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LIVESTOCK PRODUCTION AND HIV/AIDS IN EAST AND SOUTHERN AFRICA

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Foreword

This collaborative study was initiated following discussions between the Breeding Biology Group, Institute of Animal Sciences, Swiss Federal Institute of Technology (ETH), Zurich and the Animal Production Service, Animal Production and Health Division, Food and Agriculture Organization (FAO), Rome. The study, which builds on earlier work carried out by ETH (Goe and Stranzinger, 2001, 2002), describes the linkages between HIV/AIDS and the livestock sector, and establishes a baseline of information for developing future research activities. Information obtained from this study was used as the basis for a keynote presentation at an FAO Technical Workshop "Linkages between HIV/AIDS and the Livestock Sector in East and Southern Africa" held from March 8-10, 2005 at the International Livestock Research Centre (ILRI), Addis Ababa.

Executive Summary

This background study paper is based on a review of the literature about the current level of understanding of the linkages that exist between livestock production and HIV/AIDS in countries in East and Southern Africa. Emphasis is given to these two regions since they are the hardest hit by HIV/AIDS in sub-Saharan Africa. Gaps in our knowledge about these linkages are identified and outstanding issues highlighted. Priority areas for future research activities are then recommended. Key points from the study are summarized below:

Incidence of HIV/AIDS. Sub-Saharan Africa has just over 10% of the world's population, but is home to more than 60% of all people (aged 15-49 years) living with HIV—some 25.4 million. In 2004, an estimated 3.1 million people in the region became newly infected, while 2.3 million died of AIDS. Among young people aged 15–24 years, nearly 7% of women and about 2% of men were living with HIV at the end of 2004. The AIDS epidemic is affecting women and girls in increasing numbers. Women and girls make up almost 57% of adults living with HIV in sub-Saharan Africa and are disproportionately affected by HIV across the region. In the past, rates of HIV/AIDS in urban populations were greater than in rural areas, although that gap is narrowing. No longer can HIV/AIDS be regarded as mainly an urban-centred disease.

Changes to traditional farming patterns. Women constitute the majority of smallholder farmers, providing most of the labour and managing a large part of the farming activities. A number of countries have seen an increasing trend in female-headed households. The HIV/AIDS epidemic has resulted in large number of children becoming orphans as both parents die from AIDS. Orphaned children will be a large subset of the total HIV/AIDS affected population in the rural areas in the years to come.

Impact of HIV/AIDS on Agriculture. The effect of HIV/AIDS on agricultural production is related to people's livelihoods and varies according to ecological zones, farming systems and stage of the disease. Initially, effects at the farm household level are observed in terms of the impact on family labour. Less time available for cropping and livestock activities results in lowered farm production and thus income generated. In addition, indigenous knowledge and skills about agriculture and livestock are being lost as adults fall ill and die before they can pass the information on to their children. This is compounded by reduced capacity of extension programmes due to staff being afflicted by HIV/AIDS. There is a high likelihood that tertiary education in agriculture, animal science and veterinary medicine is being negatively affected as well.

Linkages between Livestock and HIV/AIDS. The extent to which HIV/AIDS impacts the livestock sector is not well known. General household survey information indicates that once family savings are exhausted, both crop/livestock farmers and pastoralists begin to sell their animals to cover medical expenses or meet funeral costs. The distressed slaughter or sale

of animals results in less livestock products being available for food or marketing/income. Cropping activities are affected if draught animals are sold or quantities of manure become limited. Breeding stock and young animals (particularly cattle) are now being sold in many of the very hard-hit areas. Reliable information about the impact of such sales on herd structures, animal productivity, reproduction and animal genetic resources for both crop/livestock and pastoral systems is not available.

Coping strategies. Strategies employed by affected households to achieve food security include: raising poultry; sharing draught animals or using donkeys for tillage and transport; raising small ruminants (sheep goats and pigs) for manure, sale and consumption; selling livestock products; bull fattening schemes; and communal programmes for pasture improvement and management of grazing areas.

Mitigating strategies. Livestock based interventions that build on current coping strategies used by affected households are available and in many instances already in place in a number of countries. The challenge is to not only broaden their use, but to ensure that they are accompanied by appropriate support mechanisms that consider the "coping stage" of affected families. Education and training is especially important, particularly for women and orphans. More emphasis should be given to the beneficial uses of livestock food products as important sources of micronutrients in helping to slow the progression of HIV/AIDS, thereby allowing heads of households to support their families longer.

Information gaps. There are still major gaps in our understanding about the effects of HIV/AIDS on crop/livestock, pastoral and peri-urban production systems. Impact studies are required to better assess the impact across the livestock sector as a whole – from the household to the national level. These studies should be both multidisciplined and multisectoral and need to be designed and implemented now before the epidemic is expected to reach its peak in 2015-2020. A more complete information baseline needs to be established so that the current impact of HIV/AIDS on the livestock sector can be reliably evaluated and realistic projections made for the future. Only then can a set of "best practices" be developed that can be used to mitigate the impact of the epidemic on the overall sector and help support households in achieving food security.

Future research. Initial research should focus on crop/livestock and pastoral systems, and include a cross-section of affected countries (i.e., low, medium and high prevalence rates). On-farm studies are warranted to: 1) assess the impact of HIV/AIDS on overall management, productivity and health of cattle, sheep and goats; 2) measure the extent to which slaughter/sales of livestock and the transfer of animals through inheritance by afflicted households is impacting animal populations, herd structures and breeding stocks at the local, regional and national levels; 3) identify specific methodologies and data requirements for future monitoring of the epidemic on the livestock sector. More emphasis should be given to further developing strategies that will allow households to retain their livestock assets, particularly small ruminants and draught animals, and intensify the production of poultry, ducks, rabbits, etc. Use of reduced tillage methods and equines (as an alternative to oxen) with appropri-

ate implements should be further promoted in certain areas. Animal health and extension services (both public and private) will need to be modified to meet the changing demands of the rural population.

Introduction

This paper begins by providing a review of the literature about the current level of understanding of the linkages that exist between the livestock sector and HIV/AIDS[1] in countries in East and Southern Africa, namely: Botswana, Ethiopia, Kenya, Lesotho, Malawi, Mozambique, Namibia, South Africa Swaziland, Tanzania, Uganda, Zambia and Zimbabwe. Emphasis is given to these two regions since they are the hardest hit by HIV/AIDS, although pertinent information for other countries/regions of sub-Saharan Africa is included where available. The paper then identifies gaps in our knowledge about the linkages between livestock and HIV/AIDS, and highlights outstanding issues that need to be addressed. It concludes with recommendations for future research activities to be carried out.

[1] Human immunodeficiency virus / acquired immune deficiency syndrome.

