

Managing Agricultural Resources for Biodiversity Conservation

Case study of Ethiopia, Kenya, South Africa and Zimbabwe

(Draft in Progress)

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Abstract:

Agriculture and livestock production dominates the region's gross domestic product and employment base. South Africa, Kenya, Zimbabwe and Ethiopia all have increased their exports of agricultural crops over the last ten years and the share of agricultural products out of total merchandise exports has also grown over this period. The region maintains a biodiverse natural resource base with large areas having some level of legal protection. In spite of this though, the region is plagued with drought, food insecurity, political instability, and slowing economies coupled with falling GNP growth and little foreign investment.

Agrobiodiverse ecosystems have steadily declined in the region as the concepts of the Green Revolution have created a profound effect on directing agriculture away from agrobiodiverse farming systems to monocultures with external inputs. However, while in the short term, productivity is seen to increase, vulnerability to pests, climate and economic changes make this system high risk for small and large farm holders. Consequently, since the middle of the last century, land degradation has steadily increased and continues as international and national policies aimed at biodiversity conservation have not yet mainstreamed a diversified agricultural approach but which have restricted much of their application to a few introduced species.

In the global context, by focusing on cash and export crops, governments have opened the rural economy to the influences of the global system of markets that transmits international prices to local communities. The result has been that many farmers are unwilling to continue producing basic food crops for domestic consumption because of the new opportunity to profit from commercial crop production. The value of traditional food plants has thus been eclipsed by the economic attraction of other food and non-food crops leading to reduced focus on production of these food crops in a manner conducive to biodiversity conservation.

With greater movement towards commercial farming inputs, people have become more reliant on purchased food. In situations of fluctuations from climate and market values, people have already been lead into greater poverty. Moreover, unfettered market liberalisation policies, without integration of social and environmental provisions, tend to aggravate unfair competition and inequitable terms of trade, which compounds food insecurity and increases pressures on resources.

Market prices do not yet reflect the real value of products from biological resources as the economic valuation has yet to be quantified and incorporated into national accounting systems. Without the economic internalization of external costs, biological resources continued to be exploited beyond sustainable levels.

In summary, the loss of agrobiodiversity, amongst other factors such as population growth and lack of political will, can be seen as stemming from an increased reliance on natural resources to meet macroeconomic goals and foreign capital needs and a failure to acknowledge and address long-term environmental costs associated with economic growth objectives. These causes of biodiversity loss has lead to ecosystem conversion and unsustainable levels of consumption through the adoption of environmentally destructive practices. Changes in land tenure to that of "willing buyer - willing seller" basis and away from communal land holdings, has not proved to provide the personal incentives for environmental protection.

Constraints to the greater integration of agrobiodiversity into agroecosystems include lack of adequate national agriculture policies and lack of inclusion of necessary planning in National Biodiversity Strategy and Action Plans; lack of planning at the landscape level and the related constraint of lack of cross-sectoral linkages within government Ministries. Where new policies exist that deal with agrobiodiversity, further development and input from communities are required to create more concrete, substantive benefits.

A number of best practices have been identified. In general, the best practices have commonalities which include respect for indigenous knowledge and traditional agroecosystems, promotion of appropriate technologies rather than the mechanization of agricultural practices, irrigation, pesticide and fertilizer use, they work within the rural economy rather than forcing rural areas into the global economy. In effect, these practices realise sustainability through high levels of biodiversity which can better cope with fluctuations in ecological and market stresses. And equally important, they recognise that there are no quick fixes.

The agricultural production system:

Arable land in semi-arid and arid Eastern and Southern Africa is a small proportion of the land base (Table 1). In Kenya, for example, arable and permanent crops occur on less than 10% of the land base. These arable lands are generally already under intensive agricultural production (Mutta *et al.*, 1998). Yet the agricultural area of the country extends throughout almost half of the land, which means that extensive forms of livestock production and smallholder farming are an appreciable influence on a large land base.

	Kenya	Ethiopia	Zimbabwe	South Africa
Land Area (1000Ha)	56,914	100,000	38,685	122,104
Agricultural Area (1000Ha)	25,820	30,600	20,550	99,678
Arable & Permanent Crops (1000Ha)	4,520	10,600	3,350	15,750

Table 1. Agricultural Land Use Statistics: Kenya, Ethiopia, Zimbabwe and South Africa, 1998, © Copyright FAO 1990-1998.

For Kenya and Ethiopia, landmaps with highest potential for agriculture is not necessarily where there is the most intensive cropland (Fig. 1). Soils within the Rift Valley may have high agricultural potential, but occur in a very arid area (Thrupp with Megateli, 1999).

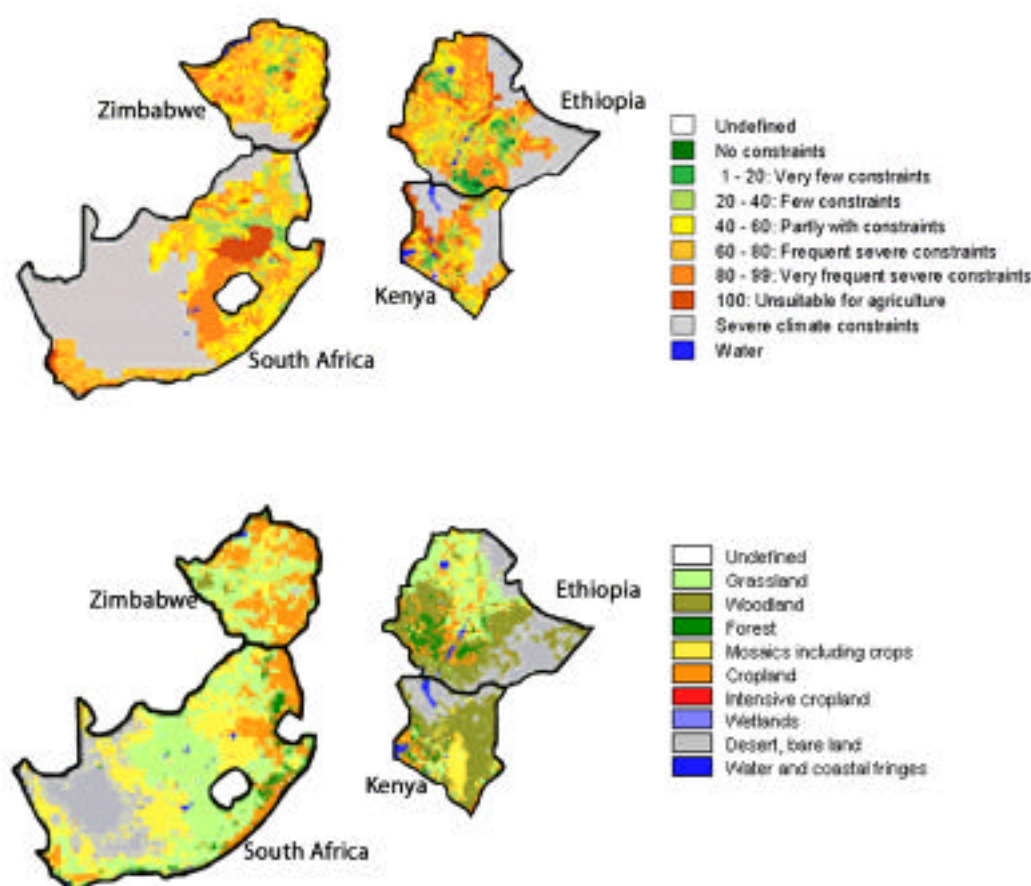


Figure 1: Maps of agricultural constraints (top) and present land use categories (below) in the four-country area. From: Measuring the potential of farmland: FAO's GAEZ system, available online at <http://www.fao.org/ag/magazine/0012sp1.htm>

