, the area became under increasing human pressure impacting the habitat available to the native wildlife. Many new settlements (over 1400 huts) were established in and immediately around the Sanctuary. Although efforts have been made to prevent habitat loss, lack of law enforcement, the volatile political conditions and lack of alternative available to the local people have resulted in continuing encroachment and habitat conversion (Birdlife International, 2003).

In the surrounding area, livestock and crop production are the major sources of income. The Sanctuary is the only available grazing land in the zone and over 10,000 cattle depend on the area during the rainy season. The resultant reduction in space and the poor quality of grazing land have forced the livestock and native mammals to compete (Birdlife International, 2003).

Messana and Bereket Netsereab (1994) have proposed to establish a multiple-use system of wildlife conservation and human land use by dividing the Senkele Sanctuary and the surrounding area into four different zones (Fig. 1):

- Wildlife zone (zone 1). This zone should be reserved for the exclusive use of the wildlife
- Pastoral zone (zone 2). In this zone limited grazing of livestock during the wet season
- A sylvo-pastoral zone (zone 3). zone for limited grazing and limited utilization of the woody vegetation
- A buffer zone (zone 4) between the Sanctuary and the surrounding crop land. However, the idea was not implemented.

Wildlife management should adapt new situations and new understandings emerging from experience and the supporting biological and social sciences (Riley et al., 2002). Considering the actual population growth rate of humans, increasing demand for natural resources and the growing pressure for access to land, it is clear that the human-wildlife conflict may not be eradicated in the near future. This needs to be managed urgently (IUCN, 2003). The problems facing the Swayne's hartebeest are not primarily due to an inability to utilize effectively their natural habitat but due to a reduction of that habitat and the consequent competitions with man and his domestic stock (Fassil Tekle, 1996). The subspecies is threatened by further loss of habitat to subsistence agriculture, overgrazing by domestic cattle and by increasing number of new settlements in and immediately around the Sanctuary. The hartebeests have been restricted into a smaller area because of large number of human movement into areas that were formerly hartebeest habitat. These factors make Swayne's hartebeests of Senkele in greater danger of extinction at present than any other time in the past.

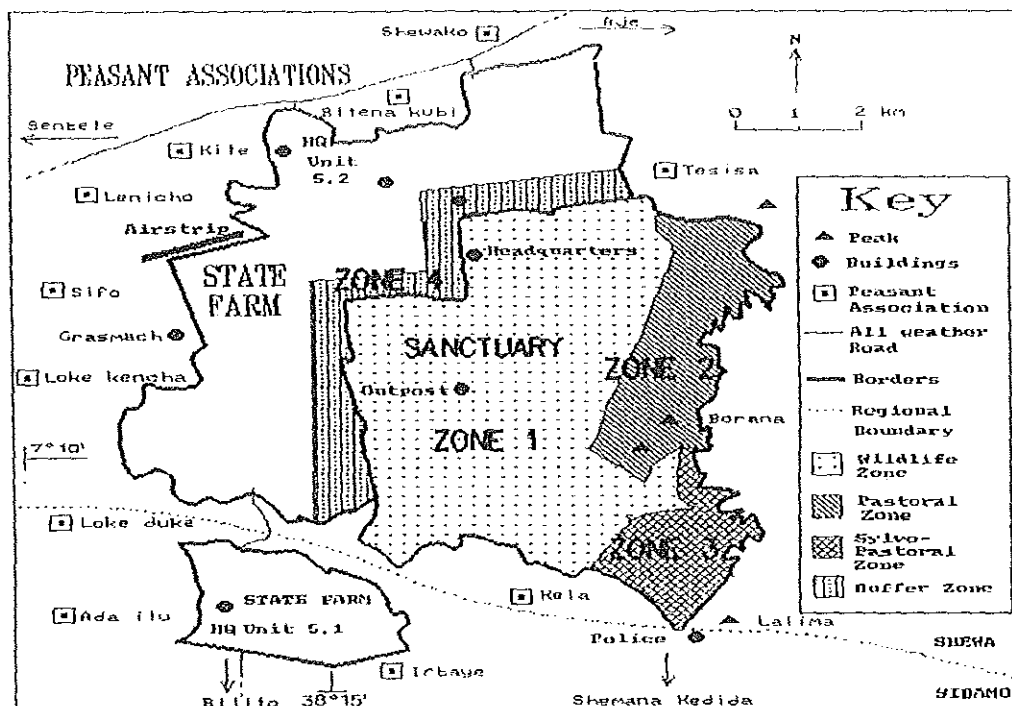


Figure 1. Proposed scheme for the development of vegetation management in Senkele Sanctuary.

According to Messana and Bereket Netsereab (1994), land use practice in the Senkele plains is highly inter-dependent. The interaction between wildlife conservation and traditional agro-pastoralists indicate that the Senkele Plain represents functioning albeit with some conflict, integrated land use system. Therefore, for sustainable development both stakeholders (wildlife conservationists and agro-pastoralists) should reconcile their differences. As a result, the present study is carried out to identify the causes/problems of human-wildlife conflict in parallel to determine the population status of Swayne's Hartebeest in the Sanctuary.

1.3 Objective

To assess the causes of human-wildlife conflict and to determine the current population status of Swayne's hartebeest in Senkele Swayne's Hartebeest Sanctuary.

The specific objectives

To identify the impact of livestock and human on wildlife and vice versa

To survey the population status of Swayne's hartebeest

To assess the livestock population in the study area

To identify the attitude of the different stakeholders on how to manage the Sanctuary

2. DESCRIPTION OF THE STUDY AREA

2.1 Location and topography

The Senkele Swayne's Hartebeest Sanctuary is one of the protected areas in Ethiopia. It is located on the western side of the Great Rift Valley, 320 km south of Addis Ababa. The Sanctuary is currently in the Oromia Administrative Region, East Shoa Zone (Fig. 2). It is located between 7° 10' N and 38° 15' E. The Sanctuary was established in 1976 to protect the Swayne's hartebeest (*Alcelaphus buselaphus swaynei*) (Messana and Bereket Netsereab, 1994). The 200 km² area occupied by the hartebeest in 1972 was reduced to about 58 km² in 1973, and then to 36 km² (Messana and Bereket Netsereab, 1994).

To the East of the Sanctuary are the Tesisa, Borena and Lalima hills. The northern and Southern parts of the Sanctuary harbor huts and expanded farmlands belonging to the Arsi people. Since 1991, prior to the previous state farm, the western part of the Sanctuary demarcated by huts belonged to the Arsi people (Fig. 3). The topography within the Sanctuary is characterized by a gently undulating plain dissected by a number of valleys. The altitude ranges from 2000 to 2100 m asl.

2.2 Climate

The average rainfall at Senkele, measured over four years (1991-1994) is 1,116 mm. It has a moderately bimodal pattern of rainfall typical of the 'Woinadega' agro-ecological zone of Ethiopia (1700-2700 m altitude; 600-1200 mm annual rainfall). The three-month dry season, from November to January, is followed by the 'Belg' rains, in March-April, and the 'Kremt' rains, from June to September. The mean monthly temperature is relatively constant throughout the year but diurnal variations can be considerable. Monthly maximum temperatures range between 26°C in the dry and early wet seasons and 21°C in the late wet season. Monthly minimum temperature is lowest during the dry season, falling to 8-9°C on some occasions, and rising to their maximum values of 14-15°C between March

and May. Predictably, the relative humidity follows the rainfall pattern. Monthly minimum values increase from 30-40% in the dry season to 50-60% in the wet season. Mean maximum values fluctuate slightly around 80%. During the dry season, cloud cover is at a minimum and wind speeds are at their annual maximum contributing to the high levels of evapotranspiration associated with tropical climate patterns.

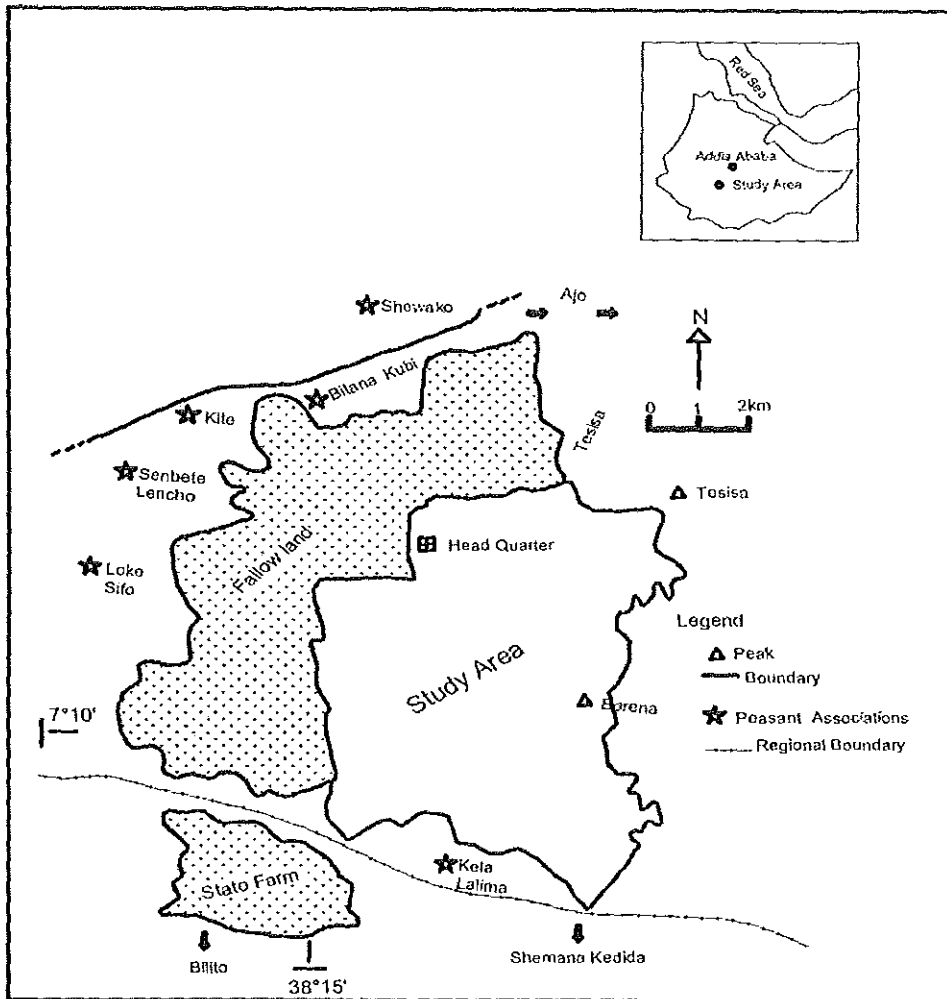


Figure 2. Map of the study area with map of Ethiopia inside.

At present, less than 28 km² of the Sanctuary remains for the hartebeest, as the rest of it was taken over by the peasants living nearby (Fig. 3).

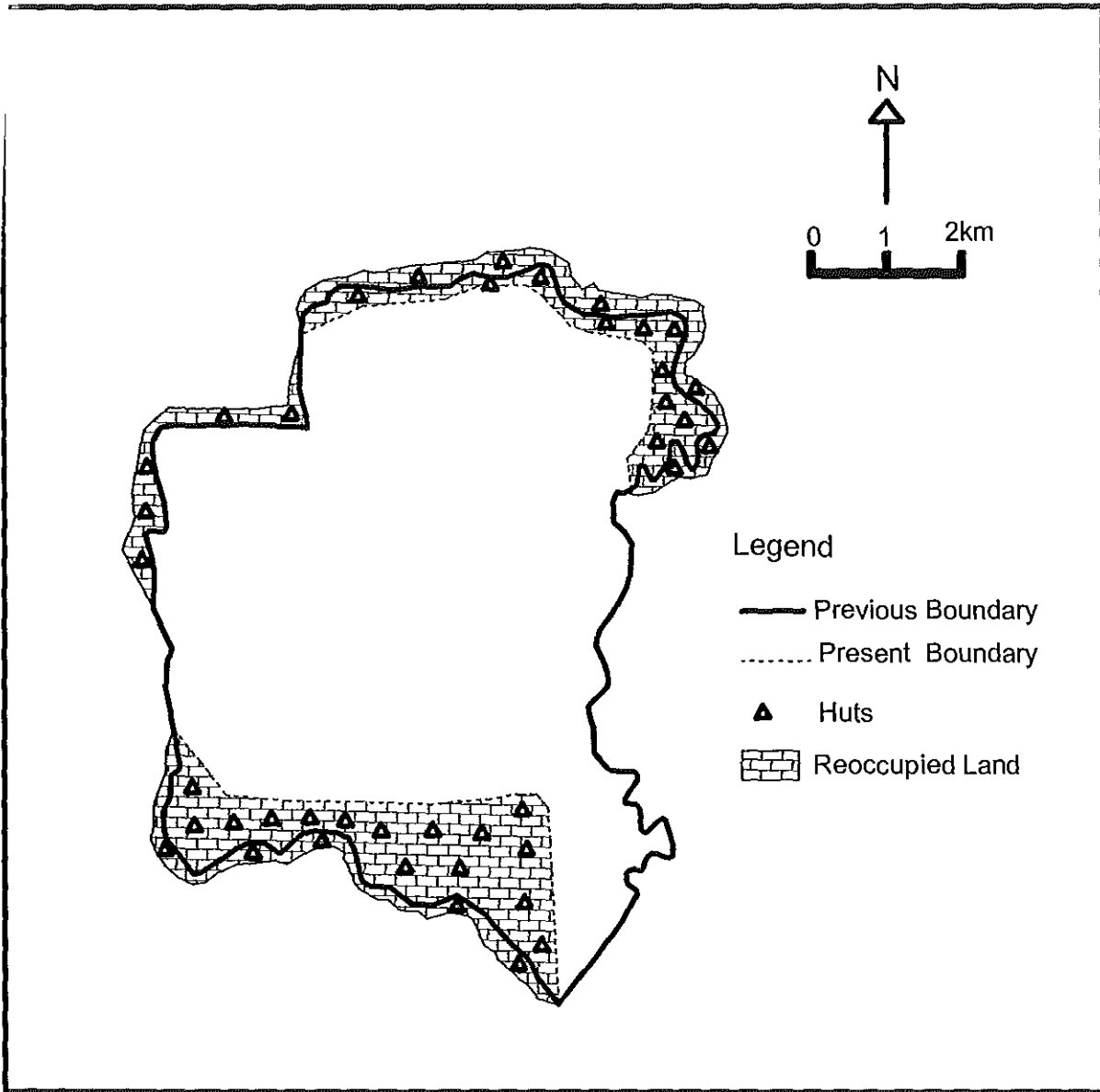


Figure 3. Map showing the previous and present boundary of the Sanctuary.

2.3 Vegetation

The vegetation in the Sanctuary is best described as montane savanna and comprises various different habitat associations such as savanna woodland, natural grassland (with fewer tree and shrubs) and, in the valleys, rich shrubland (Birdlife International, 2003). Messana and Bereket Netsereab (1994) analyzed the vegetation within the Sanctuary based on differences in the species composition and cover of grassland. This resulted in the identification of three distinct vegetation communities (Fig. 4). These are:

Pennisetum Grassland type 1 (P₁)

Pennisetum Grassland type 2 (P₂)

Mixed Grassland (MG)

2.4 Geology and soil

The main geological formation in the Senkele area is Ignimbrite, which has given rise to heavy textured, dark sandy loam to clay top soil; moderately deep to deep on the open plains but shallow on sloping land. Subsoil varies from gritty, brownish and loam to clay (Messana and Bereket Netsereab, 1994). The erodability of the soil is very high, particularly along tracks and plough lines, where, gullies rapidly formed once the vegetation cover is removed (Messana and Bereket Netsereab, 1994).