Data Sources

Data for this paper was collected from a wide range and variety of sources. Literature reviews were carried out using recognized comprehensive international databases for the agricultural sciences, including AGRICOLA (Agricultural Online Access, U.S. National Agricultural Library), the Commonwealth Agricultural Bureau (CAB) Abstracts, and FAOs international information system for the agricultural sciences and technology (AGRIS/CARIS). These databases were supplemented by specialized searches of collections of selected university libraries in Europe and the U.S. Additional searches were carried out on the Web using a number of "search engines" (Google, Yahoo, etc.) to locate and review relevant information on HIV/AIDS posted by international aid and development agencies and non-governmental organizations (NGOs) working in sub-Saharan Africa. This search also included country government "HomePages" and their respective agricultural ministries, as well as various types of "grey" literature[2]. Efforts have been made to cite all references used in this paper in full. In those cases where information was found on the Web, but a complete source was not given, then the website address has been included in the reference list.

[2] Non-conventional articles, documents, proceedings, reports, etc. See: Information Retrieval List Digest, Vol. 14, No. 7, Issue 443. "GL'99-Call for Papers, New Frontiers in Grey Literature, Fourth International Conference on Grey Literature".

HIV/AIDS - Current Situation

Sub-Saharan Africa has just over 10% of the world's population, but is home to more than 60% of all people (aged 15-49 years) living with HIV—some 25.4 million [range 23.4-28.4 million]. In 2004, an estimated 3.1 million [range 2.7-3.8 million] people in the region became newly infected, while 2.3 million [range 2.1-2.6 million] died of AIDS. Among young people aged 15–24 years, an estimated 6.9% [range 6.3- 8.3%] of women and 2.2% [range 2.0-2.7%] of men were living with HIV at the end of 2004. The AIDS epidemic is affecting women and girls in increasing numbers. Women and girls make up almost 57% of adults living with HIV in sub-Saharan Africa and are disproportionately affected by HIV across the region. On average, there are 13 women living with HIV for every 10 infected men and the gap continues to grow. In most countries, women are being infected with HIV at earlier ages than men.[3] The differences in infection levels between women and men are most pronounced among young people (aged 15–24 years). The epidemics in sub-Saharan Africa appear to be stabilizing generally, with HIV prevalence at around 7.4% for the entire region. But stabilization does not necessarily mean the epidemic is slowing[4]. On the contrary, it can disguise the worst phases of an epidemic—when roughly equally large numbers of people are being newly infected with HIV and are dying of AIDS (UNAIDS, 2004b).

HIV infection is becoming endemic in sub-Saharan Africa. Some countries hardest-hit by the epidemic, for example Botswana (adult prevalence rate (APR) of 37.3%), South Africa (APR of 21.5%) and Zimbabwe (APR of 24.6%), are thought to be experiencing negative population growth, due to AIDS mortality. Life expectancies in HIV/AIDS affected countries are projected to decline, negating gains achieved during the past several decades. By 2010, many countries in Southern Africa are expected to see life expectancies falling to nearly 30 years of age, levels not seen since the beginning of the 20th century (Stanecki, 2004). Current high prevalence levels mean that even those countries that do eventually reverse the epidemic's course will have to contend with serious AIDS epidemics for many subsequent years (UNAIDS, 2004b). It is predicted that by 2020 HIV/AIDS will be the single largest infectious killer of adults in their prime in the developing world (World Bank, 1997). Not only is HIV/AIDS a human tragedy and major health problem, but it is also a development crisis (World Bank, 1999; Schwartländer et al., 2000). The scale of the disease is so large that

[3] Among young people aged 15–24 years, an estimated 6.9 percent of women and about 2.2 percent of men were living with HIV at the end of 2004. It is thought that this higher infection rate is largely due to sexual abuse and violence. These two types of aggression are serious problems that transcend economic, social, ethnic and geographical lines. Adolescents, children and young women and girls in particular experience increased abuse in the form of domestic violence, rape and sexual assault, and sexual exploitation or undergo female genital mutilation. For some young women, their first sexual encounter occurs under coercion or force, which can be associated with an increase in HIV transmission. See Section 2, pp. 21-22 in UNAIDS, 2004.

[4] Even Uganda which has shown consistent declines in HIV prevalence levels since the mid-1990s, remains burdened with a serious epidemic (UNAIDS, 2004b).

through its effects on population levels and macroeconomic growth, it may influence the prospects for achieving food security in the developing world (Brown, 1997). HIV/AIDS will have a long-term impact on the lives of several generations of Africans (UNAIDS, 2004b).

URBAN VERSUS RURAL POPULATIONS

Two out of every three Africans live in rural areas. Since the mid-1980s, rural communities in East and central Africa have been increasingly affected by HIV/AIDS (Barnett and Haslwimmer, 1995)[5]. In the past, rates of HIV/AIDS in urban populations were greater than in rural areas, although there was little difference in HIV infection rates between urban and rural infection rates in some countries, such as Swaziland, South Africa, Zimbabwe and Botswana[6] (FHI, 1999; UNAIDS, 2000). More recently, improved and expanded surveillance has shown that HIV prevalence in rural areas is lower than anticipated. Nevertheless, over time as differences in infection levels between rural and urban areas narrow, the absolute numbers of HIV-infected persons in rural areas may be expected to equal or surpass the number in urban areas (FAO, 2004a; UNAIDS, 2004a,b,c). Moreover, rates of HIV/AIDS rates in most countries continue to rise due to migration, trade, refugee movements, strengthened rural-urban linkages, etc (Topouzis, 1998). Thus, no longer can HIV/AIDS be regarded as mainly an urban-centred disease.

[5] For example in Malawi, median prevalence based on data collected at antenatal clinics showed that it was about 20% of urban sites in 1992 when nation-wide monitoring began, but had increased to 70% in 1998 (Ngiwira, et al., 2001).

[6] An important determinant of the differential levels of HIV infection is the amount of movement and linkages between urban and rural areas. See Fransen and Whiteside (1997).

Agriculture and HIV/AIDS

Agriculture affects food security, the fate of national economies and the sustainability of environmental assets. It accounts for 24% of Africa's gross domestic product, 40% of its foreign exchange earnings and 70% of its employment (Annex 1). In 2000, about 56% of all Africans (more than 430 million people) were engaged in agriculture (UNAIDS, 2004b). Much has been written over the past 20 years about the impact of HIV/AIDS on agriculture, human nutrition, food security, rural poverty, gender, livelihoods, household assets, etc[7]. It is not the purpose of this paper to review how HIV/AIDS impacts each of these topics in detail. Rather, emphasis is given here to highlighting selected studies where livestock was included as part of the evaluation of how the epidemic impacted agriculture production overall within a farming system. It should be noted that the impact of HIV/AIDS on different agricultural/farming systems (namely, crops, crop/livestock or pastoral) and the ability of families/communities to meet basic production requirements needs to be viewed within the broader context of other constraining factors, such as animal diseases[8], droughts or floods, ethnic conflicts or war, lack of draught animals or farm power, high production costs, limited access to inputs or credit facilities, poor rural infrastructure, inadequate markets and transport systems, and ineffective government policies supporting agriculture and livestock production. The prevalence of HIV/AIDS exacerbates these constraints to agriculture/livestock production.