About 13% of South Africa's surface area can be used for crop production. High potential arable land comprises only 22% of the total arable land. Slightly more than 1,2 million ha are under irrigation. As

throughout the region, the most important factor limiting agricultural production is the availability of water. Rainfall is distributed unevenly across the country, with humid subtropical conditions occurring in the east and dry, desert conditions in the west. Agriculture is practised in areas where land is highly unsuitable for cultivation, and as with Kenya, some high potential areas remain to be developed. Water remains the greatest determining factor of agricultural development. More than 50% of water in South Africa is already used for irrigation. The area under irrigation is 1.3 million ha and limited water availability suggests that at most an additional 200 000 ha could be brought under irrigation. This would represent 8% of the area suitable for arable farming. Present irrigation schemes vary from small schemes such as vegetable gardens on communal land to very large schemes fed from large reservoirs built on the major rivers of South Africa.

Agriculture and livestock production contributes to at least one-third and generally about half of the gross domestic product of many of these countries, and employs more than 70% of the labour force (Mutta *et al.*, 1998; FAO, 2001; Thrupp with Megateli, 1999). In Ethiopia, over 80% of the GDP comes from agriculture, and where agro-industries are included, the agricultural sector as a whole employs over 90% of the population. Although rich in a number of natural resources, food security and hunger nonetheless plague the region. An estimated 33 % of the population of Africa, largely women and children, suffer from hunger (IFPRI, 1995) and per capita food production has steadily declined by 23 % over the past 25 years (FAO, 1995). In the Greater Horn of Africa, approximately 46% of the population face chronic food insecurity (USAID/State, 1994).

In the Horn of Africa region, the main food crops are maize, sorghum, millet, barley, teff, wheat, rice, pulses, cassava, ensete, sugarcane, and oilseeds (FAO, 1996) Livestock production is also extremely important to livelihoods. Kenya and Ethiopia export agricultural products, mainly tea, coffee, meat and leather in addition to pyrethrum and some food crops (Cleaver and Schreiber, 1994). Agricultural export earnings have enabled the countries to purchase food imports and other goods. In recent years, the countries in the region have increased the land under export-oriented agriculture. While Africa's share of trade in agricultural commodities is small (Fig. 3), it is increasing. Principal trading partners for African countries have been the countries of Western Europe, to which Africa exported 12 billion dollars worth of agricultural products in 1999, and from which the continent imported 5 billion dollars worth.

An excellent report on food security and the environment in the Horn of Africa notes: "Although several countries in the region have increased their land area and earnings in export-oriented agriculture in recent years, this strategy does not generally help countries and communities achieve food security. Although export growth is theoretically intended to help the economic situation and has benefited the enterprises involved, it has sometimes reduced production capacity for immediate local needs. This trend also increases dependency on uncertain export markets. Meanwhile, hungry local people often do not benefit, and internal food insecurity continues or worsens. For example, even though Ethiopia exported thousands of tons of wheat to Kenya in 1996 and 1997, food deficits are still serious for the population. The government's claim of 'food self-sufficiency' is misleading, because an estimated 52 % of Ethiopia's population is food insecure (Kedir, 1997)" (Thrupp with Megateli, 1999).

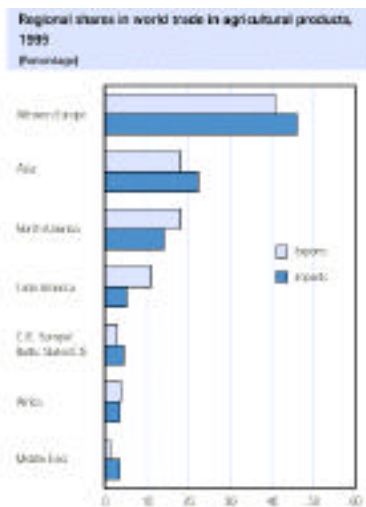


Figure 2. Regional shares in world trade in agricultural products, 1999, %age. From: WTO, Trade Statistics 1999. available online at: <http://www.wto.org>

South Africa, Kenya, and Zimbabwe have increased their exports of agricultural crops over the last ten years (Fig. 4) and the share of agricultural products out of total exports has increased over this period as well (Table 2); even while food scarcity has remained an issue within the region. Although growth in export agriculture may benefit trade balances and specific exporters, it may exasperate internal problems of food security (Thrupp with Megateli, 1999).

	1990	1999
Kenya	54.2	59.1
Zimbabwe	43.6	47.3
South Africa	12.5	14

Table 2. Share of agricultural products in economy's total merchandise exports, %age.

From: WTO, Trade Statistics 1999. Available online at: <http://www.wto.org>



employed in this sector. Major export products are tobacco, iron and steel, cotton, meat products, cut flowers. However, recent years have seen a market shift from EU towards SADC that now accounts for 30% of total exports. South Africa is Zimbabwe's single major import supplier and the two countries have a bilateral trade agreement. It is a highly imbalanced trade relation in favour of South Africa, and the imbalance has been steadily increasing during the last decade. The South Africa-EU free trade agreement is likely to have negative implications for Zimbabwe. According to studies conducted by The Trades Centre, some of the negative effects of the FTA on Zimbabwe's economy include displacement of some Zimbabwean exports on the South African market by exports from EU, particularly agricultural products; subsidised EU goods entering into Zimbabwe via South Africa and threatening local production; revenue loss; investment diversion and general reduction for preferential market access for Zimbabwean products in both South Africa and EU. Positive effects might include increased competition and some trickle down effects. (Tekere, 1999) Zimbabwe has a widespread informal cross-border trade, particularly with South Africa. This trade, which is not recorded officially, has been increasing during the last decade.

SOUTH AFRICA: In South Africa, the share of agricultural produce in the GDP is slightly receding and was about 30 billion Rand (4,4 %) in 1996. The contribution of Agriculture to South Africa's GDP was 4.2%, 4.7% and 4.5% in 1995, 1996 and 1997 respectively (The National Department of Agriculture and Land Affairs, South Africa). Altogether, South Africa's agriculture is well developed and can successfully hold its ground on the world market, especially through products like wine, fruit, vegetables and sugar (http://www.suedafrika.net/economy/e_agrar.htm). The South African economy has been undergoing a process of trade liberalisation and it is beginning to comply with WTO agreements in terms of tariff reduction and removal of export subsidies. South Africa is still to a large extent dependent on primary products in its export, mainly agricultural and mining products. Its dependence on gold, the backbone of the South African economy, shows its vulnerability with declining world market prices. Manufacturing exports are becoming increasingly important and account for around 20% of total exports. The industrial sector is, however, dependent on imported inputs such as technologies, capital goods and even product components. (TIPS, 1998)

Assessment of agricultural biodiversity resources of the region

Agricultural biodiversity in the case study countries is quite high. Ethiopia in particular has been identified as one of the world's unique centres of domesticated plant diversity (Worede, 1992; McNeely *et al.*, 1995; Thrupp, 1997). Ethiopia is a primary centre of domestication and diversification for some 38 crops. It possesses a rich diversity of genetic resources of pulses, linseed, chickpea, cowpea, niger seed, mustards, rape, ensete, teff, coffee, and other cereals such as sorghum, millets, barley and wheat (Worede and Mekbib, 1993). Farmers' landraces and their wild relatives are a global resource for crop improvement.

