

## 1. Introduction

Africa, the world's poorest continent, is rich in animals. Unlike other developing regions, it is rural today and will be tomorrow (UN-HABITAT, 2004). For the average sub-Saharan nation, agriculture employs over 62% of the labour force, is the single biggest (28%) contributor to Gross Domestic Product (GDP), provides subsistence for most of the population and is a major source of foreign earnings, comprising 29% of all exports (FAO, 2004).

Most African farmers (75%) cultivating most (74%) of Africa's farming land, keep livestock (Dixon *et al.*, 2001). Seventy million people in sub-Saharan Africa depend mainly on livestock and for an additional 400 million, livestock are an essential part of the farm enterprise (Blench, 2000). Livestock is of high importance to the poor and a proven "pathway out of poverty" (ILRI, 2000); 70% of the rural poor in developing countries depend on livestock (LID, 1999). In sub-Saharan Africa, the contribution of livestock to agricultural GDP is 25%, when manure and traction are taken into account this increases to 33% (Ehui *et al.*, 2002).

Livestock-keeping is a sunrise industry: population growth, wealth increase and changing consumption will double the demand for livestock products by 2020 (1990 as baseline). Most growth will be in developing countries (Delgado *et al.*, 1999), and the next 20 years will see an additional half a billion consumers in Africa. Livestock is growing faster than any other agricultural sector. Already the largest user of land (LEAD, 2005), by 2020 it will comprise 30% of the value of agricultural output and directly or indirectly use 80% of the world's agricultural land surface, making it the single most important agricultural sub-sector in terms of value added and land use (World Bank, 2001). Africa has a strong tradition and expertise in livestock keeping: production costs are low and products preferred by local, diaspora and Middle East consumers (ILRI, 1995), offering African countries the opportunity to trade their way out of poverty with livestock.

Cattle are fundamental to the livestock sector in Africa, with 232 million animals (FAOSTAT, 2005), providing food, traction, manure, income, savings, credit access and insurance as well as filling social and cultural functions (Moll, 2005). This is jeopardised by serious constraints: missing or poorly performing markets for inputs and outputs; excessive taxation and high transaction costs; low genetic potential; war, theft, cattle-raiding and natural resource conflict; malnutrition and nutritional deficiencies, climatic extremes and diminishing natural resource base and last, but not least, animal disease.

Traditionally compartmentalised as a veterinary problem, disease may be more usefully viewed as one of the interacting factors determining household or farm production and productivity. Veterinary programs which ignore the ecological, institutional and socio-economic context are not only likely to fail but can have perverse and harmful effects, including land degradation, biodiversity loss, increased conflict, spread of livestock disease and risk to human health (USAID, 2005).

Although not a stand-alone issue, researchers and policy makers regard livestock disease as a leverage point (Preslar, 1999). Sub-Saharan Africa remains a region of largely uncontrolled disease; losses are estimated at two billion dollars a year (Sidahmed, 1997). Most feared by farmers are the pandemic diseases, such as rinderpest, which wiped out communities, permanently altered ecosystems, and opened the door to colonisation (Coquery-Vidrovitch, 1988). There has been considerable success in rolling back rinderpest, but control of other epidemic diseases remains elusive. Contagious bovine pleuropneumonia, foot and mouth disease, peste des petits ruminants, swine fever and Newcastle Disease to name but some of the most important epizootics are entrenched in the African continent (OIE, 2003).

Epidemic disease is catastrophic and photogenic, but the economic burden from endemic disease may be higher. Parasites are important causes of endemic disease in Africa, including: internal parasites (nematodes, trematodes and cestodes) and external parasites (ticks, mites, biting flies); tick borne diseases (e.g. theileriosis, cowdriosis, anaplasmosis and babesiosis) and tick associated (e.g. dermatophilosis, toxicoses and abscesses) diseases; and trypanosomosis.

Zoonoses are important as diseases transmissible from animals to man. In Africa, rabies, brucellosis, tuberculosis, cysticercosis, hydatidosis, toxoplasmosis, trichinosis, Rift Valley fever and trypanosomosis are among the most devastating. Most (75%) emerging human diseases originated in animals (Karlan, 2005).