WOMEN AND AGRICULTURE

In sub-Saharan Africa women contribute between 60-80% of the labour for food production, both for household consumption and for sale (FAO, 1994b). Traditional farming patterns are seen to be changing over time. In many countries agriculture is becoming a predominantly female sector as a consequence of faster male out-migration and because of the number of men who are too sick to work or who have died of AIDS (FAO, 1998a). Women now constitute the majority of smallholder farmers, providing most of the labour and managing a large part of the farming activities on a daily basis (Saito et al., 1994). A number of countries have seen an increasing trend in female-headed households. By the mid-1980s women headed an average of 31% of all rural households - a much greater

[7] The impact of HIV/AIDS on agriculture and farming practices at the semi-subsistence level and impact on livelihoods, labour, capital assets, etc., has been described by a number of authors. For example, see Gillespie (1989); Barnett and Blaikie (1992); Barnett and Haslwimmer (1995); Barnett et al (1995); Barnett and Whiteside (1999); FAO (1994a,b); Rugalema (1998); Topouzis and Guerny (1999); White and Robinson (2000); IFAD (2001); White (2002); FAO (2003a,b,c,d); Topouzis (2003); Villareal, (2003) and Gillespie and Kadiyala (2005).

[8] For example, the national cattle herd in Botswana was about 2.5 million in the mid-1990s. The government-ordered slaughter of the entire herd in northwest Kgamiland District in 1995 to prevent the spread of cattle lung disease (contagious bovine pleuro-pneumonia, CBPP) to other parts of the country reduced the national number by at least 200,000 (IIASA, 2001).

proportion than in other regions. There is much variation within this trend, however, ranging from a proportion of 10% in Burkina Faso and the Niger in the early 1990s to 46% in Botswana and 72% in Lesotho in the late 1980s (FAO, 1998a). As a result, a higher proportion of women than men are engaged in most phases of the production cycle for food, cash crops and livestock - in addition to their household work and small income-earning activities. However, given that women and girls are disproportionately affected by HIV/AIDS throughout sub-Saharan Africa (76% of people aged 15–24 years living with HIV/AIDS are female) (UNAIDS, 2004b,c), it can be expected that this will have a drastic consequences and a devastating impact on overall agriculture production in the coming decades.

ORPHANS

The HIV/AIDS epidemic has resulted in large number of children becoming orphans as both parents die from AIDS. The largest increases in number of orphans will occur in those countries with the highest HIV rates, such as Botswana, Lesotho and Swaziland, where national adult HIV prevalence exceeds 30% (UNAIDS, 2004a). Extended family relationships are the first and most vital source of support for households affected by HIV/AIDS, including those with orphaned children (UNICEF, 2003). The situation is far more serious when both parents die, as youth-headed households are often unable to produce enough food for their own consumption. This is a result of both inadequate resources and the orphans' inability to use and manage what little they have for optimum crop production. In addition to lacking the necessary skills for crop and weed management, youth-headed households tend to know little about livestock management (FAO, 2003c). In addition, orphaned household heads and members, who have already suffered a significant loss of knowledge about farming because of the death of one or both parents, are also hampered by the belief that they are too young to participate in community support programmes (FAO, 2003d). Orphaned children will be a large subset of the total HIV/AIDS affected population in the years to come. Thus, mitigation activities to reduce the impact of HIV/AIDS on livelihoods will need to include special programmes directed at ensuring that children in rural areas are provided with education and training, so that they can, whenever possible, continue to remain on the farm and earn an income from agriculture and livestock activities.

IMPACT OF HIV/AIDS ON LABOUR AND PRODUCTIVITY

Unfortunately, especially in the hardest-hit countries, the epidemic attacks the agricultural base, infecting or killing many agricultural workers prematurely. This loss of labour can contribute to an overall reduction in agricultural output which, subsequently, negatively impacts farm income and household assets, and threatens household food security (Topouzis, 2003). Current estimates project that by 2020 AIDS will have claimed one-fifth or more of all agricultural workers in Southern Africa (Villareal, 2003: UNAIDS, 2004b).

The effect of HIV/AIDS on agricultural production is related to people's livelihoods and varies according to ecological zones, farming systems and stage of the disease. Initially, effects at the farm household level are observed in terms of the impact on family labour. Households facing labour shortages due to a family member being ill or having died, initially try to cope by farming smaller plots, cutting back on weeding, repairing fences for livestock and tending irrigation ditches. A lack of family labour or workers can be critical,

particularly if one or two key crops must be planted and harvested at specific times (Bollinger and Stover, 1999). It was found in HIV/AIDS affected households in Zambia that female adults who must care for ill family members do not have time for farming activities, especially during times of planting, weeding and harvesting (which are mainly women's activities). In some instances, women-headed households adopted conservation farming which did not significantly reduce the amount of labour required, but rather distributed farming tasks more evenly over the dry season, thus allowing early planting (FAO, 2003b). Affected families often must leave parts of their land fallow which can result in erosion and degradation (Barnett and Whiteside, 2002). Ultimately, loss of labour slowly begins to negatively affect the overall farming system, due to changes and delays in cropping activities and practices (planting, weeding, mulching, harvesting, etc) (Barnett and Blaikie, 1992; Barnett and Haslwimmer, 1995; Baier, 1997). When male children are ill, activities such as tending livestock suffer significantly. In turn, livestock become more vulnerable to disease, predators and thieves. Tillage and transport operations using draught animals usually cannot be carried out when older males are sick. The result is that overall agricultural production is reduced (FAO, 2003b). Similar scenarios are reported for many other studies carried out in other eastern and southern African countries (Rugalema, 1998; FAO, 2003a,c,d; Jayne et al., 2004; Gillespie and Kadiyala, 2005).

IMPACT OF HIV/AIDS ON THE TRANSFER OF KNOWLEDGE

Indigenous Knowledge

It has been recognized for some time that indigenous knowledge (IK) plays an important role in smallholder crop, crop/livestock and pastoral production systems. Traditionally, in many areas, the usual way for children to learn required skills is by working with their parents. Given the HIV/AIDS pandemic, this is often no longer possible and, owing to the gender division of labour and knowledge, the surviving parent is not always able to transfer the skills of the deceased one (Topouzis and Guerny, 1999). In mixed crop/livestock systems, for example in Uganda and Zambia, women are generally responsible for tasks such as weeding, harvesting minor crops, transporting produce, caring for poultry and performing household duties. The death of the wife to AIDS can make it difficult for other household members, particularly adult males, to carry out these tasks in addition to caring for children (FAO, 2003c,d). Studies in Uganda have found that less emphasis is being given to the use of IK to sustain animal and crop production than in the past and more reliance is placed on so-called "modern" methods. However, the inability of affected household members to regularly attend agricultural seminars also means that they will not benefit from these "new" extension messages. In addition, a loss in morale about the future is resulting in affected households focusing their planning horizons on the very short term and not seeking information about new farming techniques (FAO, 2003d).

In pastoral communities, the death of specialists in indigenous practices has led to the loss of IK about using medicinal herbs for treating animal diseases and the abandonment of indigenous skills for handling difficult births (dystocia) (FAO, 2003d) In rural Namibia agricultural extension services are limited and there is little sharing of information within and between communities, thus indigenous knowledge and skills play an even more important role within household production systems (FAO, 2003a). Indigenous knowledge

is an important local resource that needs to be preserved and incorporated into strategies developed to mitigate the impact of HIV/AIDS and reduce food insecurity at the smallholder level[9].