In the Greater Horn of Africa region, people maintain a wide variety of food crops and farmers' varieties. The region is rich in landraces of finger millet *Eleusine coracana*, which has a long storage life, preferred taste and high nutritional value, pearl millet *Pennisetum glaucum*, the world's sixth largest cereal crop and very tolerant of heat and drought), sorghum (*Sorghum bicolor*, a quick maturing food plant), the rare emmer wheat *Triticum dicoccum*, endemic *Triticum aethiopicum*, and teff (*Eragrostis tef*, with high iron and protein content) (NRC, 1996). In Ethiopia's northwest Gondar region, as an example of agricultural diversity, farmers plant together six or more crops, including maize, fava bean, sweet sorghum, cabbage, tomato, pumpkin, and bottle gourd, and grow many wheat, finger millet and barley varieties in specific mixtures to cope with drought (McNeely *et al.*, 1995). Farmers of southern and central Ethiopia have diverse home gardens that often include intercropping of taro, yam, vegetables, medicinal plants, and coffee with the perennial false banana, ensete *Ensete ventricosum*.

Diverse livestock species and forages that are managed by pastoralists also contribute nearly 30 to 40 % of the total value of food and agricultural production (Hanson, 1994, Scherf, 1995). Domesticated animal diversity in Africa comprises some 15% of the world's cattle breeds, 20% of turkey breeds, 10% of the world's goat breeds and 8 % of sheep breeds (Scherf, 1995). In the Greater Horn of Africa, there are more than 60 cattle, 18 goat, 15 sheep, 5 dromedary, and 6 wild mule varieties (Scherf, 1995).

Traditionally, farmers in the region- both men and women- have effectively managed and enhanced biodiversity in their farming and pastoral systems. Farmers plant, select and conserve multiple varieties, using intercropping, crop mixtures, and rotations. Where possible, they also plant trees in farms and use forest resources for food-related purposes. Local farmers develop new varieties and crops in response to changes or stress in the environment, threats of disease, and changing socio-economic conditions. In drought-prone areas of Ethiopia, for example, grain varieties are grown in complex mixtures to help stabilise yields over time (McNeely *et al.*, 1995). Farmers have important

indigenous knowledge of the region's agrobiodiversity, but this knowledge is generally not supported or conserved.

Zimbabwe and Kenya are thought to be centres of crop diversity for cucurbits. South Africa, while not a recognised centre for crop diversity, is one of the world's leading centre of wild plant diversity, and along with this plant diversity comes diversity in other taxa, such as bees and other beneficial insects.

Impacts of the agricultural production system on the biodiversity

Land Use



(Figure 5. Photograph of buffer zone adjacent to national park, Zimbabwe, courtesy of CAMPFIRE)

Considerable portions of land in each of the countries under consideration are under protected status. To their credit, there are over 88 million hectares of land set aside within the African continent, which makes up almost half of all protected areas in the tropics. African governments have set aside over 48 million hectares of land, or 55 % of this total, since independence. African governments spend an estimated \$115 million each year on managing these areas, which may amount to almost 20% of total land area. Actual expenditures on protected areas and wildlife as a %age of these countries' total budgets range from .20 % in Botswana to .60 % in Zimbabwe. In comparison, the US has protected 8% of its land area, and spent 15 % of its total budget on protected area management and wildlife (Adams and McShane, 1995).

However, it should be noted that protected areas are not necessarily the ideal habitat for biodiverse resources. Often, they have been selected because they are marginal for agriculture (Zimbabwe NBSAP). As well, they restrict wildlife to small areas, in comparison to the original situation of extensive wildlife migration. Before the arrival of Europeans, the African continent boasted a network of large-scale migrations, among them gazelle, scimitar-horned oryx, springboks, zebra, eland and red hartebeest. As of fifteen years ago, only the migration of wildebeest in the Serengeti and white-eared kobs in southern Sudan remained intact (Adams and McShane, 1995). Nonetheless, the wildlife species of Africa (and many of the birds and insects as well) are adapted to large-scale movements, which inevitably bring them into contact with human settlements.

Perhaps because of a long tradition of conservation and protected areas in Africa, it has also long been recognised that the fact of "shutting people out" of protected areas creates considerable inequities and tensions in the border zones around protected areas. Moreover, human populations and wildlife have co-occurred on the continent for millennium, and even with a system of protected areas, there is still more wildlife occurring outside of parks than within, in countries such as Kenya (Western, 19?). Zones of interaction between agricultural lands and protected lands have a complex set of pressures upon them, which are increasingly being recognised by the conservation community. In the countries under study here, such zones occur primarily in the central zone of Kenya, in the Rift Valleys of Ethiopia, and in northern Zimbabwe (Figure 4). There is still considerable debate on whether communities bordering protected areas should be encouraged and permitted user rights within the protected area, as an incentive to promote conservation, or if income-generating activities should be stimulated away from the

interface. A recent study of community conservation projects on the borders of national parks in Western Africa has suggested that under limited resources for monitoring and surveillance, a number of community conservation projects have been failures. Yet recent publications on forest democracy and policy in relation to forest conservation in Eastern Africa document communities in Tanzania which have turned around the status of dryland forests under their care once they have been granted full control of their own resources.