2.5 Wild animals

In addition to the Swayne's hartebeest, other wild herbivores that occur in Senkele Sanctuary are Bohor Reedbuck (*Redunca redunca*), Warthog (*Phacocoerus aethiopicus*), Greater kudu (*Tragelaphus strepsiceros*) and Oribi (*Ourebia ourebi*). The latter was the most common in the past and Senkele means Oribi in the local language.

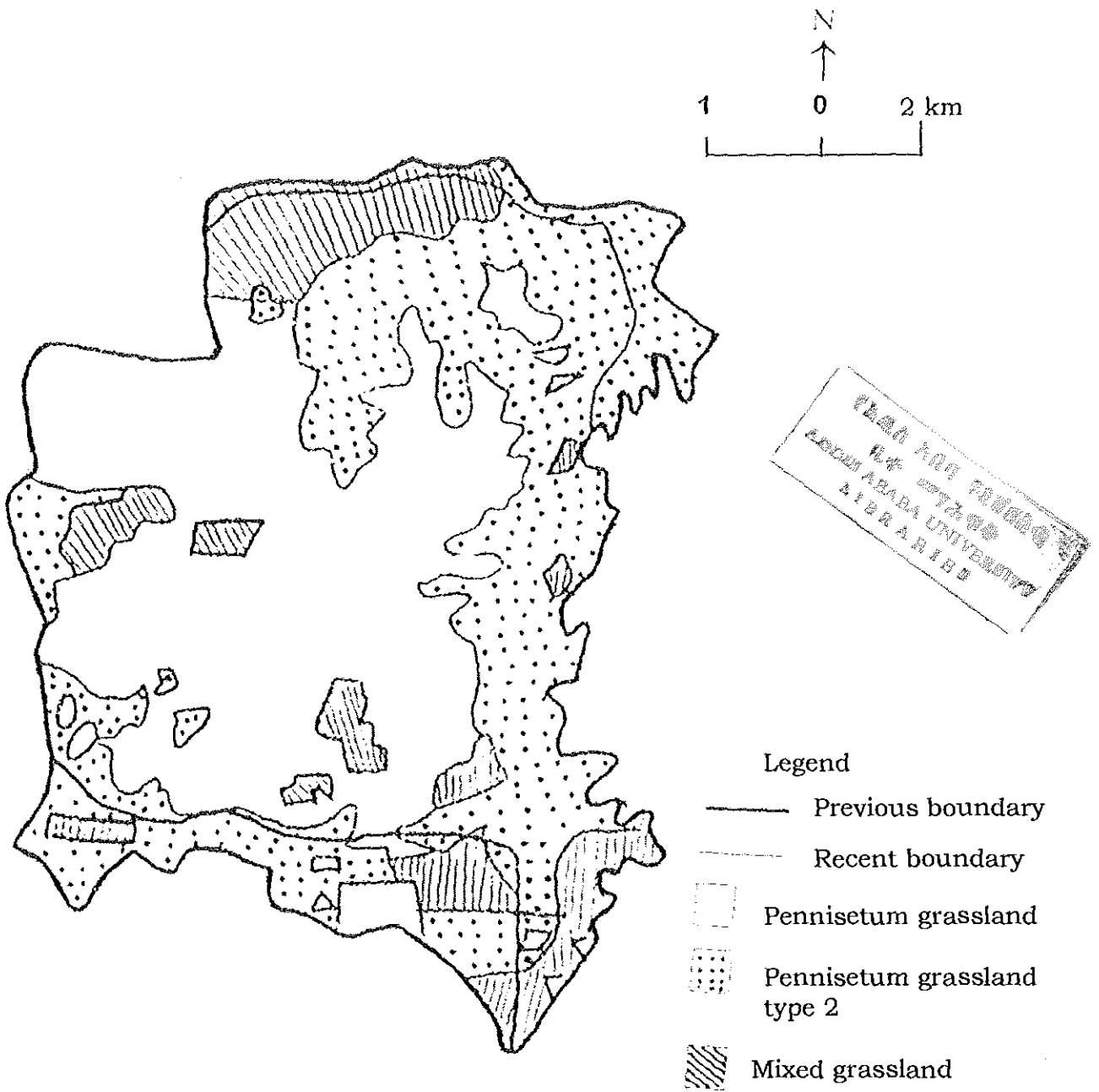


Figure 4. Map showing the vegetation communities of the Sanctuary

Among the primates, vervet monkeys (*Cercopithecus aethiops*) can be seen in a restricted forest area. Crested porcupine (*Hystrix cristata*), Aardvark (*Orycteropus afer*) and Abyssinian hare (*Lepus habessinicus*) are also observed. The large carnivores have traditionally been hunted for sport or as pests by the local pastoralists. Lion (*Panthera leo*) was reported in the area earlier but now disappeared (Hunting Technical Service, 1976). Leopard has been observed in 1995 in the more wooded area. Spotted hyenas (*Crocuta crocuta*) are very rare, probably numbering less than 10, and have never been observed in packs of more than three animals. In contrast, and perhaps as a result of the decline in the larger carnivores, Jackals (*Canis aureus*) have increased in number and together with feral dogs may be the most important predators of new born hartebeests.

2.6 Human settlement and land use system

In the Senkele Plains, the dominant land users up to 1940 were the pastoralists. Subsequently, the influx of new elite following the Italian war (1936-1941), led to the development of mechanized farming in the area. In the late 1960s, areas of pasture in the area were increasingly brought under cultivation and the pressure on remaining pasture was intensified (Messana and Bereket Netsereab, 1994).

Crop production is the main activity followed by livestock rearing. The principal crops of the area are maize (*Zea mays*) and potato (*Solanum tuberosum*) but in limited areas, haricot beans (*Phaseolus vulgaris*) is also observed. Greater number of livestock in particular characterizes Siraro Woreda and the study area.

Before 1990, the number of settlers in and around the border of the Sanctuary was non-existent. After 1991, people started to show resistance against EWCO through a variety of action such as occupation of the territory, livestock grazing and fire wood collection in the Sanctuary. Those

who occupied the land built huts along the border of the Sanctuary and expanded their farmland (Nishizaki, 2004).

3. Materials and Methods

Both focus group discussions and questionnaires were used to collect information from communities living in and around the four selected peasant associations. The selection was based on the distance from the Sanctuary and their impact on the conservation area.

3.1 Duration of the study

Initial study was carried out from August to October 2005 to cover the wet season. Additionally, data were collected from November 2005 to March 2006 to accommodate dry seasons. The periods represented the three seasons experienced in and around the Senkele Swayne's Hartebeest Sanctuary, the heavy rain, short rain and dry seasons and thus gave representative samples for the whole year. Quantitative data were obtained from both wet and dry seasons. In both this seasons, data on the population size and structure of Swayne's hartebeest were gathered besides the questionnaire and group discussion.

3.2 Study sites

Four Peasant Associations were selected for household questionnaire study. Each of this Peasant Associations differed from one another in its geographical location (Fig. 2) and household numbers (Table 1).

Table 1. Total household number and sample size across the four study sites.

Study site	household number *	Sampled household	%
Loke Sifo	1200	62	5
Senbete Lencho	828	55	6.64
Kela Lalima	764	53	6.94
Kite Tesisa	624	50	8.01
Total	3416	220	6.44

*Source: CSA, 1995

3.3 Questionnaire

A household questionnaire survey was conducted in and around the Senkele Swayne's Hartebeest Sanctuary ranging from 0 to 4 km apart from the Sanctuary boundary. The questionnaire was pre-tested among some group of a population which is not included in the main sample group. In the household survey, people were interviewed by two native speakers. Training was provided for the interviewer on how to fill out forms and how to approach sensitive questions on illegal hunting and encroachment in and around the boundary of the Sanctuary. To gain people's confidence, every household was visited prior to the interview and the purpose of the study was clearly presented.

The questionnaire was administered to members of the household on a random manner based on first come first serve basis and alternating male

and female respondents as much as possible and different age groups. Each study area covered between 50-62 households. Four Sanctuary staff members and two Woreda Agricultural Officers were also incorporated to provide information on the impact of the local people on the protected area, their awareness of damage by wildlife and their suggested measures to reduce the losses.

Thirty five questions were included in the study to examine the conflict between local people and wildlife in the area (Appendix 2). The questions were intended to gather demographic data (age, sex, family size, number of wives), crops grown, acreage, damage caused to crops (using categories ranging from no damage to very much damage) and the species of wildlife responsible, protection measures adopted, perceived wildlife population trend, livestock type and number killed by wildlife and the attitudes of local communities towards wildlife and the Sanctuary management.

3.4 Focus group discussion

Group discussion methods were used as a complement for the questionnaires. Five pre-designed open-ended questions were used (Appendix 3) for gathering information. Information was collected on how local communities perceive wildlife, how they access and use the Sanctuary's resources (grass, forest), the co-existence of wildlife and communities and as a whole how both local communities and wildlife benefited from the protected area.

Four focus group discussions were conducted; one in each study site. The group size in each discussion varied from 15 to 20 people. Participants were selected based on their age and duration of residency in the area. Participants were invited to discuss issues according to their convenience. Most often, community leaders were approached in advance and requested to organize meetings two days from then. Local translators were employed for each discussion. Some direction was given to each translator as to the

procedures of group discussion, in order to secure a lively and productive discussion. Information collected from group discussion was collated and summarized using a text analysis method, and is presented in a narrative fashion.

3.5 Resource Conflict

The impact of local people on protected area concerning the presence of traditional hunters in the community, possibilities of farm extension, fuel wood, and pole and thatch collection site also investigated. Records were carried out on the number of users in collecting firewood and the total number of livestock (cattle, sheep, donkey, goat and equines) observed. The records were carried out during the census period of Swayne's hartebeest. In addition to these, number of new settlements occurring in and around the Sanctuary was recorded.

3.6 Population estimation of Swayne's hartebeest

The entire study area was divided into five blocks with artificial and natural boundaries (Fig. 5). The term 'blocks' in this context refers to a small area with natural and/or artificial boundaries that can be easily identified on maps as well as in the field. The distance between consecutive transects varied depending on the vegetation cover.

Block 1 and 2 had less Acacia cover and the other blocks were relatively denser with Acacia and other vegetation on the eastern side. Total count method was applied throughout the study period to estimate population size of Swayne's hartebeest as adopted by Sutherland (1996); Norton-Griffiths (1978) and Caughley and Sinclair (1994).

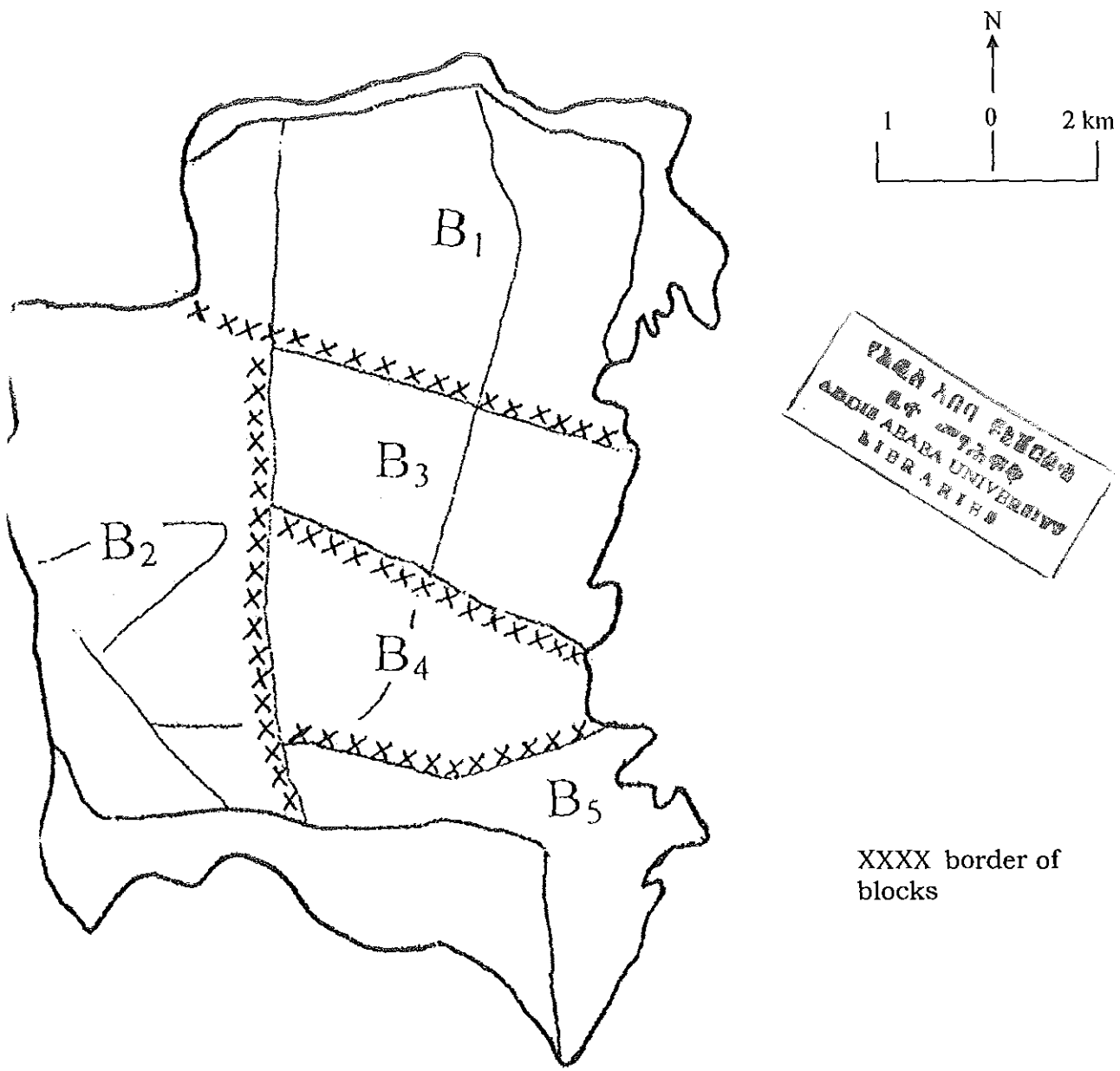


Figure 5. Map showing division of the study area in to five counting blocks.

Counting was carried out using unaided eyes and/or a pair of binoculars, while on foot and/or on car, twice during the wet season and twice during the dry season. Census was conducted when the Swayne's hartebeests were

most active and with good visibility in the morning (9:00-11:00 a.m.) and in the afternoon (3:00-5:00 p.m.). Each total count was completed within 2-2 1/2 hours in a day with the help of two well-experienced and responsible scouts from the Sanctuary.

3.7 Sex and age structure

During the census of Swayne's hartebeest, detailed observations of the entire herd was made. This enabled to categorize the populations into their respective age groups. The categories used were adult male and female, sub-adult male and female, and young. To categorize the animals into these groups, the methods of Knight (1970); Bergerud (1971); Lewis and Wilson (1979) were followed. Information on the approximate demographic composition and structure, such as age class and sex ratio, was used to predict the general trend of Swayne's hartebeest population to understand whether it is declining, increasing or stable. Population trend of Swayne's hartebeest was determined by comparing the present findings with the previous findings of different researchers conducted in Senkele Swayne's hartebeest Sanctuary. Sex was differentiated quite accurately with binoculars at a distance of 60-meter range.

3.8 Data analyses

Statistical package (software) used to analyze the data was SPSS version 11. Each question was coded to run SPSS. Descriptive statistics was carried out to calculate frequencies, and to allow cross-tabulations (Field, 2000). Chi-square tests for selected variables, to determine the degree of dependence between independent variables and attitudes towards the wildlife and Sanctuary in general. One way ANOVA was used to compare wet and dry season population size of Swayne's hartebeest in different blocks.

Further, the mean numbers of individuals during wet and dry season were computed using independent sample t-test to see whether there is any significant difference in their population between the wet and dry season.