It is important to note however, that not only do older or adult members pass on knowledge and farming skills. Young educated people who have knowledge about or who have the ability to grasp the knowledge from extension agents are also victims to HIV/AIDS. Compounding this reduced transfer of knowledge at the farm or community level is the fact that the extension services within East and Southern African countries are also being impacted by HIV/AIDS. Agricultural ministries and other rural development institutions are seeing a disruption of operations and erosion in skills and knowledge capacity (Topouzis, 2003).

Tertiary Education

The extent to which the HIV/AIDS epidemic has thus far impacted African tertiary institutions (universities, polytechnics, teacher training colleges) that offer studies and training programmes in agriculture, animal husbandry and veterinary medicine is not well known. One general review states that HIVAIDS is creating a special crisis in tertiary education and that many tertiary institutions report or predict high infection rates among staff and students (Meyer, 2003). A "Working Group on Higher Education" composed of members of tertiary institutions in Africa has identified HIV/AIDS as a central theme to be addressed. Institutions will be encouraged to develop AIDS-related institutional policies, management capacities, awareness programmes and support services. Commissioned research on how to manage the consequences of AIDS will be occasionally undertaken (ADEA, 2004). A reduced training capacity at the tertiary education level in a country will ultimately, not only result in negative impacts at the level of the household production system, but also have major ramifications on agriculture/livestock production at the national level.

[9] Gari (2002) makes an interesting observation regarding HIV/AIDS and IK and agrobiodiversity. He states that the AIDS epidemic generates an additional paradox regarding agrobiodiversity and IK. As AIDS disrupts customary agricultural systems, socio-demographic structures and community dynamics, it further impairs the maintenance of agrobiodiversity and IK. At the same time, as poor households and communities become severely impacted and impoverished, agrobiodiversity and the associated IK become increasingly important for achieving food security, whilst coping with the specific needs and changes owing to HIV/AIDS. See also Gari and Villareal (2002).

Importance of Livestock

Livestock play an important role in poverty alleviation, food and nutritional security, environmental sustainability and human health in many of the world's poorer countries. The overall process of agricultural and socio-economic development in these countries is directly linked to livestock and their products. Recent estimates suggest that livestock form a component of the livelihoods of 70% of the world's poor (Ashley et al., 1999). It is well established that in addition to providing the rural poor with food (meat, milk and milk-products), livestock serve a multitude of other valuable functions, including draught power, manure for improving soil fertility and fuel, and by-products (hides, skins, wool, hair) (McDowell, 1977; Jahnke, 1982). Livestock are one of the few capital assets owned by the poor and can be crucial to maintaining household survival in times of crisis by providing security and a source of cash income (de Haan et al., 1997; Delgado, et al., 1999). Livestock are particularly important for women because they offer opportunities for generation of income and represent personal assets. They also provide reinforcement for social support networks and fulfilment of cultural roles (Ashley et al., 1999; Niamir-Fuller, 1994; Waters-Bayer and Bayer, 1992).

HIV/AIDS AND THE LIVESTOCK SECTOR

The extent to which HIV/AIDS impacts the livestock sector is not well known. General household survey information, collected mainly in East and Southern Africa, indicates that once family savings are exhausted, animals (and their products milk, meat and manure) are usually the main resource sold to cover medical expenses or meet funeral costs (Annex 2). This practice is commonly observed for both smallholder farmers and pastoralists (Barnett and Haslwimmer, 1995: Engh et al., 2000; FAO, 2003a,b,c; Bishop-Sambrook et al., 2005; Mutayoba, 2005). The slaughter or sale of animals reduces herd size, resulting in less livestock products being available for food or marketing/income. Cropping activities may also be affected if draught animals are sold or quantities of manure become limited. Reduced crop yields in turn can cause livestock production to decline because of less feed (crop residues). Similar coping strategies are seen in West Africa as well (Abamu and Nawanze, 2003). In Burkina Faso for example, affected households sell livestock and reorganize labour as usual responses when family member being unable to work (Sauerborn, 1996).

A lack of labour may affect overall management of livestock, particularly grazing (Barnett and Haslwimmer, 1995; Engh et al., 2000). Animal health also becomes a concern if veterinary services no longer function properly because staff members are absent from work to attend funerals or care for relatives, or have contracted AIDS and died (Haslwimmer, 1994). Men are usually responsible for cultivation with draught animals, harvesting, threshing and overall farm management. If the man in the household is no longer able to work or dies, even if the cattle and other livestock are not sold to cover medical or funeral expenses, the remaining family members often do not have the management skills, knowl-

edge, time or financial resources to care adequately for them (Stover and Bollinger, 1999; Haslwimmer, 1994). A study in Zimbabwe found that cattle outputs were reduced by 29% in affected families (Kwaramba, 1997). Not only are women and children often faced with managing livestock without the necessary skills and experience, the loss or transfer of livestock following the death of an adult male, due to property inheritance/culture, can result in women and children losing these resources altogether (Annex 3) (Engh et al., 2000, FAO, 2003a,b,c)[10].

For those households afflicted by HIV/AIDS, the "unplanned" disposal of livestock can directly affect breeding programmes. Previously earned income from draught animals maybe be lost if animals are slaughtered, sold or remaining family members do not have the skills or physical strength to manage them. Owners may become forced to sell their select bulls or females before they have been able to use them to achieve their breeding goals. In those situations where a bull is shared by several families or a village, the sale or removal of the animal can negatively affect the overall production and structure of local herds. Decreased herd sizes can reduce available breeding stock and thereby impact animal genetic resources (AnGR) within a community or area. Additionally, lack of family labour and poor knowledge of traditional management systems by remaining family members can result in indiscriminate mating or unsound breeding practices. The extent to which sales of livestock as the result of HIV/AIDS have begun to affect different livestock populations both at the community and national levels in those countries having a high incidence of the disease is not well known. It was found from a study carried out in southern Zambia that in the past, it was rare for affected households to sell a heifer or lactating cow. However, now it has become quite common to see both a cow and calf offered for sale because of a desperate need for income to meet household needs (FAO, 2003b). Sales of young animals and breeding stock have also been reported from a study in Uganda (FAO, 2003d). A schematic overview of how HIV/AIDS can impact livestock-owning households is depicted in Annex 4.

[10] For example, a household survey in Zambia found that of 32 households which lost husbands to HIV/AIDS-related illness, 44% of the widows lost cattle, 28% lost small stock and 41% lost farm equipment to their husband's family (FAO, 2003c).