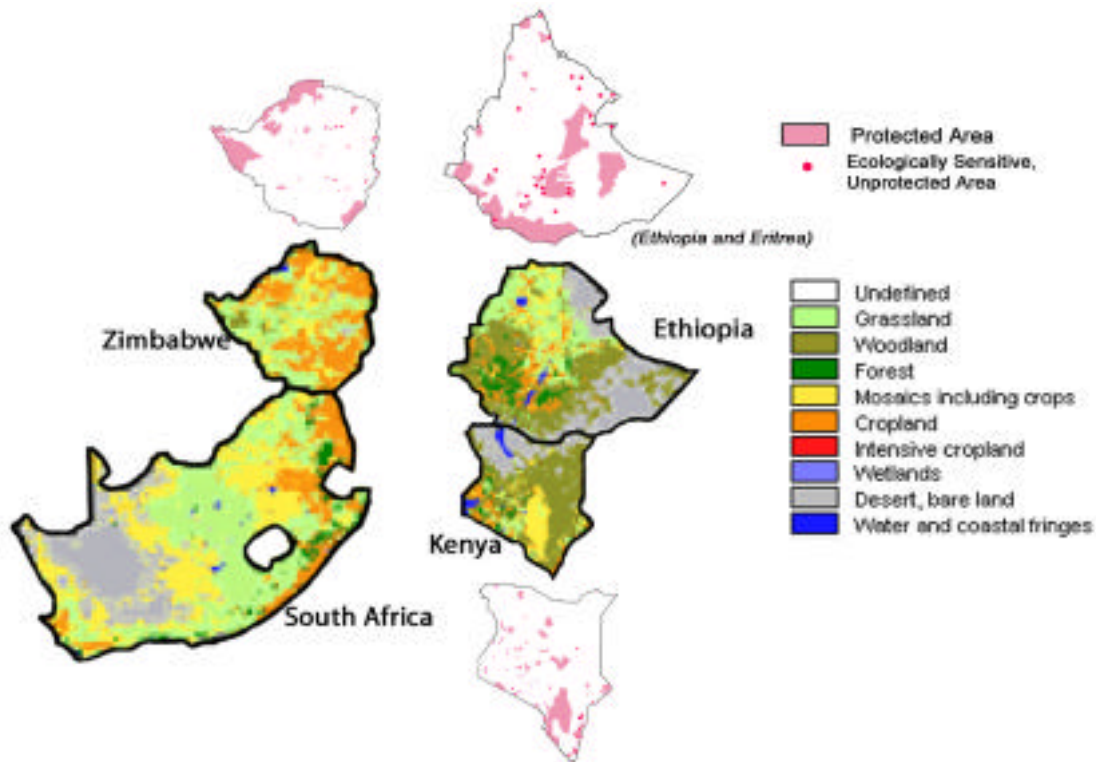


Figure 4: Maps of present land use categories in the four-country area. From: Measuring the potential of farmland: FAO's GAEZ system, available online at <http://www.fao.org/ag/magazine/0012sp1.htm>, and adjacent to each of Zimbabwe, Ethiopia and Kenya, maps of protected areas and ecologically sensitive, unprotected areas in each country, from WCMC (World Conservation Monitoring Centre). 1993. Ecologically sensitive sites in Africa. World Bank Washington DC, USA.

Zones of direct competition between agricultural land use and unprotected, ecologically sensitive areas are numerous, as depicted on the maps above (Figure 4), such as around the southern lakes region of Ethiopia, and the coastal zone of Kenya.

In the arid regions, which characterise the case-study countries, land is fairly marginal for agricultural production unless it can be irrigated. In Zimbabwe as well as other countries, there has been considerable investment in dam construction for irrigation purposes. Apart from submerging ecosystems, dam construction introduces new, mesic ecosystems in arid lands, and extract water from ecosystems further downstream, many of which may already suffer from water shortage. For example, the environmental impact assessment on the construction of the Batoka dam on the Zambezi River identified problems of flooding *Acacia albida* communities and key habitats of some birds. If irrigation water is used for intensive agriculture with high levels of agrochemicals, such chemicals can pollute surface and ground water and negatively impact on aquatic ecosystems. In principle, such adverse effects should be scoped and mitigated against in an Environmental Impact Assessment, as is now required in Zimbabwe and Kenya, and is under draft legislation in Ethiopia. The impact of agricultural development on arid land biodiversity is a real threat and needs to be better captured by planning mechanisms.

In Zimbabwe, agricultural technologies have effects on habitat fragmentation for wildlife. The elimination of tsetse flies in the Zambezi Valley has opened an area which is marginal for agriculture. In addition, the eradication of buffalo in some parts of Zimbabwe to create foot and mouth free zones or the EEC beef production areas has marginalized this wildlife species (Zimbabwe NBSAP).

All countries in the case study legally produce game meat through ranching, farming, cropping or culling, licensed hunting or problem animal control initiatives, except Ethiopia which permits only trophy hunting. These schemes, in the combined total of Botswana, Mozambique, Zimbabwe, Zambia, Malawi, Tanzania and Kenya, collectively yield about 8,500 metric tonnes of meat annually, with an estimated local value of nearly USD 7.7 million. Although significant, such quantities are small compared to potential yields. Game meat production sectors in all countries suffer from veterinary restrictions associated with the transfer of wildlife born diseases to domestic livestock. These favour domestic meat production and severely limit access of game meat to more lucrative markets. As a land use option, game meat initiatives also receive little in the way of government subsidies when compared to operations producing livestock.

Nonetheless game meat production in some countries such as Zimbabwe (2,925 mt per year) are substantial, and represent a viable alternative to other agricultural land uses such as farming and livestock ranching in semi-arid areas. Within the large scale commercial farming sector in Zimbabwe, returns from game ranching, hunting, and photographic safaris are more attractive than those from meat production. The higher returns from game in comparison to cattle farming in this sector are evidenced by the considerable shift from beef production that has occurred on some farms. Theoretical comparisons of wildlife and cattle performance in a typical communal area of Zimbabwe indicated also an advantage of wildlife over cattle (Z\$.63/kg vs. Z\$.38/kg from cattle) (Martin, 1989)

A recent report (Barnett, 2000) has highlighted the degree to which the illegal bushmeat trade is becoming a major source of protein for human populations in the area. Historically, bush meat in the region has been perceived as a purely subsistence activity undertaken by a limited number of traditional societies. The research undertaken by the author has shown that the increasing human population, acute poverty and widespread unemployment in the region, however, is leading to a greater reliance on natural resources. In one district of Kenya, for example about 14 kilograms of bush meat per household is consumed by 80% of the households each month, representing the bulk of all meat protein consumed, with domestic meat playing a reduced role in meeting protein requirements. Bush meat is in demand because it is cheaper than domestic meat, from 129% cheaper in Kenya to 75% cheaper in Zimbabwe. This use of wildlife for food is one of the main contributing factors behind the recorded declines in many animal species in the region.

In all countries of the region, there is an important level of consumption of indigenous vegetables, many of which have become adapted to thriving in a feral state around human habitation. For example, in Kenya, current research shows that the indigenous vegetable *Cleome gynandra* germinates and grows most readily in current or old "bomas"- temporary habitations built by pastoralists for themselves and their livestock (D. Augustine, pers. comm.) In Zimbabwe, there are over 30 different indigenous vegetables found in the country and the common species are *Amaranthus hybridus*, *A. thunbergii*, *Cleome gynandra*, *C. monophylla*, *Corchorus olitorius*, *C. tridem*, *Aerva leucura*, *Triumfetta annua*, *Bidens pilosa*, *Solanum nigrum*, *Cucurbita* spp. and *Hibiscus articulatus*. Most of these grow wild and are either harvested regularly or in times of food scarcity. There is, however, an overall decline in the quantity and types of major indigenous vegetables growing in these country due to the introduction of exotic vegetables.

Land degradation on agricultural land

Overall in Africa in the past half-century, approximately 2 billion hectares of land have been degraded. Of these, 300 million are thought to be highly degraded with high levels of soil erosion, nutrient depletion and desertification. (Pinstrup Andersen and Pandya-Lorch, 1995). One indicator of land degradation is soil erosion and loss of topsoil. For example, an estimated 10 billion metric tons per year of soil was lost in the Ethiopian highlands during the 1970s (Myers, 1986) leading to around 30% of Ethiopia's agricultural land being degraded by 1990. (Hutchinson *et al.*, 1991) Recently in the highlands, annual topsoil loss was estimated to be 2 billion metric tons, ranging from 2 to 10 centimetres per year (Abbi, 1995). In Zimbabwe, the communal area farming sector is thought to lose about 75 tons per hectare each year, compared to 15 tons per hectare in the large scale commercial sector (Whitlaw, 1988). Another indicator of degradation is nutrient depletion. Some analysts estimate that countries in the Greater Horn could be losing more than 20 kilograms per hectare per year of nitrogen, 8 kilograms per hectare per year of phosphorus and more than 20 kilograms per hectare per year of potassium (van Reuler and Prins, 1993).