4. Results

4.1 Questionnaire

4.1.1 Land holdings per household

Out of the respondents, 69.55% had a land holding of less than 0.5 hectare, while 30.45% had greater than 0.5 hectare. There was a significant difference ($\chi^2 = 28.64$, $DF=9$, $P < 0.05$) in the size of land holding between the study sites (Fig. 6). Many of the respondents from Loke Sifo (45.16%) and Senbete Lencho (32.73%) held >0.5 ha. In contrast, many of the respondents in Kela Lalima (41.51%) and Kite Tesisa (38%) held <0.2 ha.

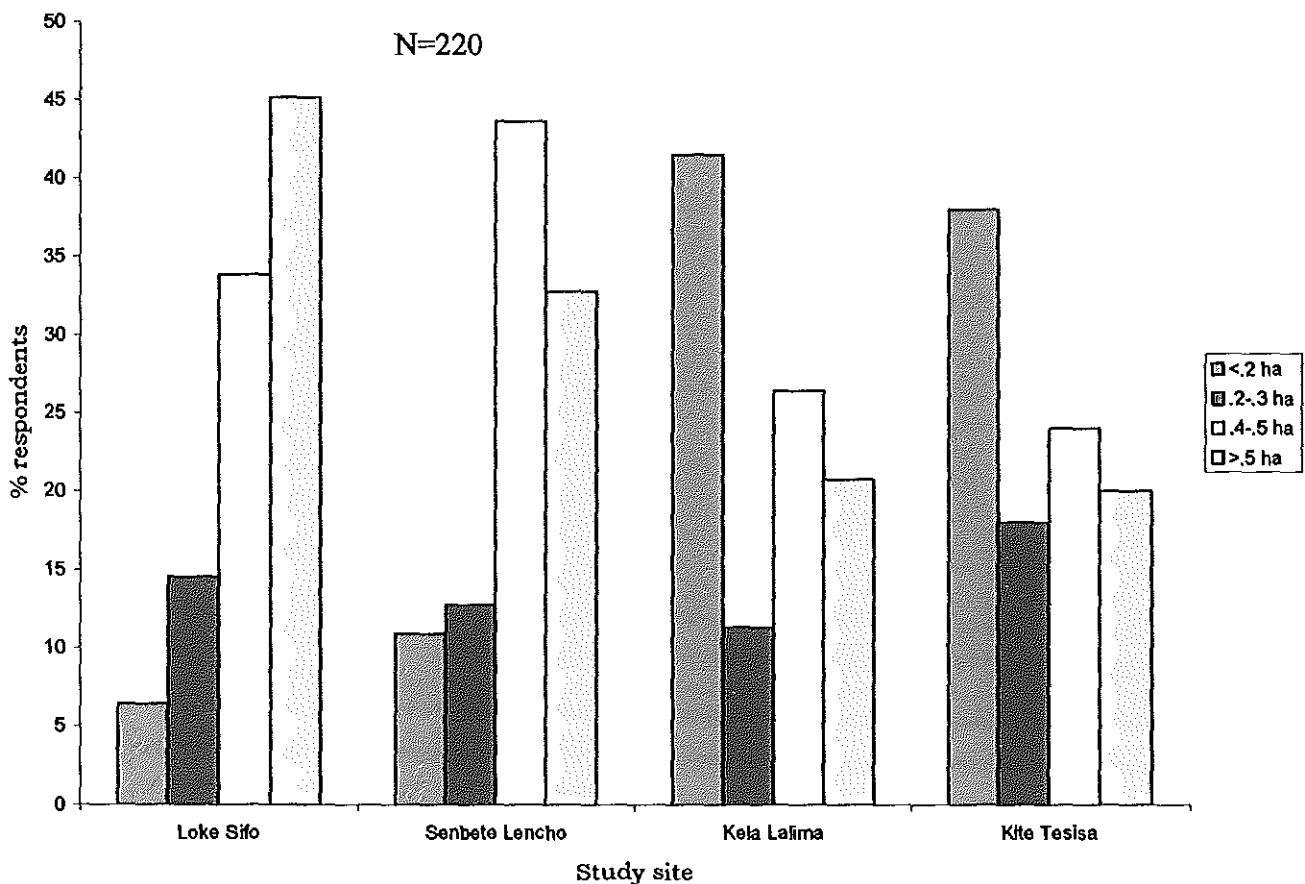


Figure 6. Land holding per household among respondents of each study site.

4.2. Focus group discussion

The result presented here summarizes the views and interest of discussants within each study area. The discussions held with communities (Plate 2) showed that communities in and around the Sanctuary held negative attitude towards the existence of the Sanctuary. Only few discussants wanted the existence and the need to see wildlife and their habitats well protected. These few discussants recognized the presence of endemic sub-species in their area and the contribution to the national economy through tourism. Even though communities do not receive direct benefits from the tourism industry, some of the respondents consider the presence of the Sanctuary as a national pride.



Plate 2. Focus group discussion with community members in SSHS.

One of the discussants described his feeling as follows: "Previously we used to hunt different wild animals especially Swayne's hartebeest during the 1991 unstable period in our area, but now there are very few animals left to see. Some areas of their habitats have been already degraded and the animals disappeared. We now have problems of water and low agricultural production. Therefore, in my view, if the government supports us we are willing to conserve the remaining wild animals".

Most discussants were dissatisfied with the existence of the Sanctuary. They considered the Sanctuary as a limiting factor not to improve their livelihood. Discussants signify the Sanctuary as restricted access to resources, a cause of forced relocation and a means of income generating for non-local people. Free access for grazing was a central issue of discussants. The restriction of the Sanctuary for grazing livestock was the reason for the low quality of their livestock. Discussants stated that they are not using the habitat and wild animals for either farming or milking, but the land was used for animals that have little benefit. Most discussants had negative attitudes towards the Sanctuary not because of crop raiding and livestock depredations by wildlife, but restricting access for resources. Discussants still use the resources such as firewood, thatching grasses and pasture even though they know it is illegal. They feel that the resources still belong to them, and they do not want any one to restrict the use of such resources. In addition, they believe that Sanctuary had conserved large area beyond its need. They feel that small area is enough for the existing wildlife and some part of conservation area should be returned for them. They also suggested that the Sanctuary management team allow them to use resources like pasture, firewood and access to grazing without restriction. Discussants

voiced universally the priority for grazing land, water and light but not the conservation of Swayne's hartebeest. They stressed that if governments want to conserve wildlife, they should see and solve our problems. Some also felt bad because some local people were allowed to live inside the Sanctuary and others are forcefully dislocated from the same area. Such unfair measures and lack of uniformity upsets them. In addition, corrupt discriminate practices by some scout members to have access to the resources have frustrated them.

Few discussants appreciated the human and livestock population growth. Some have realized that shortage of pasture and agriculture land is a consequence of livestock and population growth and recommended to the government to look for a solution. Discussants believed the situation is beyond their control and supported government intervention as a way to find a solution for wildlife and communities. All discussants believed that assistance in improving their household economies would increase their willingness to support conservation activities.

Discussants who considered the Sanctuary as useless generally have poor relation with the Sanctuary staff members. The community members viewed the benefits from the Sanctuary as negligible. They also felt that Sanctuary staff members do not like communities in and around the Sanctuary boundaries. They are interested to collect grass and firewood from the Sanctuary. Which otherwise is difficult to find outside the boundaries of the Sanctuary. If communities are allowed to use some of the resources, then they will be willing to collaborate with Sanctuary staff members. The discussants also proposed how the Sanctuary management should evolve in the future. First the need to establish a dialogue with the conservation agencies. Transparency among the conservation agencies is considered an important factor for the development of a good

relationship between the conservation agencies and communities. Secondly, the communities need to share benefits and good access to pasture and fire wood. They also wish to see more of their community members employed in the Sanctuary, to secure their ownership rights.

4.3. Attitude of the local people towards conservation area

Out of the 220 respondents, 86.4% opposed the existing wildlife conservation systems, while 9.5% supported Table 2. However, there was no significant difference on attitude towards the conservation area among village residents ($\chi^2 = 4.3$, $DF=6$, $P>0.05$). There was a significant difference in the attitude towards wildlife conservation between different age classes ($\chi^2 = 181.24$, $DF=6$, $P< 0.05$). Younger generation, age class (16-30) showed more significantly positive attitude than older age groups (age >31 years). Sex was important in determining the attitude towards conservation area ($\chi^2 = 29.2$, $DF=2$, $P< 0.05$). Male respondents had more positive attitude (81%) than females (19%). Relatively better-educated groups (elementary and secondary) ($\chi^2 = 167.76$, $DF=6$, $P< 0.05$) had more positive attitude than non-educated groups (illiterate and read and write only group). Family size also plays a role in the attitude towards conservation. Small family size (1-5) showed more positive attitude ($\chi^2= 151.3$, $DF=6$, $P<0.05$) than large family size.

Table 2. Attitude of respondents towards wildlife conservation

Response category	Villages						Community perception
	Loke Sifo	Senbete Lencho	Kite Tesisa	Kela Lalima	Total	%	
Positive	7	4	5	5	21	9.5	-Potential for tourism -Cultural value -Job opportunity -Aesthetic value
Negative	51	49	48	42	190	86.4	-No benefit from the Sanctuary -Fear of displacement -Problem with wildlife -Lack of access to grazing in the Sanctuary -Lack of access to arable land -Limit our interest of settlement
Neutral	4	2	0	3	9	4.1	
Total	62	55	53	50	220	100	

4.3.1 Benefits from protected area

Out of the respondents, 83.2% believe they did not receive any benefit from the existence of Sanctuary in their area. The expected benefits were opportunities for job, social services such as clinic, school and resources (firewood, free grazing and grass for own use and sale). Few of the respondents (16.8%) noted that they have received benefits from the protected area. There was no difference in the vision of benefit ($\chi^2 = 0.876$, $DF=3$, $P > 0.05$) between respondents among the study sites (Fig. 7).

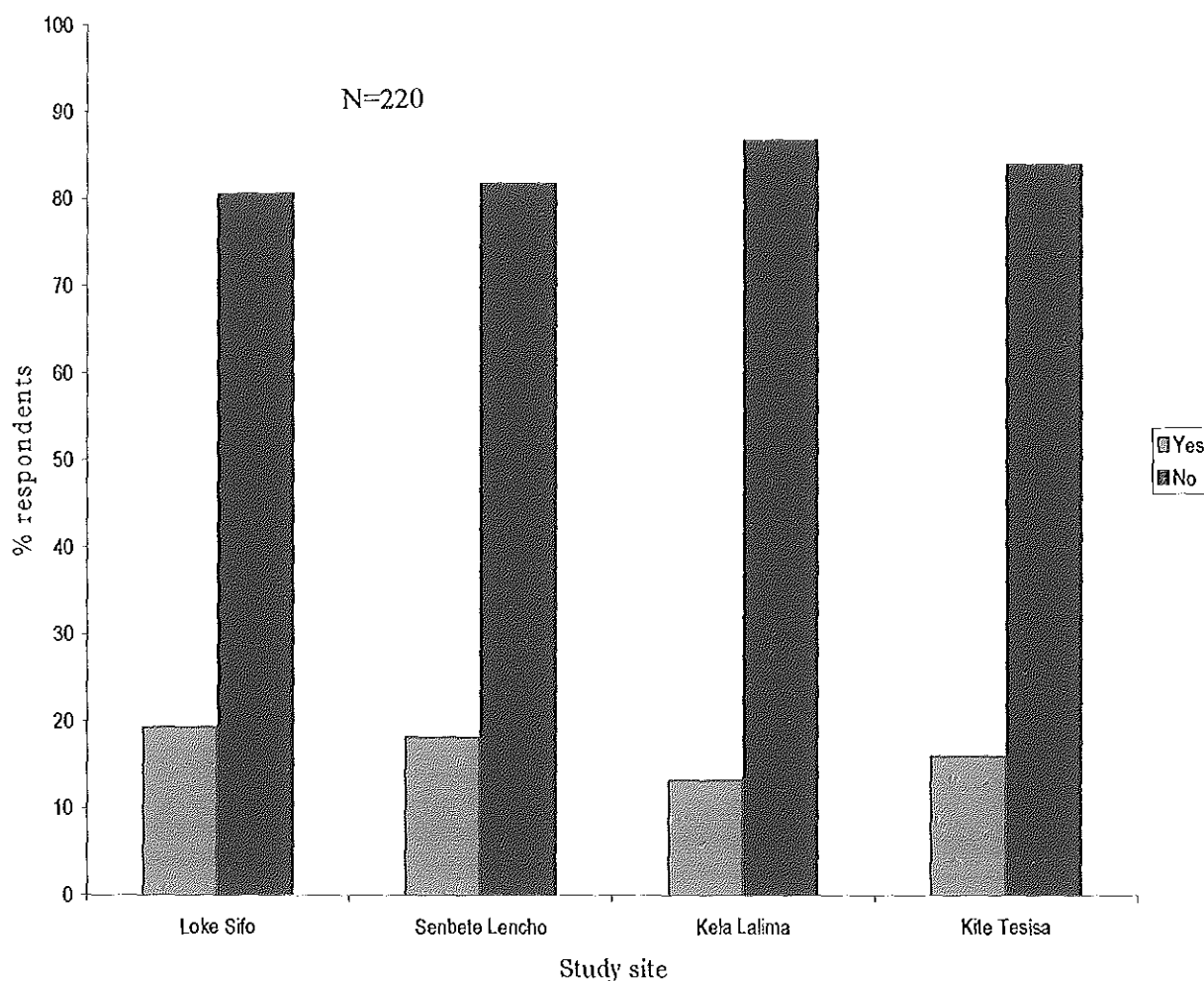


Figure 7. Views of respondents on benefits getting from protected area.

4.3.2 Views of respondents on wildlife

Among the respondents, 40.91% stated that wildlife is not important and the continued existence of wildlife had a negative impact on their livelihood, while 30.45% had no idea on the matter. However, 28.64% of this considered wildlife as important. Reason given for the importance of wildlife include wildlife attracting tourists, hunting during drought, enjoyment of seeing wildlife, and importance for future generations.

The views of wildlife did not differ significantly ($\chi^2= 1.3$, $DF=6$, $P>0.05$) among respondents from the four study sites (Fig. 8).