Pastoralists

Most of the information found in the literature concerning HIV/AIDS and agriculture focuses on crop or crop/livestock systems. There has been little research done to determine the impact of the epidemic on livestock production, management and sustainability within pastoral systems. Most of the few reports available discuss impact in terms of HIV/AIDS spreading within pastoral communities in parts of Kenya, Tanzania and Uganda, due to men and women migrating to cities to search for work or mixing with other ethnic groups when migrating with herds in search of grazing and water. Forced sales of animals to meet medical and funeral expenses, and the loss of male labour are also commonly cited (FAO, 1994, 1997; Haslwimmer, 1994; Barnett and Haslwimmer, 1995; Sengendo, 2000; May, 2003; Kitaka-Nakasongola, 2005). A survey carried out in Uganda of 48 non-affected pastoralist households (36 male-headed and 12 female-headed) and 22 affected households (16 male-headed and 6 female-headed) found that 88% of the affected households sold cattle to cover medical or funeral expenses following the death of a household member. One in five of the affected households, compared with one in 25 of the non-affected ones, reported reduced sales of milk compared to five years previous to family member's death, probably because these households had fewer cattle (FAO, 2003c). Another study addresses the pastoral livestock production system, but from a socio-economic view of the linkages between HIV/AIDS and diversity of pastoral livelihoods (Morton, 2003). Proposals for carrying out future research tend to give emphasis to similar themes and do not clearly identify livestock as a component of study objectives (Rutagwenda, 2002).

There is an urgent need for research that addresses the current situation of HIV/AIDS in pastoralist areas. Studies are needed to determine the impact on the pastoral production system itself, what types of mitigation strategies affected communities have developed and how effective and sustainable these strategies are. More research is needed to understand vulnerability and resilience of pastoral groups to HIV/AIDS, what traditional safety nets are in place and whether they are working (Morton, 2005; Waters-Bayer et al., 2005).

ANIMAL GENETIC RESOURCES

Preliminary survey data from 180 countries indicates that some 30% of farm AnGR may now be at a high risk of loss, with the majority of these being located in developing countries (FAO, 1998b; Scherf, 2000). In sub-Saharan Africa the predominant system of smallholder farming is mixed crop/livestock production (Sansoucy, 1995; de Haan et al., 1997). The livestock sector is largely made-up of large and small ruminants (cattle, sheep and goats) (Delgado et al., 1999; ILRI, 2000). In terms of worldwide livestock distribution, an estimated 17% of the cattle, 15% of the sheep and 16% of the goats are raised in this region (FAO, 2000). A recent survey indicates that of the 145 cattle breeds found in sub-Saharan Africa, about 32% are considered to be at risk of extinction (Rege, 1999). Resource poor farmers living in marginal production environments are particularly depend-

ent on AnGR, mainly from indigenous animals, rather than so-called 'improved or exotic' breeds. The total diversity of AnGR available to farmers, and the resulting diverse multitude of products, makes it possible for humans to survive in a wide range of production environments. Indigenous livestock breeds often possess valuable traits such as disease resistance, high fertility, good maternal qualities, longevity, and adaptability to harsh conditions and poor-quality feeds, all qualities that form the basis for low-input, sustainable agriculture. Thus, AnGR diversity contributes in many ways to human survival and well being, with differing animal characteristics and hence outputs being tailored to suit a variety of local community needs (Köhler-Rollefson, 2000; Thies, 2000; ILRI, 2001).

Rege (1999) reported that the main causes of threat to the 47 breeds/strains of cattle in sub-Saharan Africa thought to be at risk are crossbreeding, inter-breeding civil conflict and neglect. What is also noteworthy about these 47 breeds/strains is that the majority of them are located in those countries that have the highest rates of HIV/AIDS. Thus, it is very probable that sales of animals to pay for medicines and slaughter of animals for funeral rites have begun to impact some of these same cattle populations. Moreover, animals from affected households are likely to be sold to traders and not to other livestock owners who might be more likely to adhere to sound breeding practices. Such sales to traders are likely to result in animals being slaughtered or bred indiscriminately, thereby contributing to the threat of a breed/strain. However, again, there are no concrete data that provides a picture of what is happening in different countries. Thus far, HIV/AIDS has not been included as a recognized theme at recent workshops or meetings on AnGR in sub-Saharan Africa (FAO, 2001, 2002a; Hagmann and Bester, 2003; Köhler-Rollefson, 2004). There are very few papers that address the potential linkages between AnGR and HIV/AIDS (Goe and Stranzinger, 2002).

Coping Strategies of Affected Livestock-Owning Households

The various types of coping strategies that are commonly employed by affected households to overcome the negative impacts of the HIV/AIDS (namely, losses in labour, reduced income, increased medical and funeral costs, absorbing orphans or extended family members, etc) have been put forth in many of the reports reviewed in this paper. Strategies that have been developed by households to allow them to continue to benefit from using livestock and their products in meeting their food security needs are listed here[11].

- Raising poultry for home consumption and income (eggs and meat)
- Using small ruminants (sheep and goats) for consumption, manure and sale
- Sharing or hiring of draught animals
- Using donkeys for draught (tillage) and transport (carting)
- Concentrating on livestock production over crop farming
- Communal efforts to improve local pastures nearer to village areas
- Selling of milk, milk products and livestock and loaning the money at raised interest rates, which are payable on a monthly basis
- Bull-fattening schemes

It should be noted that coping strategies often adopted by households (sale of assets, use of savings, withdrawal of children from school, etc) can also render them insecure and vulnerable (Mutangadura et al., 1999). Likewise, coping strategies involving livestock can also have a negative effect on livelihoods after some time. For example, increased sales of milk and milk products, as well as eggs, while providing income, may bring about reduced quality of diet and nutrition within the household. Selling of livestock (particularly cattle) can result in loss of milk for home consumption or sale, impact herd structure and quality of off-spring. That being said, it is well understood that many household are in such dire situations that their main concern is survival and, therefore, they have no alternative options.

[11] Following a review of the literature on the impact of adult illness and death due to HIV/AIDS and the way households cope, Mutangadura et al (1999) suggest that individuals and households go through processes of experimentation and adaptation, as they attempt to cope with immediate and long term demographic changes, and that household coping mechanisms are adopted sequentially or in stages.

Mitigation Strategies Using Livestock

Based on the available literature, there is strong evidence to indicate that HIV/AIDS is having a negative impact on livestock production in sub-Saharan Africa, and therefore consequently directly affects the livelihoods of the rural poor. For the same reason, because of the important contribution that livestock make to rural livelihoods, they can also play an important role in mitigating the impact of HIV/AIDS on the livelihoods and food security of affected households. As mentioned, affected households have already developed coping strategies for livestock keeping. What is needed now is to determine the effectiveness of these strategies to meet food security needs over the longer term and then support and build upon those that offer the most promise. Small stock can be an alternative to raising cattle and provide affected households with a means of income generation and improved diet and nutrition. Sheep, goats, poultry and (where culturally acceptable) pigs, all offer a wide variety of possibilities for different production systems and resource bases.[12] These species are easily managed, affordable, prolific and have short reproduction cycles. Moreover, most women in rural areas of sub-Saharan Africa are familiar with keeping them, particularly poultry and sheep and goats. They would also be appropriate for elderly and orphan-headed households. Establishing or restocking affected households with these species can provide small, but regular amounts of income from sales and quality food products in the diet (eggs, milk and meat). Importantly, livestock can provide a basis for affected households to rebuild their assets and resource base. Encouraging households or communities to embark on developing communal fodder production and establishing communal paddocks can also support improved livestock production. Training programmes for woman and orphans in animal husbandry will further support the potential for increased production at the household level.