In Zimbabwe, areas of greatest land degradation have been in natural pastures managed by the communal farming sector. A number of schemes have been initiated to introduce rotational grazing in communal areas, aimed at both improving livestock production and conserving vegetation cover, largely in areas of inherently low productivity. However, according to a study in 1992 (Chinembiri, 1992) an

evaluation of communal grazing schemes showed that there had been zero or negligible increases in herbage yield and composition, stocking rates were much higher than planned, and only 27% of the 55 schemes were adhering to the planned management systems.

Although traditional farming and pastoral systems encompass a remarkable diversity of crops, livestock and grasses in the region, this diversity has been eroded and lost over time. Extinct domestic animals in the Greater Horn include the Rwandan Inyambo cattle of Watusi variety, the Tanzanian Iringa red cattle of the East African Zebu varieties, and the Nubian wild ass last seen in Ethiopia and Sudan in the 1960s. Endangered domestic animals include the Somali pony, the Tanzanian Zanzibar Zebu, Chagga Sukuma cattle, and the Ugandan turkey (Scherf 1995).

In Africa overall, forest loss is estimated to be about 2.9 million hectares per year (Cleaver and Schreiber, 1994). Deforestation in Africa is about 30 times the rate of reforestation (Paarlberg, 1994). In many areas of the Horn of Africa, land has been virtually denuded of vegetation, primarily for fuelwood supplies (Westing, 1991). Increasing fuelwood scarcity is a related concern, which aggravates food insecurity. Throughout the region, rural people lack cooking fuel needed for survival. Women and children, who generally collect fuel, must walk long distances to obtain wood supplies. They increasingly use dung and crop residues for fuel, which can damage health and detract from soil fertility (Hutchinson *et al.*, 1991).

Land tenure policy in relation to environmental conservation

Policy makers and analysts often assume that customary land tenure (such as traditional communal systems) is inadequate for development, and that it leads to 'tragedy of the commons' from overgrazing and land use degradation. Therefore, governments in the region have instituted tenure policy changes and programmes to replace customary land tenure by new land tenure systems upholding state property and private property. The assumption has been that such changes can help increase productivity and conservation.

However, evidence contradicts this assumption. In fact, traditional tenure systems in the Greater Horn have been dynamic and flexible. Most do not involve 'tragedies' but instead have been relatively effective at resource management (Migot-Adholla and Bruce 1994). The replacement of customary systems by private ownership for land and resources tends to reduce security, partly by creating confusion and negating existing tenure (Ridell and Dickerson 1986; Migot-Adholla and Bruce 1994). State ownership has often given legal power to African elites enabling them to appropriate good lands. These changes can therefore lead to marginalisation of local people, and reduce food and environmental security (Shepard, 1998/92; Viet *et al.*, 1995; Juma, 1996).

Such problems are illustrated in the Nyeri, Kianjogu and Madu districts of Kenya, where 35 years of land titling/registration has led to land concentration, increased landlessness, and food insecurity. Here, government tenure changes vested legal rights into rights of single individuals, usually restricted to male elders. This has marginalized younger males and women farmers and tends to benefit larger farm owners rather than small holders (Roth *et al.*, 1994a). The government also established Maasai group ranches in the late 1960s and 1970s, intended to allow for community organisation and natural resource management. However, titling undermined pastoralists' mobility enforcing sedentarisation and dispossession. Politically influential non-Maasai outsiders were able to gain land unfairly, and concentrate land in ways that have increased food and economic insecurity for most Maasai community members. "

Trends in land tenure over time in the four countries have been toward a system governed by a free market. While liberalisation of land ownership has other benefits, in the context of the environment a perceived free access to land on a "willing buyer, willing seller" basis and free choice of land use combined with a single-use philosophy has exacerbated biodiversity loss and degradation (draft sessional paper on National Wetlands Conservation and Management of Kenya, January 2001 Version). That is, land becomes a commodity to be bought and sold and used as the owner deems best fit, without setting certain constraints and conditions on the basis of land use planning and conservation. This is occurring in the region as private land ownership is increasing, because despite legal instruments that relate to land use and environment there has never been comprehensive land use planning. Instead, land use planning activities have been coordinated largely at sectoral level with the exception of Ethiopia where a more unified approach has been utilized (Mutta *et al.*).

It has been acknowledged in many different ways that people need secure access to land in order to invest in its environmental improvement. Without secure access to land, biodiversity in agroecosystems is greatly threatened. Land tenure policy that encourages land sub-division, registration and

privatisation has given farmers the security, confidence and incentive to devote their time, and capital to agriculture expecting to reap the benefits there-of. This worked well while population pressure was still low but now this is leading to land fragmentation below economically viable units. There is some evidence though, that under heavy burdens of increasing land degradation, in areas of secured land tenure, some positive moves to increasing biodiversity have been recorded (Gichuki's, 19?).

Example: Due to the population increase of 2.7% in Kenya, a critical point has been reached in some areas of the country where the land parcels received by the younger generation are too small and/or too degraded for adequate food security for their own families. Often families remove land from fallow early or fallow becomes nonexistent to compensate for lowered food production, further restricting soil diversity and fertility. It has also been noted though, that in heavily populated parts of Kenya, (e.g. Kakamega and Vihiga districts) where farm size is very small, the number of trees on farms is increasing as farmers recognise their value for fodder, fuelwood, boundary delineation and food production (Sanchez, 1996; ITDG, 1999)

Movement into arid and semi-arid area – Movement into less agriculturally productive areas is having a large impact especially on the water flow of streams and rivers in Kenya. Extraction of water for subsistence agriculture and for commercial farming (including horticulture) have had a significant impact by reducing streams to dry river beds and rivers to streams. Lack of appropriate technology to convert arid into arable land is not often readily available. (Mbara, 2000). Competition for water among horticultural farms and pastoralist areas is an extremely important issue for this area, and needs more attention.

Example: Rapid land use change and land use intensification has resulted in the increase in the area under crops, extending from the semi-humid foot slopes of Mount Kenya and the Nyandarua Range to the semi-arid highland plateau. This expansion in the semi arid environment has brought about a rapid increase in the demand for irrigation. However, the rate of flow of the Ewaso Ng'iro has been decreasing since the 1960's. The median decade river flow during the driest month (February) has been reduced from 9m²/sec in the 60's to 4.5 in the 70's to 1.2 in the 80's. Much of the reduction is caused from human actions in the upper catchment river basin but as people migrate from more fertile areas to the ASAL areas the impacts are felt most heavily downstream. (Source: Ministry of Agriculture, Kenya)

Example: Previously in Kenya, a Ministry for Reclamation of Waste Lands, intended to reclaim waste (e.g. pastoral) land for cultivation was initiated. Although this ministry no longer exists in name, the official attitude to pastoralism has not changed. Governments expect pastoral communities to settle down and become cultivators, with intensive livestock keeping replacing extensive traditional systems (Odhiambo, 2000). In terms of areas, 70% of Kenya is designated as arid or semi-arid lands in which 20% of the population survive through marginal smallholder farming or pastoralism. Further settlement of pastorists will likely lead to heavy impacts on soil and biodiversity erosion and increased poverty.

Agricultural Inputs

Subsidization of agricultural inputs such as water, electricity, fertilizers and pesticides have often lead to the inefficient and environmentally damaging use. Government policies still generally exempt farmers from the "polluter pays" principle, allowing them to avoid paying the full costs of damage from pesticides, water resource degradation and other agricultural impacts (ITDG, 19?).