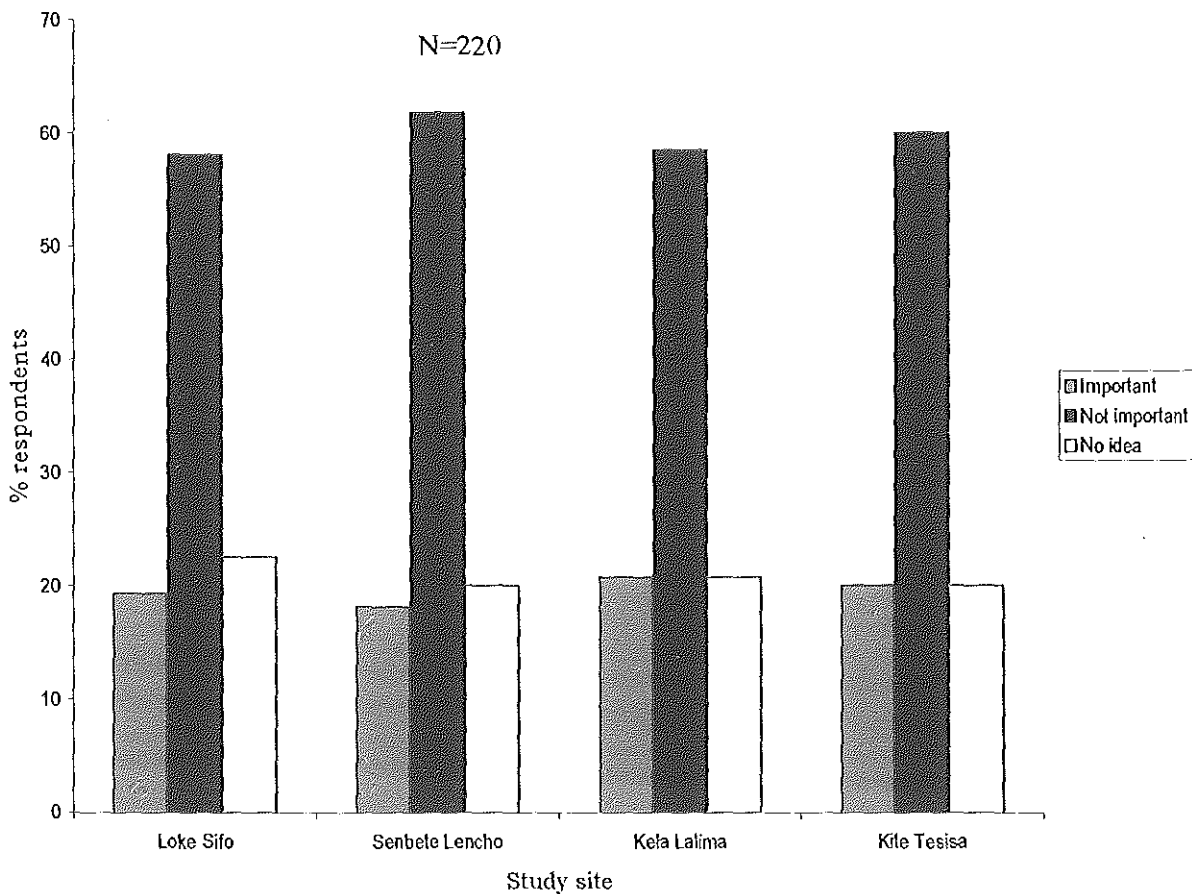


Figure 8. Views of respondents on wildlife conservation in each the study site.

4.3.3 Trends in wildlife population

Socio-economic surveys in the villages around SSHS revealed the views of villagers on trends of wildlife populations in the Sanctuary. Most of the respondents (56.8%) have remarked that wildlife populations have declined in their respective areas. However, 27.3% of the respondents remarked that the wildlife populations have increased. Only 15.9% of the respondents were unsure whether wildlife population is increasing or decreasing (Fig. 9). The view of respondents among the different villages was statistically significant ($\chi^2= 27.8$, $DF=6$, $P<0.05$). Respondents from Loke Sifo (69.35%) and Senbete Lencho (69.09%) revealed that the populations of Bohor reedbuck, Greater kudu, Orbi, Leopard and Swayne's hartebeest have declined. Lion had already become locally extinct. In contrast, respondents from Kela Lalima (41.51%) and Kite Tesisa (38%) stated the increase in wildlife populations in their respective areas.

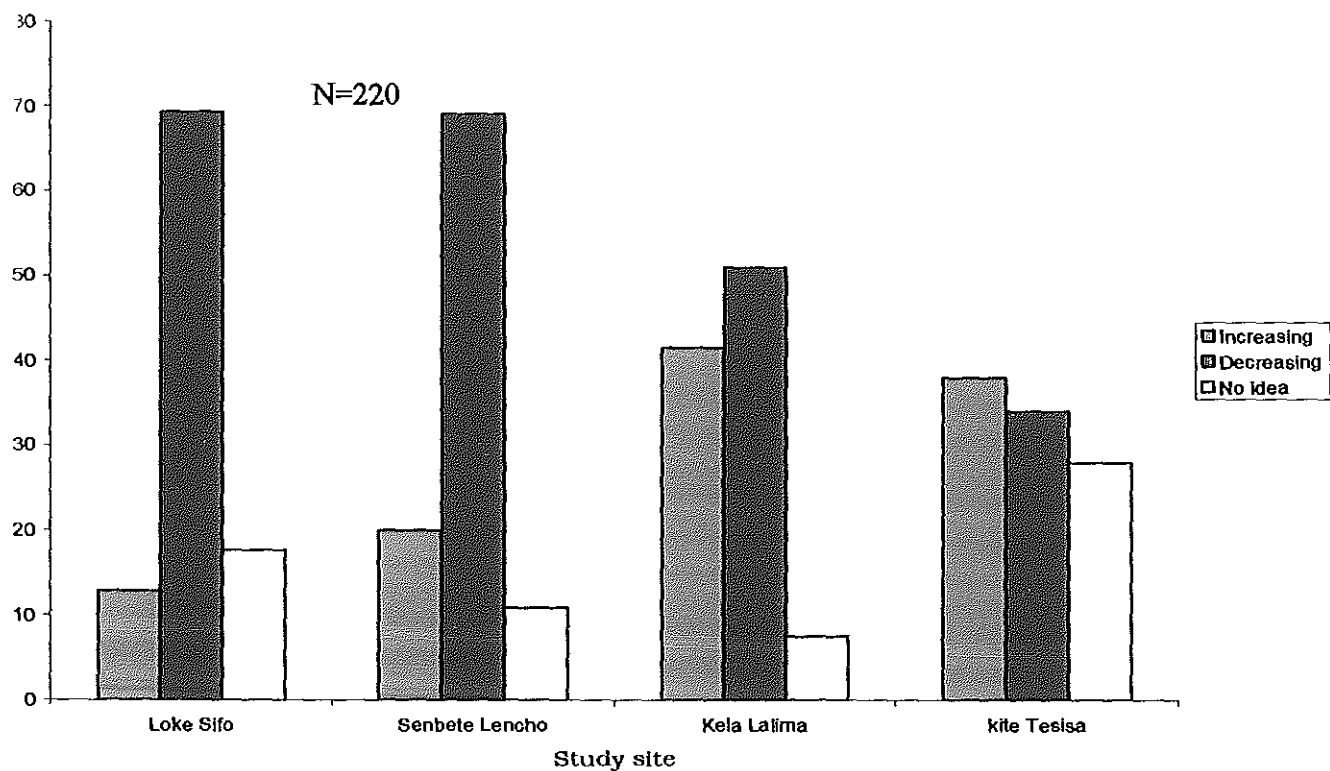


Figure 9. The opinion of local people on trends of wildlife population across the study site.

4.4. Resource conflict

The basic premise in the present study, human-wildlife conflict has escalated because of a change in land use especially, the expansion and intensification of arable farming in and around the Sanctuary and the high increase in livestock number and settlement in the Sanctuary.

4.4.1 Wildlife induced damage

Wildlife induced damage is given in Table 3 (Fig. 10). Among the households, 58.2% experienced crop damage. The majority of respondents (45%) reported wildlife caused very little damage to their crop and none of the respondents faced very much damage. The level of damage showed a significant ($\chi^2= 26.17$, $DF=6$, $P<0.05$) variation among villages. More people from Kela Lalima (22.64%) and Kite Tesisa (20%) faced much damage than the other two villages. In contrast, respondents from Loke Sifo (61.29%) and 50.91% from Senbete Lencho faced no crop damage at all.

Table 3. Wildlife induced damage on crops

Damage category	Villages				
	Sifo Loke	Senbete Lencho	Kela Lalima	Kite Tesisa	Total
No damage	40.22%	30.43%	15.22%	14.13%	92
Very little	20.20%	24.24%	27.27%	28.28%	99
Much	13.79%	10.34%	41.38%	34.48%	29
Very much	0	0	0	0	0

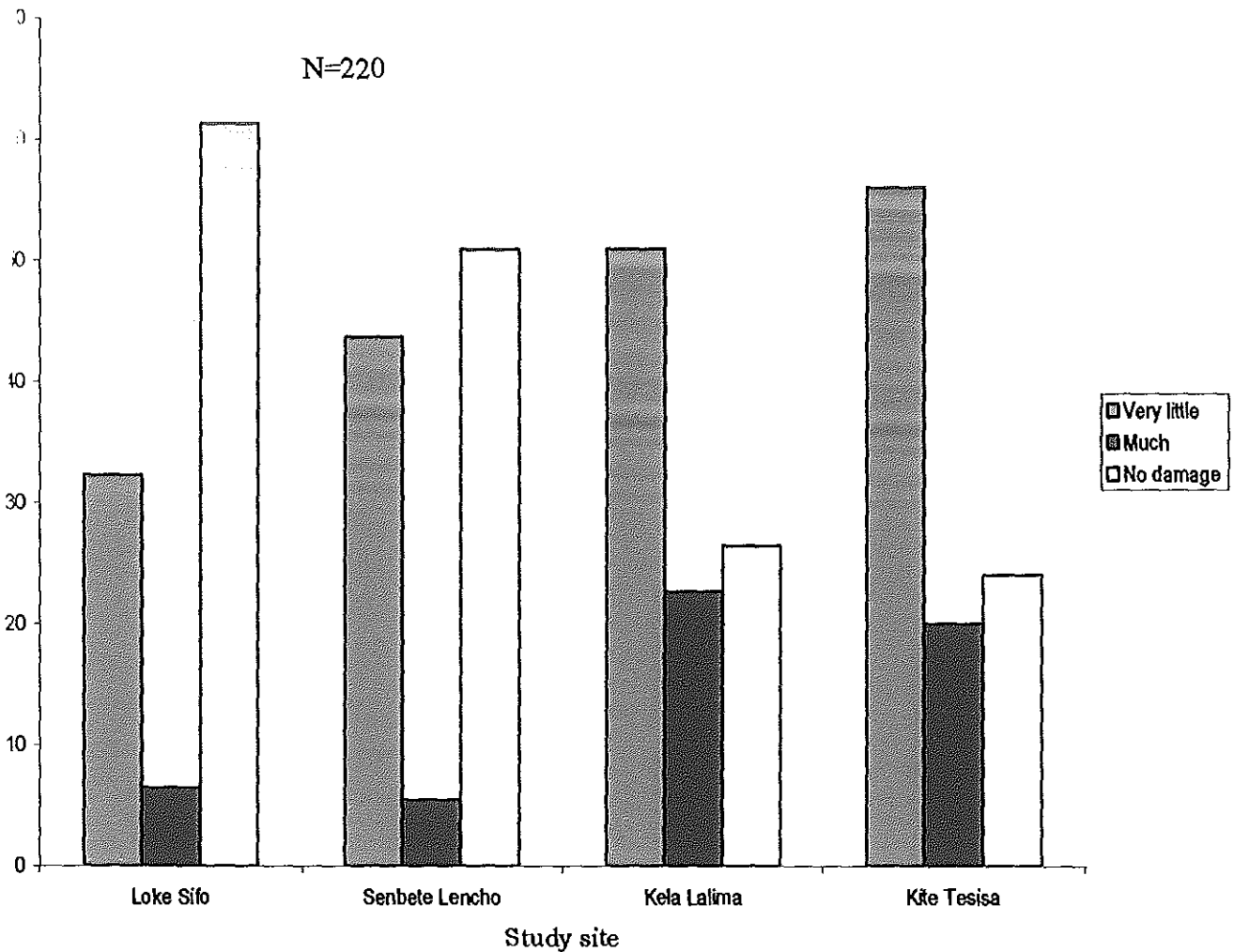


Figure 10. Wildlife damage related responses of the respondents

Respondents differed ($\chi^2= 45.43$, $DF=2$, $P<0.05$) in their views on whether or not wildlife caused problems in relation to distance from their respective areas. People who live inside the Sanctuary area generally face many problems than those living within 4 km vicinity of the Sanctuary (Fig. 11).

Compared to the reported crop damage, almost all households experienced little damage to livestock in the last 3 years (Table 4). Wildlife induced damage to crop was more widespread than damage to domestic animals.

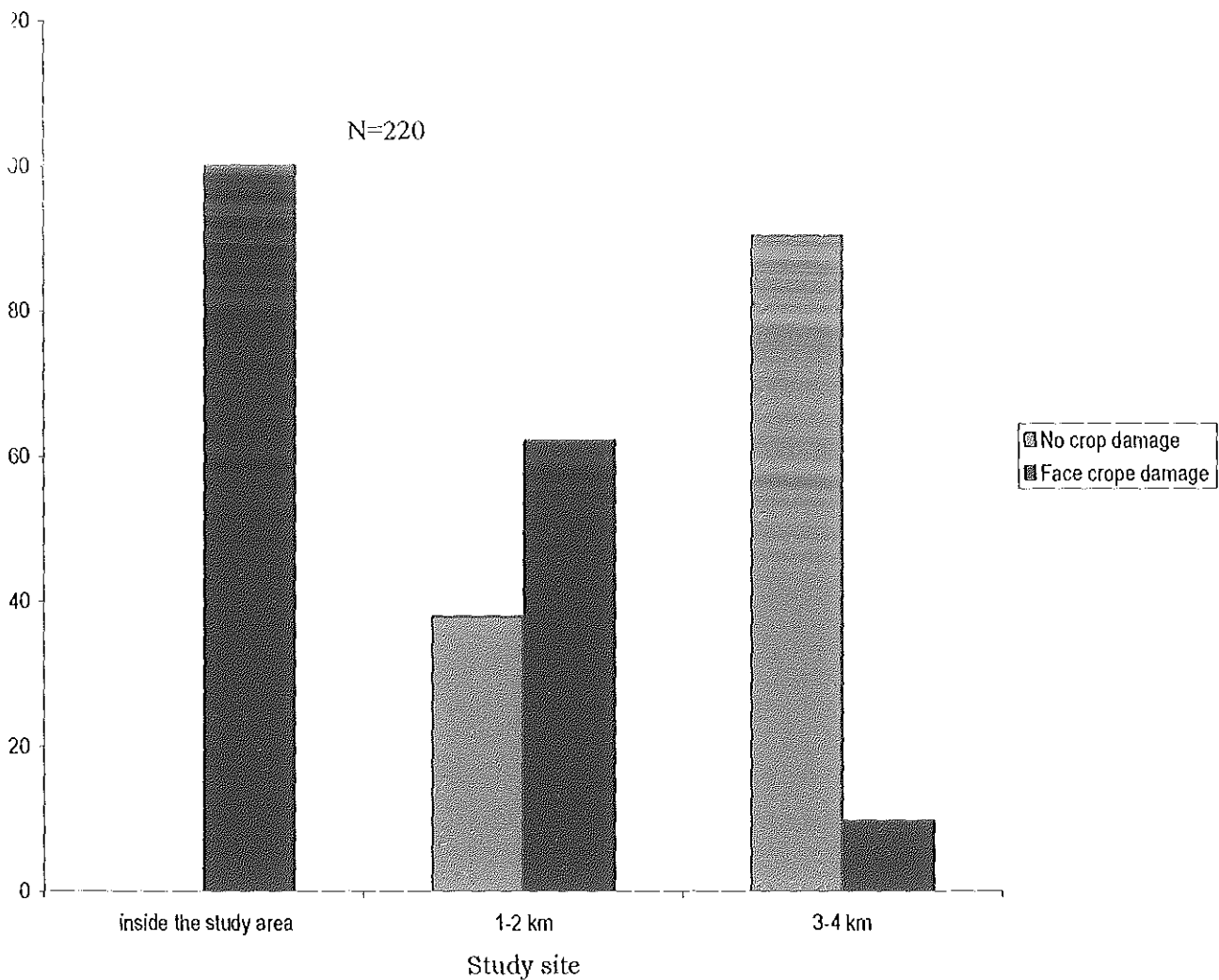


Figure 11. View of respondents on wildlife damage in relation to distance

Table 4. Wildlife induced damage on livestock in the last three years

Kinds of livestock lost	Villages			
	Loke Sifo	Senbete Lencho	Kela Lalima	Kite Tesisa
Goat	2	3	5	3
Cattle	-	-	-	-
Sheep	3	3	2	4
Donkey	-	-	2	1
Total	5	6	9	8

The local people made four species of animal were responsible for the level of crop damage (Table 5). Warthog ranked highest among this.