Simple, low-cost and effective interventions are now available that can increase the productivity of small stock through utilizing improved housing, feeding and animal health care. For example, FAOs Special Programme for Food Security (SPFS), which aims to diversify rural household incomes, promotes the use of short-cycle species livestock (poultry, sheep and goats). The SPFS is now operational in over 70 Low Income Food Deficit Countries (LIFDC) (FAO, 2004c). Livestock activities within the SPFS aim to increase productivity of existing animals, primarily through reducing the losses of young animals before they reach maturity, and to increase the ownership of animals in the most vulnerable households, including those affected by HIV/AIDS. Poultry has also been promoted by NGOs to help affected

[12] Other smaller animals (e.g. rabbits, ducks, guinea fowl or grasscutter) may also play an important role in certain crop/livestock and peri-urban systems.

families earn income and have improved nutrition. VETAID carried out a pilot project in 2002 in partnership with the Red Cross to alleviate the impact of HIV/AIDS on rural communities in Swaziland. Families comprising children and elderly people were supplied with a small breeding flock of chickens suited to low management and survival in rural areas (VETAID, 2004). Similar programmes are underway in Mozambique (Alders, et al., 2003) and Tanzania (Mutayoba, 2005). Livestock are also being used by other NGOs as a means of mitigating the impact of HIV/AIDS. Heifer Project International has several projects that particularly target families affected by AIDS. They have provided in-calf heifers in Kenya, and in Ghana goats, sheep and grasscutters (HPI, 2004). In Zimbabwe goats have been used as a means to generate income at an orphanage for children who lost their parents to AIDS (ITDG, 2004). Donkeys also offer an alternative source of animal power in place of oxen (Goe, 1993; PI, 1992).

While such interventions are available and can be used to help mitigate the impact of HIV/AIDS, it is important to remember that not all affected households will necessarily be at the same stage of coping. Factors determining a household's ability to cope include: access to resources, household size and composition, access to resources of extended families, and the ability of the community to provide support. Households with higher incomes or better alternative resources are better able to cope with the impact of HIV/AIDS (Mutangadura et al., 1999). Thus, introduction of livestock-based interventions will need to take these coping factors into consideration, if the interventions are to be effective and sustainable[13]. In some instances, providing feed or veterinary care may be appropriate, whereas in other situations small breeding flocks of poultry maybe introduced. In addition to determining which livestock intervention is best for an affected household, it is important that reliable baseline studies have been carried out so that the most needy families are identified. Households who have adequate resources to cope with the impact of a family member who has HIV/AIDS should not receive support for interventions over those who do not. For example, it was reported that a cattle restocking programme in Uganda, aimed at assisting households who had lost their livestock, in some cases distributed animals to the better-off households and "missed" those in the same community who were most afflicted (Ejobi, 2002).

[13] It is also important that government policies and programmes are designed so that positive household responses are reinforced, and those compromising household security are discouraged (Mutangadura et al., 1999).

Contribution of Livestock to Human Nutrition

Numerous papers, international workshops and conferences have addressed the importance of nutrition in helping individuals in sub-Saharan Africa affected with HIV/AIDS to maintain their health. Yet, the contribution that livestock can make (eggs, milk and meat) to human nutrition and its complimentary role to other foodstuffs in the household diets of the rural poor is missing or scarcely discussed in many reports or proceedings (Piwoz and Preble, 2000; ACC/SCN, 2001; AIARD, 2003; IFPRI, 2005). Likewise, poverty reduction strategies put forth by international organizations fail to include or even mention the role of livestock in providing food directly or as a source of income through sales which can in turn be used to buy food (Björkman, 2002; ICRW, 2002). More emphasis should be given to the beneficial uses of livestock food products as important sources of micronutrients in helping to slow the progression of HIV/AIDS, thereby allowing heads of households to support their families longer (Randolph and Sammons, 2005). There is a need to make donor agencies, organizations and institutions involved in human nutrition programmes for HIV/AIDS affected families more aware of the contributions that livestock can make to household diets and food security on most smallholder farms in sub-Saharan Africa.

Existing Information Gaps

Overall, information on the impact of HIV/AIDS on three major livestock production systems within sub-Saharan Africa is lacking. Initial efforts should be directed towards investigating the first two systems.

- Crop/livestock – cattle, sheep, goats, pigs, poultry[14]
- Pastoral (and agro-pastoral) – cattle, sheep, goats, camels
- Peri-urban – cows (milk, dairy products), poultry[15]

Specifically, information is needed about the impact of HIV/AIDS on:

- Overall management and production (including feeding, reproduction and animal health)
- Species and breed distribution
- Herd growth and structures (including off-take/marketing and inheritance transfers)
- Working animals (cattle, camels and equines) for draught and transport
- Consequences of a decline in availability of food products (milk, meat, eggs) on diets of affected families, both in terms of income generation and health
- Macroeconomic effects as livestock populations change (national and regional levels)

Additionally, much more needs to be learned about the different production and socio-economic strategies being used by households to safeguard their livestock-related production outputs and assets. It will be necessary to have access to these types of information to reliably predict what will be the impact of HIV/AIDS on overall livestock production in smallholder/community and national herd populations of countries in 15-20 years when the epidemic is expected to reach its peak. Such information is also required to ensure that at the local, regional and national levels the breeding stocks of cattle, sheep and goats are adequate to support sustainable livestock production and maintain genetic diversity in the future. Access to this information will also make it possible to better develop appropriate strategies and programmes that will allow affected and non-affected households to benefit more from their livestock resources and be able to better meet their food security needs.

[14] Note: Other smaller animals (e.g., rabbits, ducks, guinea fowl, grasscutter) may also play an important role in certain crop/livestock and peri-urban systems.

[15] There appear to be very few studies on HIV/AIDS and food security in urban areas where livestock are kept as a source of food and income (Palamuleni et.al., 2003).

Need for Impact Studies

The importance of livestock in mitigating the effects of HIV/AIDS can no longer be ignored. There is now the need for impact studies to be carried out which focus on linkages between HIV/AIDS and the complete livestock sector, from household to national levels. Such studies are required to measure the current impact and predict what the future situation may be. Only then can a set of "best practices" be developed that can be used to mitigate the impact of the epidemic on the overall sector.

APPROACHES

A number of approaches have been taken to identify and monitor the impact of HIV/AIDS on agriculture and livelihoods. Two relatively well-known ones are briefly highlighted here. Barnett and Haslwimmer (1995) put forth a "systems hierarchy" that begins with the impact of HIV/AIDS at the farm household system and then monitors the effects as it moves into the subordinate crop/livestock system and then progresses through the farming system and later into the regional and national agricultural systems. Their work focused only on the first stage using the approach of Barnett and Blaike (1992) that puts forth the hypothesis that not every farming system is equally vulnerable to the loss of labour. Rather, the degree to which a farming system is vulnerable to the HIV/AIDS pandemic depends on a number of characteristics, most of which are linked to their adaptation to a loss of labour. In terms of livestock, the study by Barnett and Haslwimmer (1995) mainly addresses the issues of sale of animals by both crop/livestock farmers and pastoralists to meet medical, funeral and food expenses, and labour availability as it generally affects animal husbandry. No information is given nor possible methods put forth for collecting detailed information on livestock production systems across any of the four hierarchies.