The continued presence of controllable diseases, epidemic, endemic or zoonotic, can be attributed to the adverse institutional environment. Richer countries are controlling or have eliminated these diseases; their persistence in Africa is a function not of epidemiology, but of pervasive poverty, high external debt, low education, mal-governance, disempowerment of farmers and consumers, low social capital, unstable and unrepresentative governments, ineffective public services and an under-performing and ill-regulated private sector. As summarised by Leonard (2000):

*“African states are confronted with most of the following: corruption (Gould, 1980; Gould and Amaora-Reyes, 1983; Klitgaard, 1990); patronage (Joseph, 1987); inflated public payrolls; severe fiscal scarcity and a consequent ‘budgeting by cash-flow’ (Caiden and Wildavsky, 1975); constant shortages of critical inputs (Moris, 1977), weak performance rewards for public servants, due both to erosion of their value by inflation and the failure to use them to support organisational objectives (Montgomery, 1987); and political authorities who are insecure, indecisive, arbitrary, and interventionist (Moris, 1977; Jackson and Rosberg, 1982)”.*

Solving the constraints to livestock production, including animal disease, must take this institutional context into account if they are to be appropriate and helpful.

Development in Africa is lagging, but success stories show a way forward, the expansion of cotton cultivation in west Africa being a notable example. Strongly linked to movement out of poverty, in the 90s farmers in cotton-growing districts experienced a 10% drop in poverty, while for those relying on subsistence food production, poverty increased (Goreux and Macrae, 2003). The West

African FCFA region is the world's second biggest exporter of cotton providing a livelihood to 10 million people (FAOSTAT, 2005), with production and exports of cotton predicted to grow over the next decade (FAO, 2003). Cotton as well as other cash and subsistence crops are mainly cultivated using animal traction, so cattle survival and health underpin the entire farming system. Here, trypanosomosis is the most serious cattle disease and west Africa, along with Ethiopia, has been designated as a priority area for trypanosomosis control by the international community.

Trypanosomes are blood-born parasites spread between animal hosts by insect vectors (tsetse flies) or mechanical transmission (biting flies, injections). Present for more than half a billion years (Stevens and Gibson, 1999), they are of low pathogenicity to the African wildlife with which they have co-evolved, but in domestic livestock cause serious and fatal disease. While indigenous cattle breeds domesticated in Africa have considerable resistance, in Zebus, disease is more severe and without treatment usually fatal. Trypanosomes also affect humans; sleeping sickness was first described in the 14th century, and explosive outbreaks at the start of the last century decimated populations in east and west Africa (Grischow, 2004). We are currently in the third major historical sleeping sickness epidemic; around 50,000 cases are reported each year and the true incidence is believed to be ten times higher (WHO, 2001a).

Cattle trypanosomosis is managed by multiple strategies including keeping naturally resistant (trypanotolerant) cattle and vector avoidance/reduction/elimination, but the most important strategy is indubitably the use of trypanocidal drugs. Their high reliance on drugs for the management of trypanosomosis makes farmers very vulnerable to the emergence of drug resistance.

Drug resistance is an inevitable sequel to drug use; reports of trypanocide failure emerged as early as 1927, and resistance has been generally found within a decade of drug release. For many diseases, the continuous development of new drugs allows health systems to keep a precarious step ahead of drug resistance. But for cattle trypanosomosis no new drugs have emerged in the last 40 years and none are likely to in the near future. The high cost of *de novo* drug production, estimated from 200 to 800 million dollars (Di Masi *et al.*, 2003), compared to the low value of the market for African trypanocides, estimated at 20-30 million dollars (Borne, 1996), is a strong disincentive for the private sector to invest in development of new drugs.

The heavy dependence of farmers on trypanocides, the alarming emergence of resistance, the unlikelihood of new trypanocides appearing, the low adoption of alternatives to drugs, and the development importance of the west African cotton zone stimulated a series of German-funded activities in this region. The first phase (1998-99), led by the Free University of Berlin, was essentially diagnostic, mapping resistance prevalence in south-west Burkina Faso and developing and validating field and laboratory tests for resistance. The second phase of the project had the overall goal of improving the livelihoods of smallholder farmers in the cotton zone of west Africa. The project purpose was better management of trypanosomosis in the presence of resistance. The results presented here, took place within this project which started in 2002 and will finish in 2006.