Table 5. Rank of crop raiding species found in the Sanctuary

Village	Rank 1	Rank 2	Rank 3
Loke Sifo	Warthog	Swayne's hartebeest	-
Senbete Lencho	Warthog	Swayne's hartebeest	-
Kela Lalima	Warthog	Vervet monkey	Swayne's hartebeest
Kite Tesisa	Warthog	Porcupine	Vervet monkey

4.4.2 Protective measures adopted

Respondents indicated that self-defence against crop damage by wild animals largely depended on scaring the animals and guarding. Local means mentioned to scare animals included chasing animals by banging on tins or drums, shouting and throwing objects, use of brightly coloured objects and a wide and deep trench as a barrier that wild animals cannot step over it. The technique has been used for millennia and is successful.

4.4.3 Human impact on the Sanctuary

Humans mainly put pressure on the Sanctuary by utilizing the grass for different purposes. Out of the 220 participants, 52.73% used the grass primarily for grazing, 22.27% for thatching house and 25% for sale. The Peasant Associations differed significantly ($\chi^2= 14.74$, $DF=6$, $P<0.05$) in their primary use of grass. Residents of Loke Sifo (32.26%) and Kite Tesisa (28%) used mainly for thatching huts. In contrast, respondents from Senbete Lencho (34.55%) and Kela Lalima (30.19%) used mainly for sale (Table 6).

Table 6. Usage of grass from the Sanctuary.

Villages	n	Grazing	House construction	For sale
Loke Sifo	62	54.84%	32.26%	12.90%
Senbete	55	56.36%	9.09%	34.55%
Lencho				
Kela Lalima	53	50.49%	18.87%	30.19%
Kite Tesisa	50	48%	28%	24%
Total	220	116	49	55

4.4.3.1 Human population

According to the household information on this study, the number of wives for a man ranged from 1-7. There was no statistical difference ($\chi^2= 8.013$, $DF=12$, $P>0.05$) in the number of wives for a man among the study sites. 15.5% had one wife, 47.7% had two wives, 25.9% had three, 7.7% had four and 3.2% had five or more than five wives (Appendix 4). A man with three wives is expected to have an average of 5-8 children per wife.

Population pressure in and around the Senkele Swayne's hartebeest Sanctuary has resulted in high environmental degradation and loss of habitat for the hartebeest. The 1999 data of human population in the SIRRARO Worda Agricultural Office from eight-Peasant Associations surrounding the Sanctuary was 16,834 (Table 7). The estimate of the six-Peasant Associations in the year 2004 (Table 8) showed 24,183. The number of people increased by 30.39% compared to the 1999 population estimation within five years.

Table 7. Human population around SSHS during (1999).

Farmers association	Number of male	Number of female	Total
Bitena Kubi	1138	1142	2280
Sifo	1215	965	2180
Shewako	910	1136	2046
Tesisa	846	1096	1942
Kela	864	158	1022
Kite	757	1588	2345
Lokekencha	1236	1224	2460
Lencho	1262	1297	2559
Total	8228	8606	16834

Source: SIRRARO Woreda Agricultural Office.

Table 8. Human population around SSHS during (2004).

Farmers association	Number of male	Number of female	Total
Loke Sifo	2721	2917	5638
Senbete Lencho	1960	2116	4076
Kite Tesisa	1914	2060	3974
Kela Lalima	1879	2050	3929
Shewako	1279	1327	2606
Bitena Kubi	2001	1959	3960
Total	11754	12429	24183

Source: SIRRARO Woreda Agricultural Office.

4.4.3.2 Livestock

Livestock is the most commonly observed animal in the Sanctuary. The number of livestock in the area during the present study was by far greater than what was estimated in the previous studies. The data obtained from SIRRARO Woreda Agricultural Office in the year 1999 showed that there were about 52263 livestock (Table 9). However, data obtained for the year 2004 (Table 10) showed 59821 livestock. The comparison of the two data showed that the number of livestock increased by 12.63% within 5 years. Out of the 220 households interviewed, 6131 heads of livestock were identified. On average, highest number (28940) was recorded from August to October and these months were the time conflict was more sever in the Sanctuary, while the lowest (3200) was observed from November 2005 to January 2006.

Table 9. Number of livestock among the peasant associations surrounding the Senkele Sanctuary.

Farmers Association	Cattle	Horse	Mule	Donkey	Sheep	Goat
Bitena kubi	3992	78	15	400	942	1012
Sifo	4565	72	12	356	1544	844
Shewako	4633	42	14	280	1256	604
Tesisa	3212	70	9	350	839	1523
Kela	4774	81	10	408	1222	1031
Kite	4892	41	8	286	1103	792
Loke kenchu	2781	79	11	360	998	655
Lencho	3885	91	6	405	1122	558
Total	32734	554	85	2845	9026	7019

Source: SIRRARO Woreda Agricultural Office, 1999

Table 10. Number of livestock among the peasant association surrounding the Senkele Sanctuary.

Farmers Associations	Cattle	Horse	Mule	Donkey	Sheep	Goat
Bitena kubi	4976	54	9	714	812	1311
Loke sifo	6276	64	11	627	2115	2192
Shewako	6587	46	10	579	1720	1114
Kite tesisa	7721	59	26	847	1915	2184
Kela lalima	5877	21	16	504	1240	1579
Senbete lencho	6332	76	4	312	919	972
Total	37769	320	76	3583	8721	9352

Source: SIRRARO Woreda Agricultural Office, 2004

4.4.3.3 Settlement

Household census in and around the immediate border of the Sanctuary showed 229 huts. Most huts were constructed at the time of unstable political condition in the country. Among the huts, 112 were the newly built during the time of 2005 election period. There were 1767 huts on the periphery of the Sanctuary (Plate 3).



Plate 3. Settlement on the immediate border of the Sanctuary.

Among the respondents, 60% supported the construction of new huts in and around the Sanctuary (Table 11). However, there was a significant difference between villages ($\chi^2 = 9.18$, DF=3, $P < 0.05$) in supporting the construction of new huts in and around the Sanctuary.

Table 11. Views of respondents to the construction of new huts in and around the Sanctuary.

Villages	support construction of huts (%)	oppose construction of huts (%)
Loke Sifo	46.77	53.23
Senbete Lencho	41.82	58.18
Kela Lalima	79.24	20.76
Kitę Tesisa	76	24

Most respondents from Kela Lalima (79.24%) and Kite Tesisa (76%) supported the construction of new huts. However, respondents from Senbete Lencho (58.18%) and Loke Sifo (53.23%) opposed construction of new huts in and around the Sanctuary.

4.4.3.4 Habitat destruction and disturbance

The major components of habitat destruction and disturbance in the study area were settlement in and around the Sanctuary, overstocking livestock, frequent fire and bush encroachment, tree cutting for fuel, sale and construction of huts. Tree cutting was mainly associated with new settlement, which resulted deterioration of the remaining vegetation cover of the area. This minimizes the feeding ground, nesting and mating site of the wild animals. As a result, the vegetation structure has changed dramatically, grass cover has declined and the density of woody shrubs has increased alarmingly (Plate.4).



Plate 4. *Acacia* dominated bushland vegetation on the Eastern side of the Sanctuary.

High seed production, persistent seed banks, livestock-favored dispersal mechanisms, and high capacity of sprouting after fire characterized encroaching woody species. The resulting displacement of herbaceous vegetation by woody plants in the Sanctuary has the potential threat for the survival of the existing wild animals.

Disturbance through the habitat and constant passage of local people on horse back and on foot by uttering and shouting along the length and width of the Sanctuary have become a common activity. Every afternoon large number of donkeys laden with wood can be seen on the tracks leaving the Sanctuary. This constant passage has a greater effect on the behavior and survival of the animal.

4.5. Perception of local communities towards protected area staff members

There was no significant difference ($\chi^2= 1.7$, $DF=6$, $P> 0.05$) between studied villages in their relation with the Sanctuary staffs. Among respondents, 57.27% did not have good relationship or had conflict with the Sanctuary staff. However, 15.91% of the respondents had smooth relationship with the park staff members and 26.82% had neutral relationships (Fig. 12).

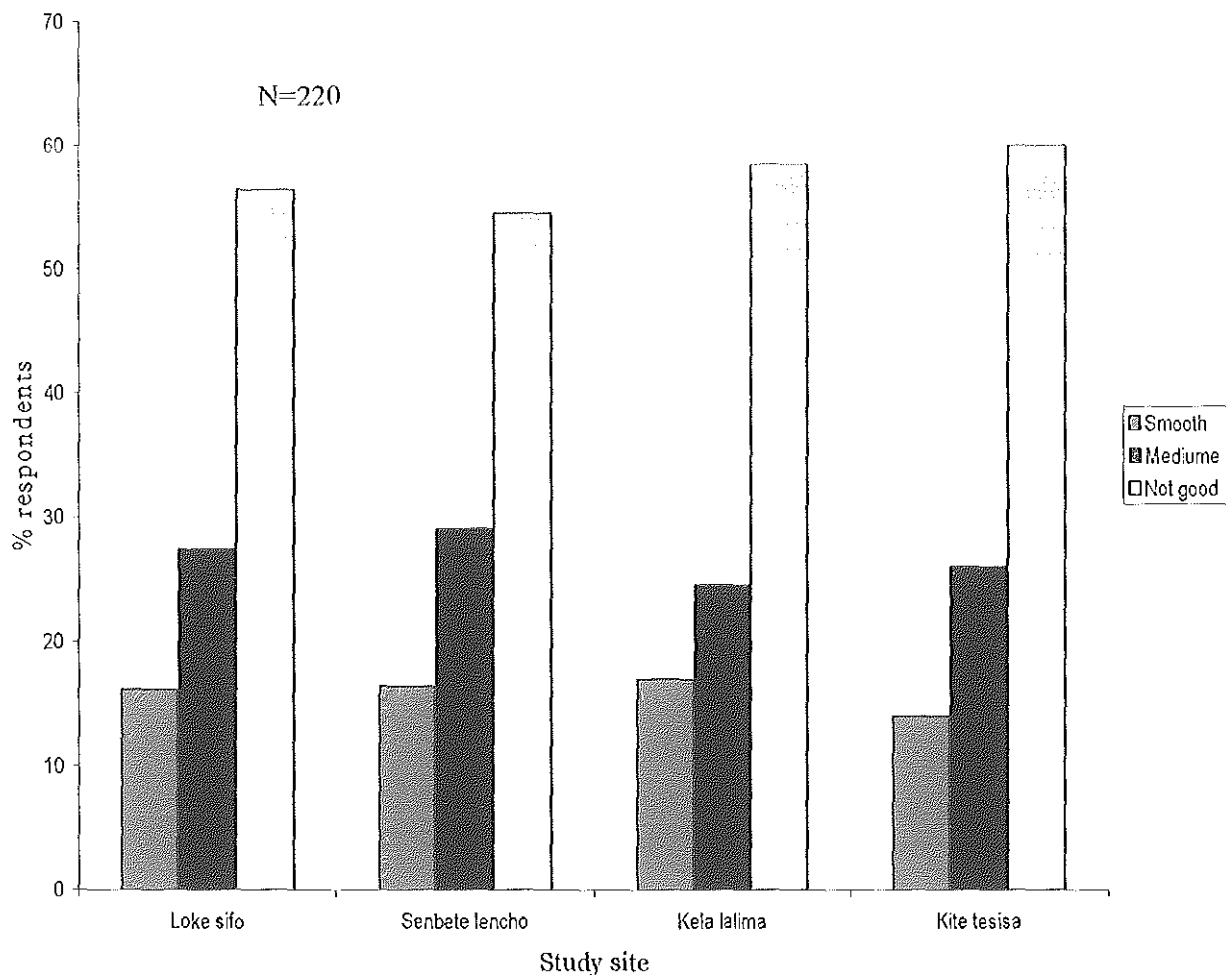


Figure 12. Relation of the respondents with Sanctuary staff.

The gap between the Sanctuary authority and local people was because of opposing views on protected area. Local communities often perceived wildlife as a liability, as a cause of poverty, means of restricting livestock grazing and demand the land for settlement and farming. Moreover, the need to use the resource freely without any limitation widened the gap. Summary of opposing views between the local people and staff of the Sanctuary is given in Table 12.

Table 12. Opposing views of local community and Sanctuary staff.

Issue of contradiction	Conservationists	Local community
Boundary of the Sanctuary	<ul style="list-style-type: none"> -No expansion of the Sanctuary boundary -Initially the area of Borena and Lalima belonged to the Sanctuary -Fencing the Sanctuary 	<ul style="list-style-type: none"> -Staff expanding the Sanctuary area -Initially the area of Borena and Lalima belonged to the Peasant Association -Fencing of the Sanctuary is a means to restrict access to the resource
Ways of using Sanctuary resources	<ul style="list-style-type: none"> -Use of the grass without disturbing the management system (cut and carry system) -No part of the Sanctuary will be allotted for permanent use 	<ul style="list-style-type: none"> - High number of cattle, cut and carry system is not convenient -Some areas of the Sanctuary should be allotted only for community use
Resettlement program	<ul style="list-style-type: none"> - The majority of the people have alternative land -Resettlement only for those who have encroached the Sanctuary during politically unstable period 	<ul style="list-style-type: none"> - The majority of re-settlers in and around the Sanctuary are landless -The resettlement program is a means of dislocation

4.6. Population estimation of Swayne's hartebeest

Table 13 shows the count of Swayne's hartebeest observed in various study blocks during the present investigation. The highest number of Swayne's hartebeest recorded was 351 during the dry season and the lowest 283.5 during the wet season.

Table 13. Swayne's hartebeest counted in the study area during wet and dry season

Season	Number recorded in each study block						Total
	Block1	Block2	Block3	Block4	Block5	Fallow land	
Wet	117	53	9	3	10.5	91	283.5
Dry	153	44	31	55	68	0	351
Mean±	135	48.5	20	29	39	45.5	317
SE	±31.21	±15.41	±7.61	±15.29	±17.29	±45.5	±19.72

There were significant differences in the mean number of Swayne's hartebeest observed during the wet and dry seasons in the different study blocks (Fig. 13). The highest record was obtained during the wet season in block 1, where 117 Swayne's hartebeests were counted and the lowest mean was 3 in block 4. During the dry season, the highest mean was 153 in block 1 and the lowest 31 in block 3. In the previous State Farm (fallow land), the highest recorded was 91 during the wet season and none during the dry season.