Use of purchased fertilisers inputs. Use of fertilizers on large scale farms, or over large areas of smallholder farms, leads to chemicals leaching into the water table effectively polluting water courses and reducing biodiversity. Use of commercial fertilizers is becoming increasingly common. Commercial fertilizers are promoted as quick fixes to low yields, a trend which many lead to a loss of traditional knowledge. Among the rural poor, amounts of fertilizers used are normally below the recommended allowances due to cost and/or improper choices of fertilizer type for soil conditions are made. Yet many farmers do not understand how to mix commercial fertilizers in combination with manures and other composting material. Government extension workers, by policy, should be promoting other means of soil fertility restoration.

Use of natural ecosystem services in agricultural production: Example: In Ethiopia, the degradation of forested areas has reduced fertility, and as fuelwood supplies have become scarce, rural dwellers have turned to dung for cooking. This diverts organic fertilizers from soil fertility maintenance. Programmes aimed at enhancing the supply of fuelwood create a farm-level incentive to redirect dung to soil fertility restoration. While research has suggested that " these programmes compete with commercial fertilizers to some extent" (FAO, 1992); from the standpoint of sustainable agriculture this is not a

negative feature. A National Fertiliser project was instituted in Ethiopia around the time of this report, aimed at about 5% of the farmers in the country. It was to include a component to promote organic fertiliser, i.e., the promotion of compost, but it does not seem to have caught on. A latter project through an NGO (see ISD, below) however has effectively disseminated information on composting techniques.

The five-year development plan for Ethiopia anticipates for large increases in the use of chemical fertilizer. As a recognition of the environmental damage, the document states '... the chemical inputs used, will be appropriately chosen, their use will be minimized to the extent possible and care will be taken about their utilization.' In general, the high input package has been presenting much more "softly" in Ethiopia with farmers encouraged to use the fertilisers provided with their own best farmers' varieties, and very little to no pesticides are used on a routine basis.

Some farmers are experimenting with mixing compost and chemical fertilisers, which is interesting because scientific researchers are also looking into mixes which are more effective than either alone. In this case, the farmer(s) had developed the innovation on their own, as the extension service in this area of Ethiopia does not have a mandate or training to advise farmers on mixing. In fact, farmers receiving assistance with agricultural inputs can be penalised or threatened if they refuse or alter the standard high-input package. There is also a strong division in thinking that compost is for organic systems, and chemicals for the other, and that as organic systems do not allow any mixing, the two should be kept separate.

The Institute for Sustainable Development in Ethiopia notes (Pers. Comm.) that most farmers in Ethiopia do not know how to make compost systematically. It has not been a part of the traditional system in most areas. In the ISD project sites where the farmers were using chemical fertiliser, they have moved fast to compost because the subsidy on chemical fertilisers has now been completely removed. Adjacent communities to project sites have spontaneously taken up composting to replace chemical fertilisers. The Regional Government of Tigray has adopted the ISD-recommended "package" to over 40 communities in the region as part of the overall food security development. The "package" includes making compost, biological and physical soil and water conservation including planting trees (the preferred species is *Sesbania*) on bunds and stopping gullies, and making ponds for water to help in the compost process during the dry season. The communities are also encouraged to make statutes/by-laws to take control of the improvements they have made, but this is the weakest part of the "package".

The shift from chemical fertilisers to organic methods is gaining urgency in Ethiopia, as the price of grains have fallen very fast, and farmers are being painfully squeezed by high input prices and low sale prices. Farmers that grow maize as their main crop are now in crisis, and suicide rates are reported to be rising, as in India.

Use of pesticides – As for the use of fertilizers, the use of pesticides is becoming increasingly more common. Rational uses which are critical for food security need to be emphasised over the all-to-often poorly informed uses.

An example of the former is the situation in Kenya and Ethiopia with pest which build up rapidly into plague status. Some of these in Ethiopia are army worm, desert locust, sorghum chafer and an endemic orthopteran, the Welo Bush Cricket. Locally, other grasshopper species can congregate and cause devastating local damage, particularly to seedlings. There is no way the natural system can stop these plagues once the pest has passed a critical population threshold. Naturally, they eat or fly themselves into their own destruction. Locust swarms and army worm invasions arise from a combination of climatic events and it is only major climate action, like strong winds and devastating rain that can remove or knock down these pests naturally. The only means people have to combat them is chemicals, and timely use of chemicals can help prevent devastation. This is the rationale behind the Desert Locust Control Organisation of East Africa. If chemicals are carefully used and 'on time', i.e.m, when the populations are just starting to build up, a lot of damage including damage to the overall biodiversity over a large area, can be prevented. One challenge from these uses of pesticides for migratory pests is the need to have large stocks of pesticide on hand to fight them.

Irrational uses of pesticides often stem from poor training of applicators such that recommended dosages are often not used. In addition, use of banned substances from other countries are often still in use. The effect of pesticides reduces biodiversity within the soil and water table and spreads through to adjacent areas affecting the entire food chain. Natural forms of pest control are destroyed in the process of supplying chemical controls, as beneficial insects are killed alongside pests. Loss of insects leads to a resulting loss of pollinators, natural control of crop pests and diseases and nutrient recycling (Thrupp, 1998).

The pesticides market in Kenya has been evolving over the years, and in 1997 stood at about 2.2 billion kshs (Mwangi, 2000). In Zimbabwe, agriculture currently uses almost US\$60 million of chemical pesticides.

All countries in the region, however, have integrated pest management programs on some staple crops, which should be expanded to provide more alternatives to chemical pesticides alone..

Demographic pressures

Population growth - The growth rate in the region is approximately 3%. Population growth is attributed to poverty, limited education, and poor access to reproductive health services. This often leads to harvesting of resources at unsustainable rates. As many rural poor populations largely depend on subsistence agriculture for their livelihoods, population pressures also lead to an expansion of agricultural lands (Wood *et al.*, 2000). The NBSAP for Kenya identifies a poverty alleviation strategy as strengthening national programmes involved in population control programmes so that they may achieve sustainable population growth rates.

In several examples from the area, however, people in more densely populated areas are more inclined to practice soil conservation. Gichuki *et al.* Study in the Machakos regions of Kenya on population increase and resource management showed that more people do not necessarily lead to more devastation. In Ethiopia, as well, the best-managed areas are also those with the densest populations, i.e., the enset-growing areas. These areas have the largest agrobiodiversity when the "home gardens" are also included.

Example: In many countries, and especially in Ethiopia, domestic animals are central to crop production as cattle are used as draught animals for ploughing in addition to their use as milk and meat products. Because of this, an increase in crop cultivation necessitates an increase in domestic animal production. Throughout the world in general, but Africa in particular, the demand for meat and livestock products is expected to increase faster than the demand for other foods (Wood *et al.*, 2001). This is an important trend, especially for this area, and merits more mention. With regard to policy development, recognition that livestock population in Africa exerts an additional pressure on the renewable natural resource base is required (UNDP, no date).

Rural to urban migration – The loss of young and middle aged adults who migrate to urban areas in search for work reduces the labour available for subsistence food production. Consequently, decreases to the amount of land under cultivation occurs as the strongest sector of the family are absent. As families become smaller and less people are available for agriculture, more land becomes fallow (which may be favourable for biodiversity) but less labour is available for agro-diverse farming.

Example: There is apparently strong evidence of this in Western province of Kenya. (E. Owango pers. comm.)