A more recent approach to assessing impact looks at the vulnerability and resilience to the impact of AIDS through the use of a "lens" (Gillespie and Loevinsohn, 2003; Loevinsohn and Gillespie, 2003). The authors describe vulnerability as being different from susceptibility in that it refers to the likelihood of significant impacts occurring at a certain level (individual, household, community, etc). Resilience refers to the active responses that enable people to avoid the worst impacts of AIDS at different levels or to recover faster at a level accepted as normal. The lens approach divides the impacts of the disease into three levels: (1) microenvironment (relating to household labour supply, household resources and attitude and knowledge); (2) meso-environment (social networks); and (3) macro-environment (institutional resources). There is little information presented about livestock and its role, except for reference to policy issues. More recent information expands on the lens approach and appears to provide adequate breadth for incorporating assessment methods to examine a livestock component (Gillespie and Kadiyala, 2005).

The above approaches provide a good basis from which to begin to develop new meth-

ods for measuring impact of HIV/AIDS on crop/livestock systems. However, modifications to these approaches, as well as including relevant "concepts and information gathering tools" used in other studies[16], will be necessary in the developing appropriate methods for measuring impact on the livestock sector. New methods will need to be also developed for pastoral and peri-urban livestock systems. In all cases, methods will need to be multi-disciplined and draw on the input from a variety of actors/stakeholders. Specific approaches will have to be tailored to situations existing within and between countries.

MULTI-SECTORAL COLLABORATION

International collaboration and cooperation has been essential in mobilizing the necessary resources to combat the spread of HIV (Clayton et al., 1994). The complexity of the impact of the disease on agricultural production and household food security requires a multi-sectoral response that should include agricultural extension, primary health care, education and appropriate nongovernmental organizations (Baier, 1997). Health, social and economic development policies will need to include a livestock component if efforts to understand and mitigate the effects of HIV/AIDS on rural populations and the agricultural sector are to be successful. However, the inclusion of HIV/AIDS into agricultural strategies is a relatively new field. Cross-sectoral and inter-institutional collaboration is required to develop appropriate strategies through operation research and documentation and the evaluation of experiences (Egal and Valstar, 1999). Incorporating a livestock component into an overall approach will require that there is an awareness and understanding of what different actors are doing. A lack of collaboration between donors and the implementation of development projects that fail to complement other HIV/AIDS programmes that already exist in a country are unlikely to be effective (Dayton, 1998; Cownie, 2005). Good coordination is necessary to avoid duplication of activities. It is important to ensure that multi-sectoral activities are in place and operational at both the national level and at the level of implementation (FAO, 2003c). It is also important the ministries and institutions responsible for livestock and animal health better integrate HIV/AIDS into their livestock policies and programmes. Those ministries concerned with agriculture, rural development, and poverty alleviation also need to assess how their policies and programmes are promoting agricultural growth in light of AIDS (Jayne et al., 2004).

Appropriate strategies and interventions need to be developed which can be employed by international development organizations, donor agencies, NGOs and national governments, including national agricultural research services (NARS), to mitigate the present effects of HIV/AIDS on livestock production and plan for future actions. Successful project formulation will require a multidisciplinary approach and inter-agency/institutional cooperation.

[16] For example, see FAO (2003a,b,c) and Bishop-Sambrook (2004).

Conclusions and Recommendations for future research

Research activities are needed to fill the information gaps that exist at present. Work should begin to develop proposals for carrying out selected country studies to:

- Obtain an in-depth understanding of how HIV/AIDS affects the overall management, productivity and health of cattle, sheep and goats.
- Determine the extent to which the slaughter/sales of animals by afflicted households is impacting animal populations, herd structures and breeding stocks at the local, regional and national levels.
- Identify responses and mitigation strategies already being employed by livestock keepers.
- Further develop interventions that will result in livestock and their products making a greater contribution to household diets and human nutrition.
- Identify specific methodologies and data requirements for monitoring and predicting the impact of HIV/AIDS on the livestock sector in the future.

Livestock and their products will continue to play an important role in providing food security and improving the livelihoods of the rural poor. At the national level, livestock are a valuable source of foreign exchange through exports for many countries in sub-Saharan African afflicted by HIV/AIDS. The current situation of the HIV/AIDS epidemic in the rural areas is going to get much worse before it gets better. The negative consequences now being observed of how HIV/AIDS is impacting families and communities will continue to erode the resource base of afflicted households. To what extent the short-term effects currently being observed will change or remain the same is difficult to predict. One can only guess at what the long-term effects will be at the micro and macro levels between now and when the epidemic finally peaks. Sustainable livestock production is a key resource that can be used to help mitigate the impacts of HIV/AIDS and promote household food security and rural development in the region. What is required now is to direct research activities towards addressing the existing gaps in information so that the benefits which livestock offer smallholders can be most efficiently exploited.

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Annex 1

Agriculture and livestock production in HIV/AIDS affected countries

TABLE 1
Importance of agriculture and livestock production in countries in East and Southern Africa affected by HIV/AIDS

Country	Percent contribution of agriculture to GDP[1]	Percent contribution of livestock to GDP [2]	Percent of adults (aged 15-49) with HIV/AIDS[3]	Percent rural population[1]
Botswana	2.5	2.2	37.3	49
Ethiopia	41.8	12.8	4.4	84
Kenya	15.8	7.4	6.7	64
Lesotho	18.3	8.7	28.9	82
Malawi	38.4	3.5	14.2	84
Mozambique	26.1	3.8	12.2	64
Namibia	10.0	7.8	21.3	68
South Africa	3.8	1.8	21.5	43
Swaziland	11.3	3.0	38.8	76
Tanzania	45.0	13.4	8.8	64
Uganda	32.4	4.7	4.1	88
Zambia	19.3	7.4	16.5	64
Zimbabwe	17.4	5.7	24.6	63

[1] http://www.worldbank.org/data/countrydata/countrydata.html (for the year 2003).
[2] Calculated by using FAOSTAT figures for a country's Livestock (PIN+) and dividing it by its Agriculture (PIN+) for the year 2003 (FAO, 2004b). This number is then multiplied by the country's GDP for Agriculture as given by The World Bank.
[3] Mean estimates. For the range of HIV prevalence in each country see: UNAIDS (2004b,c).

Annex 2

Sources of funds for funeral costs in southern Zambia

TABLE 2

Percentages of households in southern Zambia citing main sources of fund for funeral costs

Source	Household Type[1]			
	Male-headed burdened	Female-headed burdened	Male-headed unburdened	Female-headed unburdened
Household savings	10.5	0	12.2	20.8
Sale of crops	5.3	16.7	12.2	4.2
Sale of livestock	15.8	33.3	19.5	8.3
Sale of household goods	5.3	0	7.3	4.2
Help from relatives	31.6	41.7	22.0	20.8
Borrowing	15.8	8.3	17.1	29.2
Other	15.8	0	9.8	12.5
Total	100.0	100.0	100.0	100.0

[1] Burdened households were those that were supporting one or more orphans or foster children and unburdened if it was not.