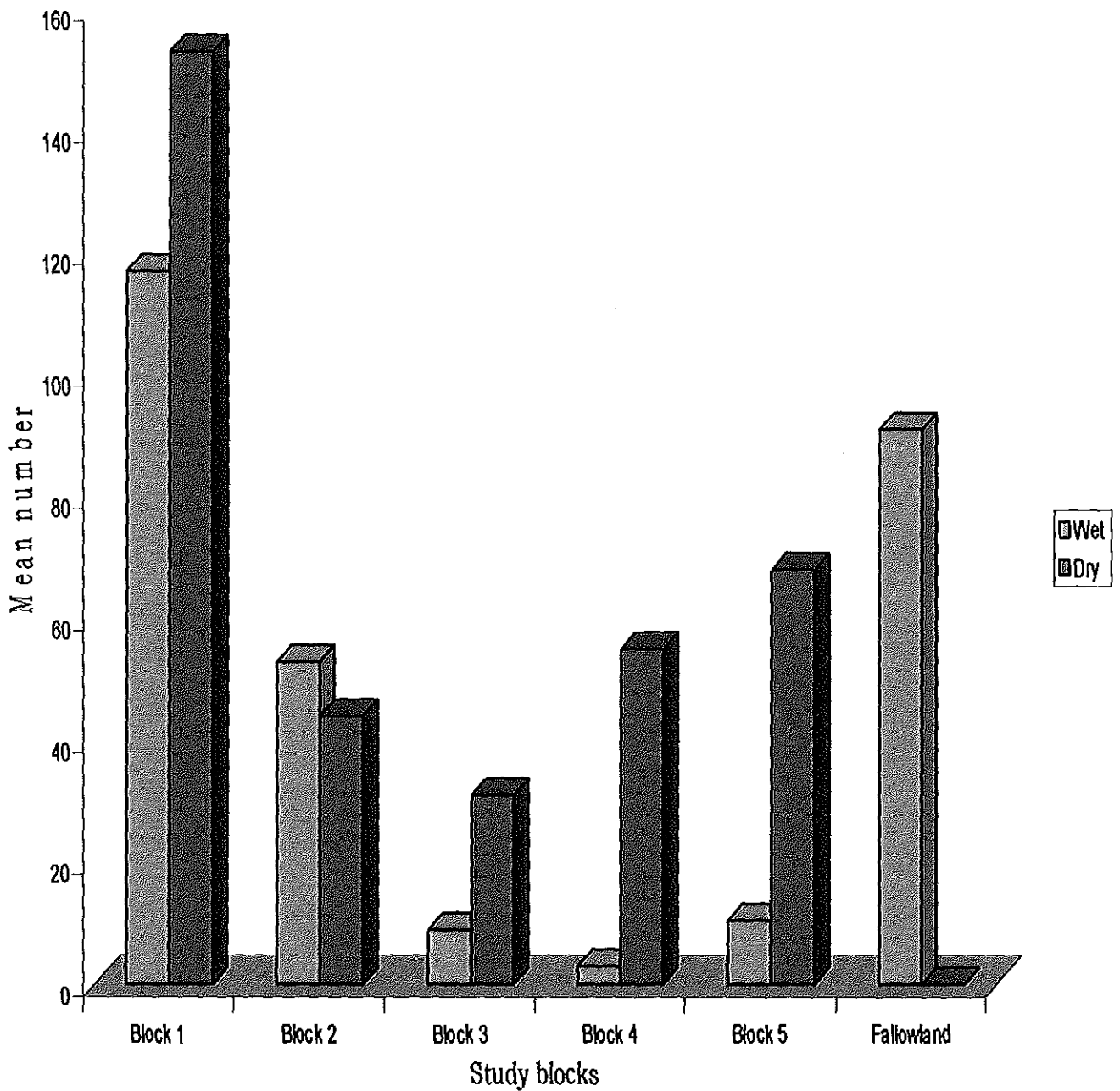


Figure 13. Mean number of Swayne's hartebeest recorded during wet and dry seasons.

The data on population count among blocks 1, 3, 4, 5 and fallowland showed significant differences ($p < 0.05$). There were more Swayne's during the dry season in blocks, 1, 3, 4, and 5 and this shifted to the fallowland during the wet season.

However, block 2 population record did not show significant difference between wet and dry seasons. The total population count showed statistical significance ($p < 0.05$) between wet and dry seasons. More number of Swayne's hartebeest was recorded during the dry season than the wet season.

The cumulative mean of Swayne's hartebeest observed during the wet and dry seasons was 317. Block 1 constituted 42.59% of the total observed individuals among the whole study area. Out side the study area (in the fallowland), 14.35% was recorded during the wet season.

4.7. Population trend

The population trend in the past showed irregularity based on the conservation effort made during each period. A rapid increase from 660 in 1977 to 3500 animals in 1990 was observed with an increase of 6.24% per year. During the present study, only 317 individuals were observed (Fig. 14). Since 1990, the overall population decline was 90.94%. The population crush in 1991 was due to the political unrest in the country.

4.8. Age and sex structure

Out of the 317 individuals sighted during the present observation period, adult females comprised 29.23%, adult males comprised 24.59%, sub-adults females, and male comprised 13.47% and 11.43%, respectively and the young comprised 21.28% of the total population (Fig. 15). The age and sex structure varied seasonally. Seasonal variation of young was seasonally is statistically significant while all other age groups were insignificant ($p > 0.05$). The difference in the young was a result of calving by large number of adult females during the dry season.

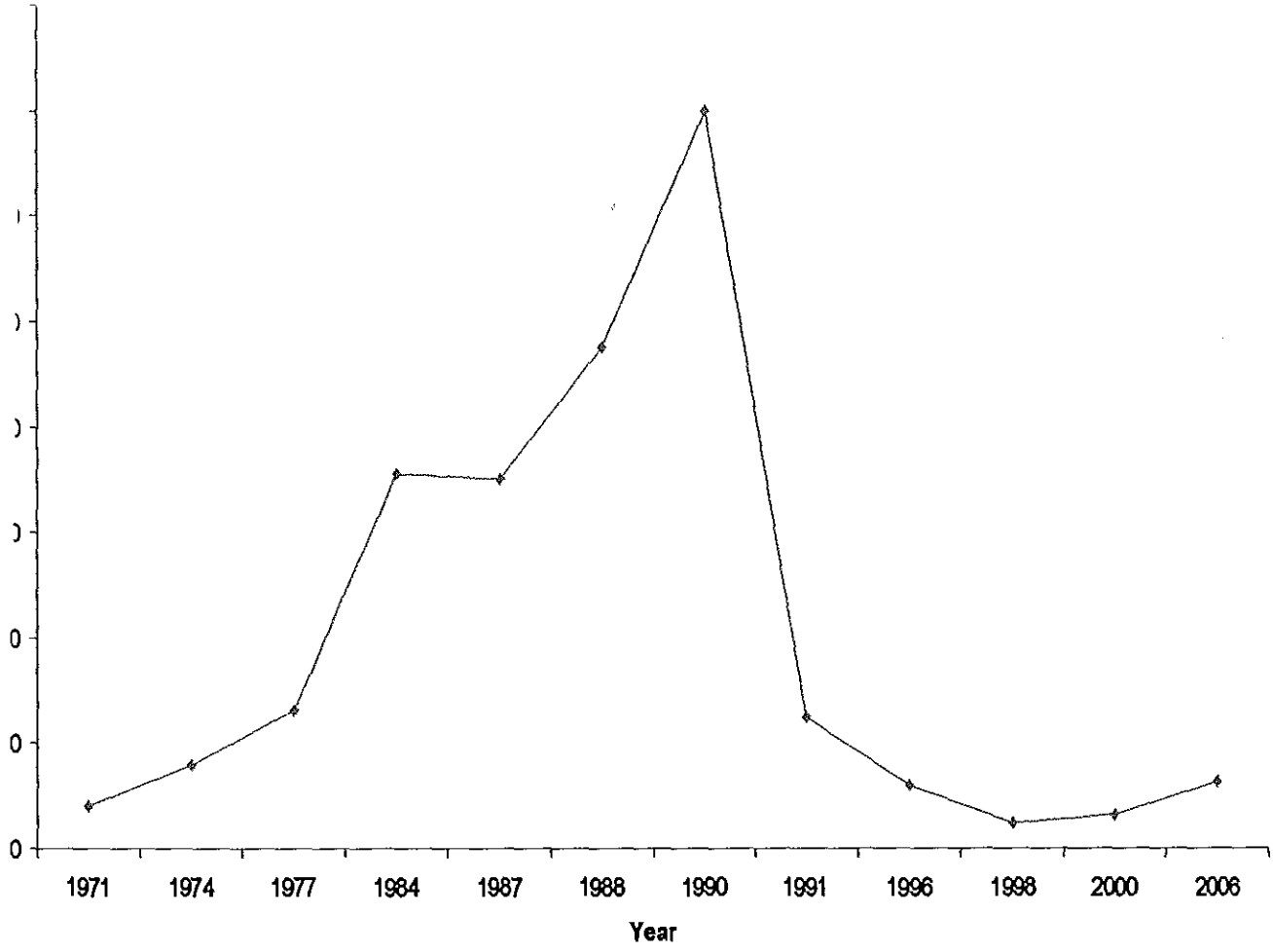


Figure 14. Population trends of Swayne's hartebeest between 1971 and 2006.

Comparison of total number of males (adults and sub-adults) and female (adults and sub-adults) for wet and dry seasons separately showed a significant difference ($p < 0.05$) where females were larger in number than males during in both seasons.

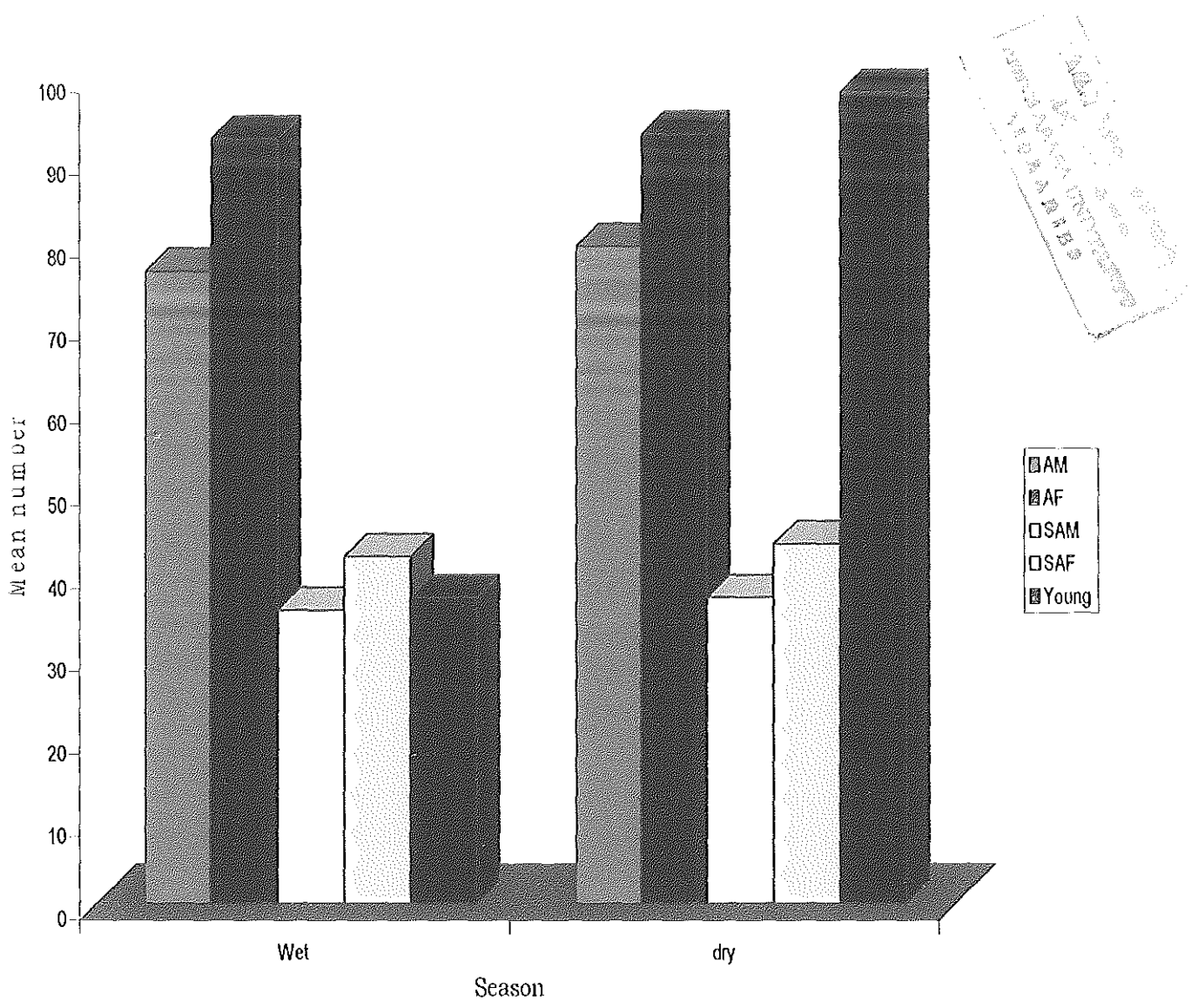


Figure 15. Mean number of different age and sex categories of Swayne's hartebeest observed during wet and dry seasons.

4.3.1 Sex and age ratio

The sex and age ratio of Swayne's hartebeest is given in Table 14. The sex ratio of male to female during both the wet and dry seasons was 1.00:1.20. The adult male to female sex ratio was 1.00:1.21 during both wet and dry seasons. There was no

significant difference ($p > 0.05$) between males and females at different seasons.

The age ratio of sub-adult male to adult male during both wet and dry seasons was 1.00: 2.15. The age ratio of sub-adult female to adult female during both wet and dry season was 1.00:2.20. Comparison of age ratios of adult-males and sub-adult males and adult-females and sub-adult females similar number was obtained during both seasons. As a result, age ratios of males and females between wet and dry season was not significant ($p > 0.05$).

Table 14. Sex and age ratio of Swayne's hartebeest during wet and dry seasons

Season	<u>Sex and age ratio</u>				
	AM:AF	SAM:SAF	M:F	SAM:AM	SAF:AF
Wet	1.00:1.2	1.00:1.18	1.00:1.2	1.00:2.15	1.00:2.2
Dry	1.00:1.2	1.00:1.17	1.00:1.17	1.00:2.15	1.00:2.3

4.8.2 Comparison of age and sex structure

Comparison of age and sex structure of Swayne's hartebeest during the 2000 survey and the present survey are given in Table 15. The age structure of the present population shows some differences compared with the 2000 findings. More young and adult males were recorded during the present survey compared to the earlier survey. However, fewer sub-adult males and females were recorded during the present study.

Table 15. Comparison of age and sex structure of Swayne's hartebeest.

Year	<u>Age and sex category</u>					
	AM	AF	SAM	SAF	Young	Total
2000 Mean	30.50	45.50	19.50	37.00	25.50	158.00
%	19.30	28.80	12.30	23.40	16.10	99.90
2006 Mean	78.0	92.75	36.25	42.75	67.50	317.25
%	24.59	29.23	11.43	13.47	21.28	100.00

4.9. Distribution and habitat association

The Swayne's hartebeest was distributed into four vegetation communities (Table 16). They were commonly observed in pennisetum grassland (PG) and in the fallowland during wet season. However, during the dry season, their distribution was extended to pennisetum grassland type 2 (P₂) and Mixed grassland (MG). Seasonal distribution of them was statistically insignificant ($p > 0.05$) in pennisetum grassland (PG) while in all other habitat their distribution was significant between wet and dry seasons.

Table 16. Observation of Swayne's hartebeest in different habitat types during wet and dry season.

Season	<u>Vegetation community</u>			
	Pennisetum grassland (PG)	Pennisetum grassland type 2 (P ₂)	Mixed grassland	Fallowland
Wet	169	14	9	91
Dry	178	147	26	-
%	54.73	25.39	5.52	14.35

5. Discussion

5.1 Questionnaire

The nature of the study required information from the most responsible members of each household. Therefore, the samples consisted adult age class (≥ 31) accounting 89.1% of the total respondents. Such age class was important in identifying the detailed information of human-wildlife conflict in the area.

The people around Senkele had a polygamy style of marriage. This is likely to increase the population size in the area. A questionnaire survey identified men who have 32 children from seven wives. Most respondents (68.18%) have a family size of 11 and above. Such large family size with small landholdings will increase the demand for more resources. As a result, communities have been imposing maximum pressure on the wildlife resources in their area.

The local people were agro-pastoralists and pastoralists and their household economy depended exclusively on agricultural and livestock production. All the respondents depended on land to generate income making the competition with wildlife more direct and intense. Majority of respondents had a landholding less than 0.5 hectare, only 30.45% have land size greater than 0.5 hectare and produce maize and potato as a staple crop. Separate plot was not allocated for livestock grazing. All members of the Peasant Associations consider SSHS as their communal pasture area.

According to the respondents, the productivity of the land for the majority of farmers is less than sufficient and has no guaranteed source of income to supplement their livelihood.