HIV/AIDS – The impacts on agrobiodiversity by victims of HIV/AIDS are likely to vary by agricultural system. In rainy areas, where a variety of crops are planted throughout the year, families can cope relatively well with the loss of few labourers. They may reduce the area cultivated and cut back on the number of crops planted, but may still be able to produce an adequate amount of food. In dry areas, where farming depends on one or two crops that must be planted and harvested at specific times of the year, the impacts are likely to be more severe. In these areas the loss of a few workers at the crucial periods of planting and harvesting can significantly reduce the size of the harvest. The loss of labour force because of HIV/AIDS could make it difficult for families to feed themselves especially if that system is based on a cash crop (Barnett, 1999).

The amount of land under cash crop production will likely be reduced before food crops. The time taken to care for the sick and seek medical assistance often directly impacts on time available for agricultural production. The outcome might be less timely farming practice resulting in reduced yields and over time, a general decline of household welfare (Bollinger *et al.*, 1999).

In many areas of Eastern and Southern Africa where food security has been a continuous issue because of drought, any declines in household production can have serious consequences. Additionally, a loss of agricultural labour is likely to cause farmers to switch to less-labour-intensive crops in some areas. In many cases this may mean switching from export crops to food crops. Thus, HIV/AIDS could affect the production of cash crops as well as food crops (<http://www.arcc.or.ke/nascop/impact.htm>). Consequently, increases in widespread malnutrition,

additional burdens for rural women, especially farm households run by women, arising from gender division of labour and land rights/resources will directly affect the amount of time to devote to biodiversity conservation and innovative farming solutions.

Although government and non-governmental measures have been put in place to support effective programmes to control the spread of AIDS (e.g. Sessional Paper No. 4 on AIDS in Kenya, 1997) the epidemic continues and the effects are accumulating.

As AIDS impacts on the working knowledgeable section of a society, the indigenous knowledge of traditional health practitioners and others who know and work with local biodiversity as well as farmers is lost. Very young are left with very old, but in such conditions of stress and burdens of caring for the ill and young, there will be little time for the elderly to transmit their knowledge to the young. (ISD, pers. Comm.)

Example: More than 50% of Zimbabwe's population reside in rural areas and are dependent on smallholder agriculture for their livelihood. Impact studies reveal a decline in cultivated acreage for the 1997/98 season due to reasons related to HIV/AIDS: shortage of labour, lack of essential inputs, draught power and farm implements. Besides the decline in crop acreage, AIDS-affected households showed poor crop management and harvest, experiencing losses in marketed output of more than 50% in maize, cotton and sunflowers. The loss of husbands, who are often solely responsible for marketing, led to marked declines in revenue and marketed produce, especially maize and cotton. So far Zimbabwean data do not indicate a dramatic switch from cash to subsistence crops (Bollinger *et al.*, 1999).

Example: As funeral attendance is an obligatory custom in many parts of rural Zimbabwe reduced contact hours between farmers and extension workers are experienced. On average extension workers spend 3 days per month (10% of total working time per month) attending funerals in their working areas. Additional contact hours are lost due to staff attrition and time the farmers spend attending funerals. Normally females and children, the most vulnerable, do not have the same time and access to extension services; this is now further compromised due to their increasing responsibilities with the loss of family members. The results of a decline of extension services is, in some areas, related to the loss of biological conservation information especially when the number of hours of extension are already extremely limited (Bollinger *et al.*, 1999).

External Factors

Influence from the West - Influence, especially the drive to monocultures, has been strong. This has been supported by policies and economic incentives and promoted through research and development programmes of the North (Thrupp, 1998). While in the short term, productivity was seen to increase in the region, vulnerability to pests and climate and economic changes make this system high risk for small and large farm holders.

Example: The NBSAP of Zimbabwe clearly states that mechanisation and industrialisation of agriculture have contributed to increasing environmental impacts. The document outlines the main effects: salinisation from fertiliser and other chemical inputs, erosion due to inappropriate farming practices and overcrowding in former homeland areas, displacement of rural populations, reduction of habitat and biodiversity, and subsidies that encourage wasteful and inappropriate use of land, water and other natural resources.

Example: In Zambia, highly uniform, high yield varieties of maize experienced devastation when a mould infested crops in 1974, and destroyed 20 % of the hybrid plants. The impact on traditional maize varieties was negligible (John, 1974).

Example: The Home Economics Offices and Ministry of Health staff in Kenya has documented that cash crop areas have higher malnutrition cases despite farmers earning higher incomes. As poverty increases with decreasing biodiversity, farmers spend a greater portion of their day in basic activities (what are "basic activities) resulting in little or no funds or time for investment in conservation activities as seen in the Nyando River Catchment Area of Kenya (Source: Ministry of Agriculture, Kenya, 2000).

Example: Traditional foods and varieties in Ethiopia such as barley, have been replaced by forage oats, *Avena sativa*, in the barley growing areas,

Relief Aid - Food aid undermines the potential of indigenous species as it does not offer incentives to encourage biodiversity protection as it removes the links between people and their sustaining ecosystems, and thus provides no incentives to conserve them (Mutta, *et al.*, 1998) Food aid and drought relief in the form of seed provision almost always contains only seed of 'modern' varieties of the main crops, which makes it very difficult for farmers to maintain biodiversity of local crops and minor crops after a drought (ITDG, 1999).

Example: During the civil war in Mozambique, farmers in one remote rural area were supplied with hybrid maize seed by an agency. This provided a crop in the first year, but the farmers needed to save seed from the crop for the following season, as there was no regular formal sector seed distribution in the area. Being of hybrid varieties, the seed they saved yielded extremely poorly the following year, so they were again unable to sustain themselves without outside support. The impact proved to be even greater as farmers had some small supplies of composite maize seed hidden in reserve. However, on receiving the hybrid maize seed, they planted this and used their own stocks of seed as food (source unknown).

In Ethiopia, however, all farmers keep reserves of their key varieties and "would rather starve than use them as food" (ISD, pers. Comm.). Often these critical stocks are placed in pits in the ground and covered so that only the farmer who placed them there knows where to get them. However, the farmers will also grow seed from food aid, as explained.

There are two other aspects of food aid that threaten biodiversity. One is the introduction of aliens, particularly weeds. For example *Parthenium* came into Ethiopia in the 1970s with shipments of food aid. The other is now the appearance of genetically modified seed, particularly maize, in food aid.

The extent to which food relief could affect agrobiodiversity is reflected in the recently revised Emergency Operation document that was jointly approved in January 2001 by FAO and the World Food Programme for food assistance to 4.4 million drought affected people in the region, worth US\$148.9 million for a period of six months.

Summary of status and trends of key aspects of biodiversity

Agrobiodiversity loss continues in the Eastern and Southern African region due to many factors, many of which are listed above. These coupled with inadequate national and international policies, which have not mainstreamed a more diversified agricultural approach and which have restricted much of their application on a few introduced species, further impacts the negative trends.

On the ground, this is especially evident with extension workers that are too narrowly focused on agriculture without providing information for a more integrated approach. Agriculture extension workers are few, in some cases the officer-to-farmer ratio is in the range of 1:1000 (Source: Ministry of Agriculture, Kenya, 19?). NGOs and community-based organisations have taken on a majority of the role from government with work in rural areas on sustainable agriculture projects. There is little material to instruct either extension workers or implementation-oriented NGOs on the role of ecosystem services in agriculture, for instance, or other aspects of agrobiodiversity.