Source: FAO (2003b).

Annex 3
Livestock losses following death of household heads in Namibia

Examples of changes to livestock ownership and access/use of resources in HIV/AIDS-affected case study households in the Oshana area in northern Namibia are given in Tables 3-6 (Engh et al., 2000).

TABLE 3

Female widowed parent with six children

Parameter	Situation before death	Situation after death	Comments
No. of cattle	27	0	Taken away
No. of sheep and goats	20	10	Some taken away, others slaughtered
No. of pigs	0	0	
No. of chickens	20	10	Slaughtered for family consumption
Total area cropped	2 ha	2 ha	
Amount of grain produced relative to annual requirements	Just enough	Less than needed	Draught power and manure no longer available
No. of household members employed off-farm	0	0	
Other income-generating activities	0	0	

TABLE 4

Female widowed parent with eight children and two other adults

Parameter	Situation before death	Situation after death	Comments
No. of cattle	40	8	Some taken
No. of sheep and goats	80	0	Taken away
No. of pigs	0	0	
No. of chickens	40	18	Some taken
Total area cropped	4 ha	3 ha	Draught power taken
Amount of grain produced relative to annual requirements	More than enough	Just enough	Draught animals taken, depends on hand hoeing; manure no longer available; no more money to use fertilizer
No. of household members employed off-farm	1	0	Died
Other income-generating activities	Cuca-shop	0	Destroyed

TABLE 5

Male widowed parent with seven children and two other adults

Parameter	Situation before death	Situation after death	Comments
No. of cattle	13	13	One ox slaughtered for funeral; one calf born
No. of sheep and goats	0	0	
No. of pigs	3	1	Slaughtered for funeral
No. of chickens			
Total area cropped	4 ha	3 ha	Labour is now short
Amount of grain produced relative to annual requirements	More than enough	More than enough	Continues to use manure and fertilizer
No. of household members employed off-farm	0	0	
Other income-generating activities	0	0	Occasional remittance from sisters and brothers is the major income source

TABLE 6

Male widowed parent with four children

Parameter	Situation before death	Situation after death	Comments
No. of cattle	55	50	Some oxen slaughtered for funeral
No. of sheep and goats	20	20	
No. of pigs	0	0	
No. of chickens	20+	20+	
Total area cropped	2.5 ha	2.5 ha	
Amount of grain produced relative to annual requirements	More than enough	More than enough	Continues to use manure and fertilizer
No. of household members employed off-farm	1	1	
Other income-generating activities	0	0	

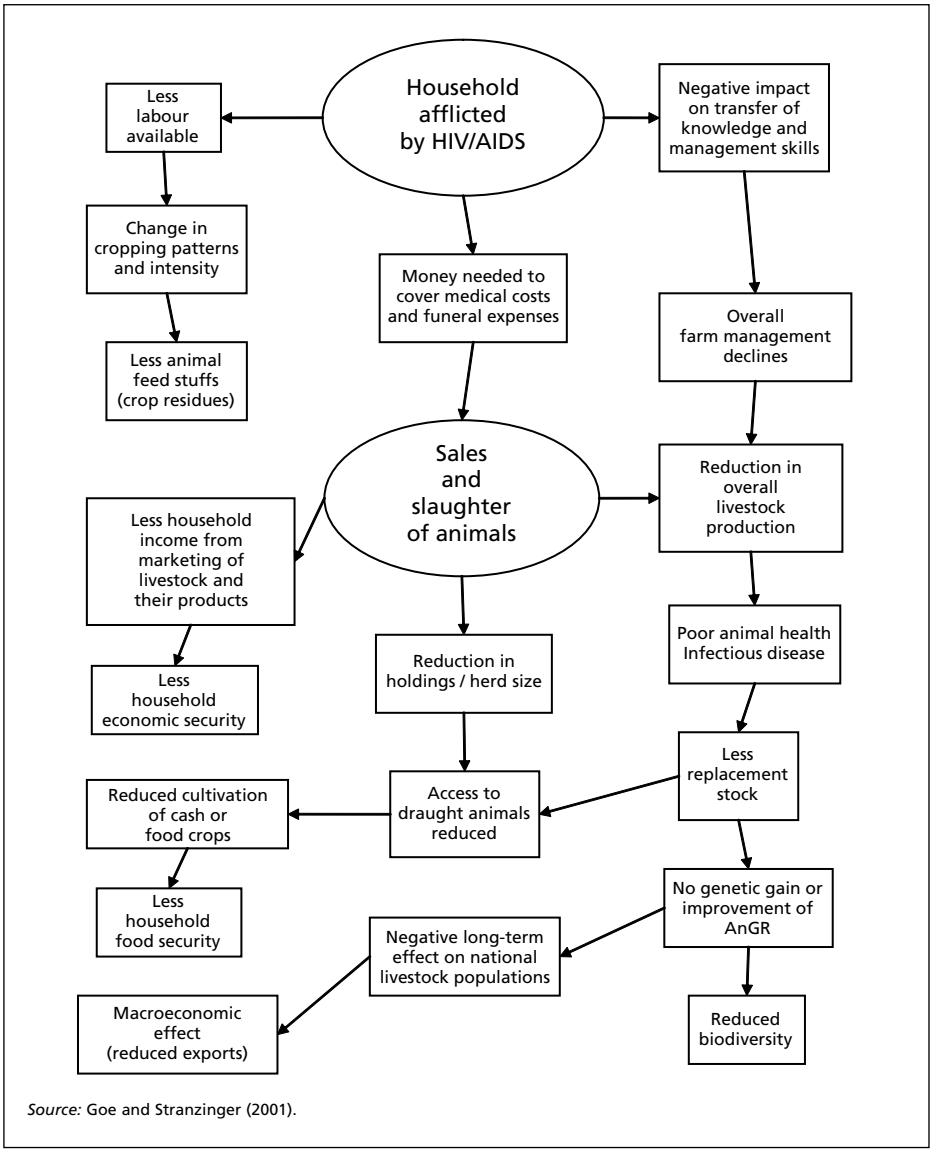
TABLE 7

Child-headed household with four children

Parameter	Situation before death	Situation after death	Comments
No. of cattle	6	4	Two oxen slaughtered for funeral
No. of sheep and goats	14	10	Dying due to poor management
No. of pigs	0	0	
No. of chickens	16	10	Dying due to poor management
Total area cropped	5 ha	2 ha	
Amount of grain produced relative to annual requirements	Just enough	Far, far less than required	Little manure used and no fertilizer; crop and weed management very poor on a reduced area
No. of household members employed off-farm	0	0	
Other income-generating activities	0	0	

Annex 4

Schematic overview of how HIV/AIDS can impact livestock production



Source: Goe and Stranzinger (2001).