Besides, such lower income groups around the Sanctuary do not get any incentive from Sanctuary. In the absence of alternative sources of income, the local people are more likely to resist rules and regulations, and continue to encroach the wildlife habitat.

Based on the questionnaire survey, all pastoralists and agropastoralists migrated to the Sanctuary between 1991- 2005 to get alternative land for settlement, crop production and grazing. Such continued movement of locals into the Sanctuary has led to the deterioration of the wildlife habitat making the Sanctuary unsafe place for the normal activity of wildlife.

Information obtained from the staff of the Sanctuary and locals showed that hunting was not a problem for the last three years. However, on several occasions, men armed with rifle were observed moving into the Sanctuary and rifles shot were heard around Borena and Lalima hills. This shows that the problem still exists.

5.2 Attitude of the local people

Most respondents, 86.4% considered existence of the Sanctuary had a negative impact on their livelihood. Lack of free access, grazing, fear of displacement from the area and limited landholding were the major causes. However, few (9.5%) of the respondents expressed a positive attitude to conservation and indicated the existence of the Sanctuary will serve as a means of generating income and services. They suggested that the Sanctuary has to be free from human intervention. A study on five protected areas in Tanzania similarly found that the attitudes of local people were influenced by the services and benefits they personally receive from the protected area

(Newmark et al., 1994). People will only seek to manage natural resources when they realize that the benefits exceed costs (Murphree, 1991). At the same time, development in terms of meeting the need of the local people is a vital component of conservation. In addition to lack of benefits, low level of awareness on the importance of wildlife makes the problem more severe in the area. Understanding the value of wildlife was a common problem in all the studied villages. One respondent said, "the government does not tell us what are the benefits of wildlife or the benefits obtained from looking after it". Such low level of awareness considered wildlife management to the disadvantage of the villagers. They viewed the government, foreign tourists and staff of the Sanctuary as the sole beneficiaries of wildlife harbored in their locality.

Most respondents did not know the prime objectives of the Sanctuary. Only 16.82% knew the need to conserve endemic species and its habitat. Lack of awareness on the objective of the Sanctuary may be one of the reasons for the hostile attitude of the local communities towards conservation of wildlife.

Women showed less positive attitude and more neutral "do not know" response than men towards wildlife conservation. This may be due to the low awareness of wildlife conservation among women than men. Moreover, the young generation age class (16-30) showed more significantly positive attitude for conservation than older age groups. These may be due to adoption of life styles and practices that are incompatible with the traditional conservation systems of wildlife by younger generations. They have awareness and education about the usefulness of protected area from different sources to make them interested to see wildlife in their nearby area.

Education is an important factor in understanding the role of protected areas and conservation in general. The educated respondents strongly supported protected areas. However, most respondents had no formal education or are illiterate (Fig. 10). Conservation may be quite difficult in the future in areas like Senkele with poor education. The findings showed that most of the local people are antagonistic to wildlife conservation as a result of low level of education and high family size. Support for conservation was positively correlated with the level of education attainment of the respondents. Heinen (1993) observed a similar situation in a study of people's attitudes towards the wildlife in Kosi Tappu Wildlife Reserve in Nepal. The study revealed that those respondents with higher household literacy rates had positive attitude about wildlife in the reserve. Hence, education is considered an initial step in improving the people's attitude towards conservation.

5.3. Resource conflict

5.3.1 Crop and livestock loss

Community perspectives towards the conservation area stem from a variety of contributing factors including loss of access to resources and benefits generated from conservation area, awareness concerning the importance of wildlife and crop depredation by wild animals (Kiss, 1990). Crop damage by wild animals is the other source of human-wildlife conflict in Senkele area. Such damage influences staple food grain (maize) and non-grain food crop (potato) that are planted for subsistence. Damage results not only from the animals feeding on crop, but also from trampling, footing and other forms of wastage. The animals involved in crop raiding varied (Table 5), but the most commonly cited pest was warthog. It was found that the pattern

of crop loss varied between villages as a result of the different movement patterns displayed by different species of the Sanctuary. Villages, Kela Lalima and Kite Tesisa reported more crop damage (Table 6) than the other two selected villages. Respondents blame Vervet monkey and Porcupine for such loss besides Swayne's hartebeest and Warthog. In addition, they relate their loss with the increasing trend of wildlife number in their respective area. However, the main probable reason for the loss of crops in such area may be due to the presence of farming land in and close to the border of the Sanctuary. The questionnaire survey also showed farmers residing up to 2 km were mainly attacked by wildlife crop damage. 97.7% of crop damage occurred within 0-2 km radius from the Sanctuary. Only 2.3% damage was reported within 3 km and above. Other studies also showed that those people closest to protected area boundaries faced more crop damage than far distance people's from the protected area (Naughton-Treves, 1996).

The conflict type was season dependent and commonly occurred in the crop-growing season when the wildlife disperses from the protected area into the neighboring community land. The cropping cycle follows the rainfall pattern of the area. The main cropping season commence late February/early March and end in August. This is followed by the second planting season of potato in early September to be harvested in November. During the present study, variability in the timing and amount of short rain in the area was witnessed.

Swayne's hartebeests damage crop (maize) only at their young stage. However, other wild animals continue to damage until the crop is harvested. Different studies show that ungulates have a positive selection of plant species and eat plant parts with the highest protein value (Field, 1976). This holds true in the case

of Swayne's hartebeest since they eat maize only at its young stage. According to the respondents, the hartebeests even started to eat the leaves of potato which the animals would not like to take it before. These may be due to the shortage of food from its normal habitat leading to consume potato leaves to fulfill the nutritional requirements.

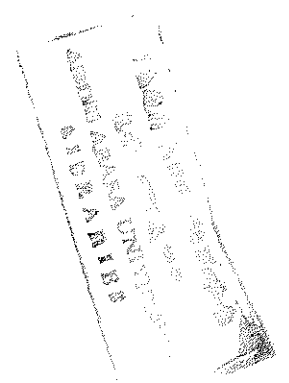
Loss of livestock by wild animals was not reported as a problem in the area. These may be due to the absence or low number carnivores in the Sanctuary that attack livestock. The decline and loss of the different carnivores on the Sanctuary may be due to the subsequent settlement and land use, habitat loss and fragmentation, and human and livestock pressure. The only carnivore that is commonly seen in the Sanctuary is the Common jackal. It is a threat more to calves of Swayne's hartebeest than livestock.

5.3.2 Human and livestock impact

Human-wildlife conflict in Senkele Swayne's hartebeest Sanctuary is longstanding issue. The increased number of human population resulted in a severe competition with the wildlife resources of the conservation area. The Sanctuary is fully affected by human impact throughout the year. Such intense pressure will curtail the normal activities of the animals.

The Senkele Sanctuary besides acting as a conservation area, it serves as a buffer between the warring Sidama and Arsi people, who both have traditional claims over the area, thus diffusing the tension between the two communities. The wildlife in the Sanctuary was practically resided on the Arsi side. The Sidama people were not observed nearby. As a result, the Sanctuary was under full pressure from the Arsi oromo.

Conflict with wildlife crop damage was not a widespread source of complaint. The main cause of conflict between the local community and the Senkele Sanctuary staff was the demand to use grass from the Sanctuary excessively. The demand of the local people on the Sanctuary grass is a function of many factors. This can be shown: Increased demand for use of Sanctuary grass=f (P+A+L+F+l). Where P=population growth, A=lack of awareness, L=enormous livestock number, F= lack of alternative animal forage, l=low-income source. Such factor sums up and makes the conflict in the Sanctuary even worse.



Majority respondents from all selected study sites believe that the size of the Sanctuary is too big. It is the main interest of the participants to have part of the Sanctuary for their own use. They think that, a small area is enough for the survival of the present Swayne's hartebeest population. Unless a radical change is carried out to change the human attitude, there is a real danger of devastation of the wildlife in the area. The high number of human and livestock will continue to have a negative impact on the Sanctuary.

The absence of a proper fence also makes people and livestock easily to move through the Sanctuary (Plate 5) in all direction without any limit. The barbed wire that was used to fence the Sanctuary as observed in the present study were on the ground. This may be intentionally carried out by the local people for easy access to the Sanctuary. The wire exposes the hartebeests to injury on its leg and skin when the animals try to move to the fallowland. Some hartebeests were observed suffering from a wounded leg in the present study most probably due to the effect of such wire. Simple observation showed that the vision of

Swayne's hartebeest is not good to detect the wire from distance.



Plate 5. Livestock grazing in the Sanctuary.

Direct and indirect information showed that locals do not want to see fence in the Sanctuary. Most respondents (90.45%) believe that the livestock and wildlife could live together in sharing the existing resources. This shows that they were not aware of the impact of livestock and human pressure on the Sanctuary.

The Senkele Sanctuary provides a wet season refugia for the livestock of the adjacent communities. Most of the livestock that

graze in the Sanctuary area are the property of people from six Peasant Associations (Table 9). In some cases, livestock from more distant peasant associations also visit and stay in the Sanctuary as a temporary settlement place to minimize long journeys from the homestead on a daily basis. This results in overgrazing due to the large number of livestock during the wet season. Overgrazing was probably the cause for the invasion of the *Pennisetum schimperi* (wire grass) in the Sanctuary that is tough and unpalatable. Since livestock consume the palatable species, the unpalatable grass species spread out and cover large areas. This has been witnessed during the present study.

In the present study, hartebeests could be observed very close to cattle to graze the available forage. Such close proximity was to compete with cattle for the limited palatable species. In addition, the area is highly infested by ticks. This may be due to the presence of large number of livestock in the Sanctuary, exposing the hartebeests for tick-borne diseases.

As wet season progresses, there was a sharp decline in the density of livestock in the Sanctuary. This was due to alternative feed of crop residue and grazing of fallowland by cattle. Hartebeests have also been observed to increasingly make use of the fallowland during wet season. This may be due to the low quality of forage available in the Sanctuary that was not able to satisfy the nutritional requirements of the animals.

As a means to reconcile the interest of conservationists and local people, a system of zoning was proposed (Messana and Bereket Netsereab, 1994) (Fig. 1). However, this was not possible due to the intricate problems. When this was proposed both livestock and human population number was low. However, compared to the year 2004 data there was an increase

in livestock number by 58.43% and human by 50.78%. In addition, illegal settlers already occupied what was proposed as a buffer zone and there was a decline in the vegetation quality and the reduction in the size of the Sanctuary at present. In this regard, it is suggested that a consultative Sanctuary planning exercise should be initiated to re-visit Messana and Bereket Netsereab (1994) management plan.

5.3.3 Settlement and habitat disturbance

Protected areas are a cornerstone of conservation policy (Wynne, 1998). However, such areas are continually under threat from growing human population in the tropical developing countries. This is particularly the case in the Senkele area, where growing population has developed as a threat protected areas directly by encroachment of wildlife area. A major bottleneck is the overstocking rate of livestock and human settlement leading to habitat loss through forest clearing for household consumption, sale, and for agriculture.

The hostile attitude of the local communities towards the Sanctuary was due to the restrictions placed in access to the resources of the Sanctuary and limitation to settle within and around the Sanctuary. Most the people who settled in and around the Sanctuary have permanent settlement elsewhere. Uncontrolled settlement and illegal migrants led to the loss of important habitats for wildlife and a reduction of land available for wild animals. Most respondents, 60% supported the ongoing construction of new huts in and around the Sanctuary. Respondents mainly from Kela Lalime and Kite Tesisa support the construction of new huts in and around the Sanctuary. Most of the respondents from this village were dislocated previously from the Sanctuary. Nevertheless, most respondents

from Senbete Lencho and Loke Sifo oppose the construction of such new huts due to the fear of competition on the existing resource of the Sanctuary.

The local people besides imposing pressure on the Sanctuary, disturb the vegetation of the Sanctuary through uncontrolled fire. In the present study, the grassland within the Sanctuary was burnt between December and February. The fire was ignited by the pastoral community (Plate 6). Fire is set in the area year after year. Other studies also show that herders set fire to grassland to maintain it for grazing. However, the frequency of fire resulted in the deterioration of the quality of habitat and eliminates many native species of plants that could not adapt (Allan and Warren, 1993). This is observed in the Senkele Sanctuary. Fire is set by the pastoral community in Senkele to improve the forage resource available in the Sanctuary for their livestock population. However, the hartebeest also benefited from the fire as evidenced by the dramatic shift in habitat utilization from the unburned area to the freshly burnt area to get from off shoots. The problem was that fire was set without any firebreak and at night when most wild animals were inactive in the Sanctuary. This shows loose law enforcement, poor management system and lack of devotion and commitment of the staff of the Sanctuary.



Plate 6. Fire set by pastoralists in the Sanctuary.

5.4. Population estimation of Swayne's hartebeest

Direct total counting method was applied in the population census of Swayne's hartebeest. This method was the most appropriate in view of the small size of the study area resulting in a reasonable degree of accuracy. A significant difference was observed between the counting of dry and wet seasons. The difference was due to the peak birth of the animals during the dry season. About 80% of the conceptions occurred between May to June just after the weaning of calves of the previous season, with a peak of 50% of conceptions during the month of May. This information was confirmed by data on the frequency of estrous females and the rate of copulation (Messana, 1993).

Some counting blocks had higher number of individuals than others. The variation in counting blocks was due to habitat quality, influence of human activities and livestock distribution (Fig. 20). Habitat quality is associated with the palatability of the plant, height of the grass and bush encroachment. The height of the grass hinders the view to watch their enemy or any intruder. This probably was one of the reasons for the hartebeest to leave the Sanctuary and preferred to stay in the fallowland during late wet season. During both seasons, hartebeests mostly concentrated in block one. This may be due to the closeness of block 1 to the headquarter makes it relatively less exposed to human pressure and has a better source of feed than other blocks.

The variation observed in the group size and distribution during the wet and dry seasons was due to the changes of feed source. Data on habitat association of Swayne's hartebeest revealed that they prefer open areas (*pennisetum* grassland and fallow land) during wet season. The *pennisetum* grassland type 2 was utilized more in the dry season. The reason for this may be most of this vegetation community is found in the shrubby and woody cover which probably help the grass not to be dry and thus be more palatable. The hartebeest utilized the MG vegetation community only a little extent since this vegetation type found near the human settlements and covers only small area that is accessible to the hartebeest. The group size aggregated more during the wet season than the dry season. The growth of grasses immediately following the rainfall is known to attract and provide more food during the wet season. During the dry season, the hartebeests split up into smaller units and are distributed widely in all blocks in search of food.

Adult male Swayne's hartebeests tend to look heavier, possess darker body color and thicker horn than adult females. It was difficult to determine the sex of young individuals compared to the adults. However, variation in horn shape and thickness is easily observed. Males have thick horn inclined to the back at the tip and females have thin horns, which forms close brackets. This diverges widely from the pedicle in the case of adult females. Besides, the primary sexual characteristics such as the presence of penis sheath and scrotum in males made the identification easier. The young have straight spike horn, which is smaller.

In the present study, the overall male to female sex ratio showed more females (1.00:1.2) than males. A similar study made by Messana (1993) and Birhanu Gebre (2000) on the Swayne's hartebeest at Senkele showed 1:1 and 1.00:1.5, respectively. Possible reason for unequal postnatal sex ratio as discussed by Bergerude (1974) and Estes (1974) was an increased predation pressure on males due to its greater boldness and the emigration of subordinate males to less favorable habitats. This probably applies to the Swayne's hartebeest in SSSHS. Especially at the time of rut, those males which are unable to establish a territory are forced out into the less favorable peripheral areas near human habitation and become more susceptible to human and other predation.

A relatively high proportion of females in the population shows that the animals have a potential to increase in number. However, low Proportion of sub-adults to others in the present investigation shows a problem of long-term survival of the young to the end of their first year in the area. Probably this was due to the high number of predators such as common jackal and spotted hyena in the Sanctuary. Common jackals were

repeatedly observed following the footsteps of Swayne's hartebeest and the local people also blame these predators for the rare goat loss in the area.

The records on the hartebeest population carried out by different researchers at Senkele showed variation in the population of hartebeests in its respective time, in 1971 (Stephenson, 1975), 1974 (Lewis, 1982), 1977 (Lewis and Wilson, 1979), 1984 and 1987 (Fekadu Kassaye and Messana, 1994), 1990 (Pers.comm), 1991 (Fassil Tekle,1996), 1998 (Nishizaki,2004) and 2000 (Birhanu Gebre, 2000).

The population although increased until 1990 showed a drastic negative change in 1991. After the 1991 large-scale slaughter of hartebeests, the trend of population has been reduced dramatically and reached its ever minimum 123 in 1998. During the present study, 317 individuals were counted which showed 49.21% population growth from the year 2000. Since the subspecies is the only viable and existing population in the world this number is still very low. According to the theory of island biogeography, small populations inhabiting small and fragmented habitats are highly vulnerable to extinction due to various ecological and genetic factors. Conservation and ecological geneticists argue that a minimum of 500 (some say 250, Mackinnon et al., 1986) animals is required to conserve a given species for a long term, whereas as effective population size of 50 individuals are needed for a short term conservation planning. Taking this into consideration, endemic subspecies such as the Swayne's hartebeest need priority attention for conservation.

Swayne's hartebeests passed through two black spots in their history that resulted in large scale decrease within a short

period. The first was the occurrence of African rinderpest pandemic that reduced drastically this world heritage. It was only restricted in distribution to few areas of Ethiopia with few numbers. The second was the human destruction in Senkele during unstable political period of the country in May 1991. This was drastic and reduced the population. At present, the hartebeests still face a number of problems even if there is some sign of recovery. If proper conservation measures are taken, the population number can increase further. However, if we let to continue on the current degradation processes like habitat loss to expand agriculture, overgrazing due to overstocking of livestock, increased number of settlement in and around the Sanctuary and high rate of bush encroachment, the current increase in number could not be obtained. Otherwise, the third black spot may lead to the total extinction of the subspecies from Senkele.

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

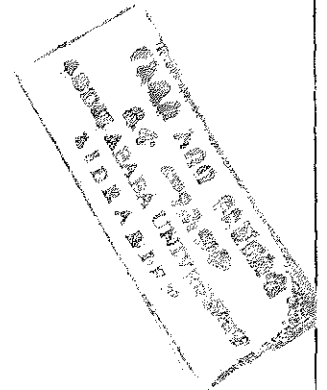
The present population of Swayne's hartebeest consists 317 ±19.72 individuals. This shows an increase compared to the population in 2000. Relatively, high number of breeding females and more young in a population shows that if better care and conservation measures are taken, the population number could build up. However, if the existing problems in the area continue the population would further depleted. At present, the major threats of the Senkele Swayne's hartebeest is overstocking of livestock, illegal settlers, habitat loss and fragmentation, poor range management technique, negative attitude of the local people and increase in human population.

Majority of the respondents oppose wildlife conservation in the area. They believe that the elimination of wildlife from the Sanctuary will enable them to take over the area for their livelihood. They want the area as a free grazing land for their livestock as well as settlement. Discussion with the local community elders has also revealed the interest of community members to have some part of the Sanctuary for their own use. The negative attitude of most respondents is determinant for the future of the Sanctuary to achieve its goal. Changing the attitude of local communities through education and sharing of benefits associated with the wildlife can serve as a means for conservation measure. Many studies have shown that the cost of conservation is the result in negative attitudes while benefits create a positive outlook (Fiallo and Jacobson, 1995). The findings of the present study show benefits, family size, level of education, age and relationship with the staff of the protected area are the key factors that determine the perceptions of local

communities. Most communities strongly need free access to grazing for their livestock in the Sanctuary. They also claim that they have the right to utilize the natural resources of their area.

In addition, at present, the conservation effort being taken at the Sanctuary is not promising. It is understaffed with only one professional warden and six scouts. Lack of commitment and moral on the existing six scouts and poor management systems will accelerate the problems further. Most of the activities are limited only around the Sanctuary Headquarter. Even if the Sanctuary possesses two well-maintained and functional vehicles, the game scouts are only confined to the headquarters and do not conduct patrolling either on foot or by car.

To bring sustainable wildlife management and rural community development at Senkele, it requires reconciling the interest of stakeholders. These will be achieved only when their interest become balanced. To balance it, requires solving the conflict between the interest of the community and the conservationists. Some of the measures to reduce the problems are introducing family planning, reducing the livestock number, emphasizes on quality, introduction of animal forage extension, awareness program towards wildlife, solving the problems of potable water, grazing land shortage, low production and productivity and introducing other community services. Wildlife conservation is a practical problem and can be solved in a practical way. Unless urgent action is taken to solve the problems, the Sanctuary will no longer act as a conservation area for the hartebeests.



6.2 Recommendations

The following recommendations are put forward to minimize the problem:

- ◆ Conservation education is totally lacking in the area and there is a need for carrying out intensive awareness programs. The educational program should focus on changing the attitudes of local people towards conservation area, increasing understanding the value of wildlife and wildlife habitats, and developing a successful and replicable wildlife educational model.
- ◆ There is an urgent need to have up to date wildlife policy and relevant legislation on the conservation of the Sanctuary. This should incorporate law enforcement to take appropriate action.
- ◆ Strengthen livestock offtake from the area and launch animal husbandry program based on quality, and introduce animal forage extension program.
- ◆ Improve the living standards of the local people of the surrounding areas of the Sanctuary to change their lifestyle and reduce their dependency on the resources of the Sanctuary.
- ◆ The boundary of the Sanctuary should be clearly demarcated with agreement of the local people and fenced with appropriate fencing material, with a formal entrance gate.

- ◆ Introduction of a 3 km wide buffer zone between protected area and community villages is recommended.
- ◆ Re-settlement action should be implemented by taking the needs and aspiration of the local people. Awareness creation should be developed before the accomplishment of any evacuating procedure. Resettlers and new settlers should evacuate and move to their original habitat. Those who do not possess land in other areas should be provided comparable land away from the boundary of the Sanctuary.
- ◆ To evacuate and resettle the people outside the sanctuary, the community, governmental and non-governmental organizations should cooperate and work hand in hand. Ignorant or reluctant higher officials of Federal Government and Oromia Regional State should be replaced by experts who are environmentally conscious and ready for action.
- ◆ The situation at Senkele should be kept under constant review and a plan for alternative conservation area should be identified if the problem persists and becomes worse to shift the animals on time to the well studied area.
- ◆ Detailed investigations should be carried out on various aspects of the biology of the Swayne's hartebeest in the Sanctuary.
- ◆ The local community should learn in order to have a behavioral and attitudinal change towards many things including own life style. Education is the only means to change cultures like polygamy style of marriage.

- ◆ Family planning system should be introduced to the people living in the area.
- ◆ A new permanent outpost should be established at Boran hill. From this vantage point, the whole Sanctuary will be clearly visible.
- ◆ Sign posts should be placed in the proximity of Bulbula, Aje and on the all weather road leading to Arba-minch road from the Sanctuary using the Swayne's hartebeest as standard road sign directions.
- ◆ Opening an alternative access route to the Sanctuary directly from Awassa through Shemana Kedida would enhance the tourist potential of the Sanctuary and break the traditional isolation of the small but precious Senkele Sanctuary.
- ◆ Upgrading of the Sanctuary to level of income generating institution so that the wildlife revenues from tourism will be distributed to the local development efforts.
- ◆ A metrological station should be set up at the headquarters to collect whether data such as rainfall, temperatures and relative humidity.
- ◆ Enhance the staff moral and increase their effectiveness greatly through training and personal patrol equipment (Modern arms, binoculars) and other incentives.
- ◆ Mobile communication between the Sanctuary headquarters and EWCO Head Office in Addis Ababa and

within the Sanctuary for patrolling and other management activities should be implemented.

- ◆ Professionals in various fields that are indispensable to the activity of the Sanctuary should be assigned.
- ◆ Experts from various disciplines should have to coordinate and work out the integrated and feasible bush management methods.
- ◆ In order to meet the nutritional requirements of the hartebeest, an intensive program of range management should be applied to improve the palatability and nutritional value of forages.
- ◆ Employ additional game scouts for effective and regular patrolling of the Sanctuary area .
- ◆ Disease monitoring and preventing strategies should be practiced in the Sanctuary to keep Swayne's hartebeest from the possible infection of disease.
- ◆ Fallowland should be allotted for communal grazing area prior to farming.

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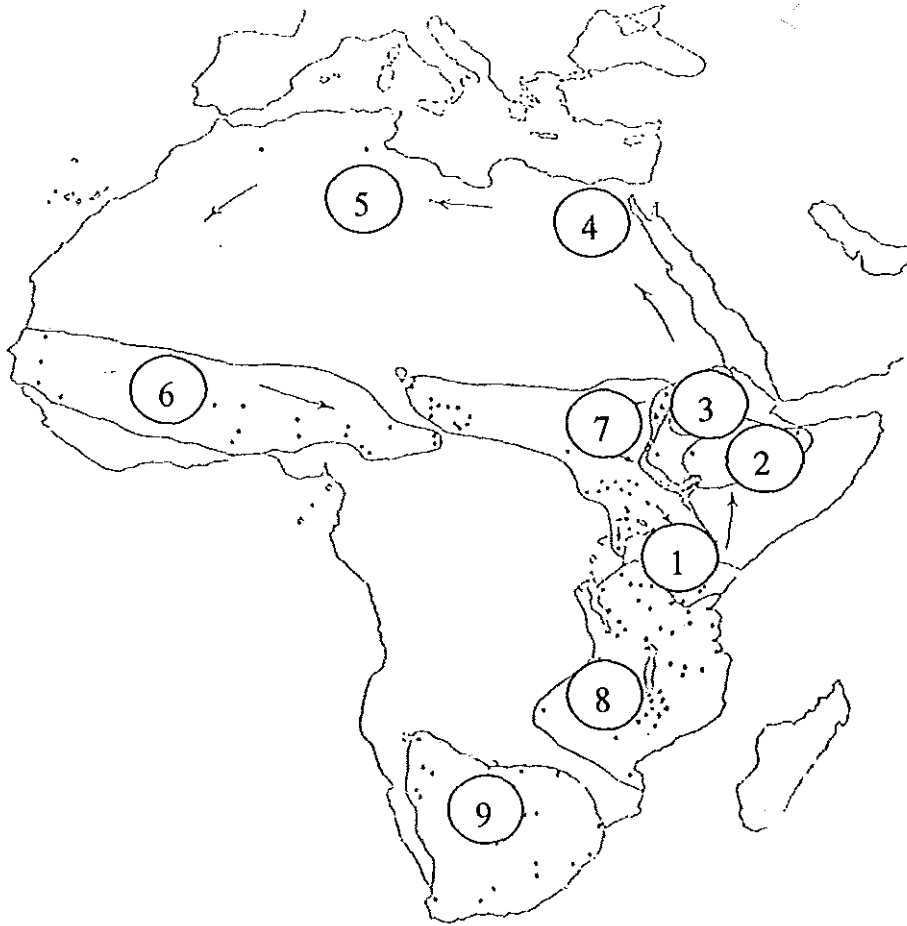
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8. APPENDICES

Appendix 1. The distribution of *Alcelaphus buselaphus* (After Ruxton and Schwartz, 1929).



Key:

- | | |
|----|------------------------------------|
| 1. | <i>Alcelaphus buselaphus cokei</i> |
| 2. | " <i>swaynei</i> |
| 3. | " <i>tora</i> |
| 4. | " <i>bubalis</i> + |
| 5. | " <i>buselaphus</i> + |
| 6. | " <i>major</i> |
| 7. | " <i>lelwel</i> |
| 8. | " <i>lichtensteini</i> |
| 9. | " <i>caama</i> |

+extinct

Appendix 2. Household questionnaire for local communities
around Senkele Swayne's Hartebeest Sanctuary.

Date-----

1. Name of respondent_____
- Age _____ Sex _____ peasant association _____,
family size _____ no of wives _____ occupation
_____. Educational status
a. illiterate b. Read and write only c. Elementary
d. High school.
Distance from the sanctuary _____ km. How long
have you lived? _____
2. What are your livelihood activities?
 - a. Crop production
 - b. Livestock keeping
 - c. Farming and livestock keeping
 - d. Trade
 - e. other (mention)
3. Do you have livestock? If yes, type and number of livestock:
Cattle sheep Goat donkey
other
4. Do you have your own land? Yes/ No
If yes how large it is?
 - a. < 0.2 ha
 - b. 0.3 - 0.4 ha
 - c. 0.5 - 0.8 ha
 - d. > 0.8 ha
5. Are you dependent on the Sanctuary for your livelihood
activities? Yes/ No If yes, how?
6. Do you know why the Sanctuary was formed?
 - a. conservation b. tourism c don't know d. other

7. Do you think that the presence of the Sanctuary benefited the community?
Yes/No If yes in what way?
8. Is there any resource that you have been prevented from the Sanctuary?
Yes/No if yes, do you know the reason? If yes, mention and describe the reasons.
9. What do you feel on the population of wildlife in the Sanctuary?
a. increasing b. decreasing c. No idea
10. What type of wild animals do you know in your area?
11. What are the main crops grown by the people around this area?
12. Do wild animals cause damage to your crops? Yes/ No
13. Name wild animals that are responsible for crop damage from most to least and type of crop attacked and at which stage?
14. How is the extent of crop damage by wildlife?
a. very little b. much c. very much
15. Which season is the problem more severe? Specify the months
16. How is the trend of crop damaged compared to the past 5 years? a. increase b. decrease c. stable
17. Have you faced livestock depredation by wild animals since the last 3 years? Yes / No

18. What control measures have been taken to safeguard the crops?
19. Do you believe wildlife is a useful resource to be conserved? yes/ no
20. Do you want to involve yourself in managing the protected area? Yes/No If no, why?
21. Regardless of the magnitude and willingness of the conservationist, which one of the following benefits you get from the Sanctuary?
 - a. Infrastructure
 - b. Resource use (grazing, firewood)
 - c. Aesthetic value
 - d. other
 - e. Nothing
22. For what purpose do you use grass from the Sanctuary?
 - a. grazing
 - b. House construction
 - c. Harvest and sell to generate income
23. Is it easier to get new land today than five years ago? Yes/No if no, why?
24. New huts are built in and around the Sanctuary, do you support this condition? Yes/ No If yes why? If no why?
25. Do you think that the Sanctuary staffs are doing good work? Yes/No
26. Is there any conflict between you (local people) with the Sanctuary staffs?
Yes/No if yes, why? Especially when?

27. How could you describe your relationship with conservationists?
a. Smooth b. medium
c. Not good
28. What are the main factors that contributed for the above relationship?
29. Is there any traditional hunter in your area?
30. What do you think the effect on your economy if there is no conservation area here ?
a. positive effect (mention)
b. negative effect (mention)
c. Neutral
31. Do you like the existence of the Sanctuary near by you
Yes/ No If no, why?
32. Do you think that wildlife and livestock can live together?
Yes/ No If yes, how?
33. Do you think the presence of people and livestock in the conservation area affects the Sanctuary? Yes/No If yes in what way
34. What is your opinion on the size the Sanctuary?
a. Too big b. Two small c. right size
35. How do you prefer the area to be managed in the future?

Appendix 3. Focus group discussion

Do you think the presence of the Sanctuary close to your area benefited the community?

In what way and what benefits have been realized up until now?

Do you think that local people and livestock affect wildlife?

How do local community and wildlife in the Sanctuary coexist in peace and harmoniously?

To increase the local community benefit and at the same time securing the Sanctuary, what should be done?

- a. by the local community
- b. by conservationists

In order to bring sustainable development for both the Sanctuary and the local community, what do you suggest?