Although, the technological capabilities to undertake *in-situ* conservation have been weak, Ethiopia, South Africa and Kenya and the Southern Africa Development Community (SADC) have established well-functioning gene banks thus leading the way to extensive *ex-situ* crop germplasm maintenance.

With greater movement towards commercial farming inputs, people have become more reliant on purchased food. In-situations of fluctuations from climate and market values, this has already lead people into greater poverty (46% of Kenya and 27% of Uganda's rural population live below the poverty line) with an overall reduction in health with declining biodiversity (Mutta *et al.*, 1998) as the reduction in consumption of indigenous foods – due to changing economic conditions and diet has lead to poorer nutritional status of children (e.g. Kakamega, Kenya) (Mutta *et al.*, 1998). In Ethiopia, poor diets, almost totally carbohydrate-based, have come about with the decreasing land area available to each family, so the traditional mix of cereal-pulse-oil crop has disappeared. Cereals are grown at the expense of pulses, and oil has almost completely disappeared from the diet of subsistence farming families. In the enset areas, the traditional diet is anyway short of protein, and the reduction of grazing areas has lead to less milk production. Milk produced is often used to extract butter for sale to the better off in the urban areas.

Population growth region wide is about 3%, which leads to a doubling of population approximately every twenty years. The HIV/AIDS epidemic will have devastating impact on the population especially in the

Southern Africa region where population growth is expected to be negative by mid-decade (The U.S. Bureau of the Census). Given the population increase in Eastern Africa and the burden of HIV/AIDS in Southern Africa within depressed economies, the food production trends suggests continued low self-sufficiency.

Government policies still largely fail to mainstream the environment into sectoral plans and policies, and agriculture is no exception. In South African, a great many policy documents have been developed, but land and agrarian reform policy still suffers from a lack of holistic management of environmental issues that impact on the poor. The vision of integrating environmental concerns into rural development has been difficult to fulfil due to confusions within the land reform process and due to the fact that land reform itself is not sufficiently integrated in rural development planning. In addition, more attention needs to be given to the philosophy of sustainable agriculture and greener agricultural practices, with which modern South Africa has very little experience (Turner & Ibsen, 2000).

Ethiopia has a comprehensive environmental policy, adopted in April 1997 which includes agriculture. Now laws to support this have been drafted and are going through the process of entering national legislation. Each region has also produced its own comprehensive conservation/environment policy and much effort is being put on getting environmental concerns considered in all relevant development processes. The latest is an Environmentally Sustainable Industrial Development (ESID) programme for the country.

Market forces favor "new" varieties and use of agrochemicals and well as larger economies of scale, the foci of agro-industry in lower-labor, industrial and monocultural production systems, leading to reductions in agricultural biodiversity. Other negative indirect effects are reduced recognition of local knowledge systems or of local diversity (e.g. local varieties and foods). This leads, in turn, to lower investments in local technological development by scientists and other innovators (including farmers). It also leads to lower income opportunities in agriculture in particular and in rural areas in general, and to the consequent loss of skilled people and new entrants into agriculture owing to outmigration from the area or the sector (FAO, 1999).

By focusing on cash and export crops, governments have opened the rural economy to the influences of the global system of markets that transmits international prices to local communities. The result has been that most farmers are unwilling to continue producing basic food crops for domestic consumption because of the new opportunity to profit from commercial crop production. The value of traditional food plants has thus been eclipsed by the economic attraction of other food and non-food crops leading to reduced focus on production of these food crops. For example, in Africa, crops of African origin account for only 30 % of continental production – Kenya has a high rate (53%) of reliance on exotic crop species (Wood, 1993). In effect, national agricultural policies are stimulating genetic erosion through the process of modernization of agriculture that promotes hybrid crops (Mutta *et al.*, 1998).

Donors are pulling out of South Africa and Kenya as they have in Zimbabwe. Decrease not only in finances but exposure to international thinking and experience implied by reduced external support may also impact biodiversity (Turner & Ibsen, 2000). However, this may also be a time that innovative approaches and self-sufficiency are generated.

Approaches to the conservation and management of the following components of agrobiodiversity, in national agricultural plans and in national biodiversity strategies¹:

With the exception of Ethiopia, none of the African countries have developed specific policies on plant genetic resources in general and *ex-situ* conservation of the resources in particular.

The main objectives of Ethiopia's biodiversity policy are: to ensure that the country's plant genetic resources are preserved, developed, managed and sustainably used; to promote the integration programmes for plant genetic resources conservation and development into national and regional development strategies and plans; to promote the creation and strengthening of national scientific capacities to explore, collect, assess, study, introduce, improve, manage and sustainably use biological resources; to encourage the participation and support of local communities in plant genetic resources conservation and development and ensure that farmers/communities share the benefits accruing from the utilization of indigenous germplasm; and to recognize, foster and augment traditional methods and knowledge of local communities relevant to the conservation and sustainable use of plant genetic resources (Mugabe, 1998).

In most countries of the region, governments have created a wide range of institutions to deal with the various aspects of biodiversity management. Most are engaged either in research, or in practical conservation. In Kenya, those that deal with plant genetic resources are the Ministry of Agriculture, Kenya Agricultural Research Institute (KARI), which houses the following departments: the National Agricultural Research Systems (NARS), the Plant Quarantine Station and the Gene Bank of Kenya (GBK); KEFRI including the Kenya Forestry Seed Centre and the Plants for Life Research Programme, the National Museums of Kenya (NMK) including the East African Herbarium and the Centre for Biodiversity.

Note: South Africa has not yet developed their NBSAP

Pollinators

Ethiopia:

Agricultural Policy – The Ethiopian Agricultural Research Organisation is in the process of being newly reconstituted, and is seeking to develop a component of research in pollination, initially in relation to pulses in the Ambo region.

NBSAP – Makes that understatement that “there are some evidences that chemical used for weed control at certain time have seriously affected the honeybee flora of Ethiopia in some localities

Kenya:

Agricultural Policy - National Livestock Development Policy of 1980 is the most recent document dealing with pollination. Apiculture is promoted for income generation and in this context expansion is encouraged.

NBSAP - Kenya and South Africa are moving forward with national initiatives that will form the Africa Pollination Initiative (API), which will then feed into the International Pollination Initiative (IPI). The Plan of Action of the IPI will be presented at COP6 for the CBD. These initiatives are an outcome of the CBD COP Decision V/5. (The document from the pollinator workshop should be ready soon, and can be mentioned here)

Within the region, Sudan, Mauritius, Madagascar and Ethiopia have developed limited capacity in the pollination field however this is generally limited to one or two individuals (C. Eardley pers.comm.) These people have shown interest however they have not initiated actions within their own countries to join the API. The IPI, AFI and the national initiatives are not yet funded.

The emphasis of the Kenya Pollination Initiative is:

- Comprehensive analysis of status and trends of pollination diversity;
- Identification of management practices which promote positive and mitigate negative impacts of agriculture on biodiversity including enhancement of productivity and capacity to sustain the service and support national plans and strategies for conservation and sustainable use of pollination.

Kenya has formed a national working group on pollination under the auspices of the National Environment Secretariat to coordinate and implement pollination activities. Some initiatives are already underway in various institutions and the Kenya Pollination Initiative is already assessing these activities so that they can be consolidated into a national pollination policy, in particular, the National Food Policy, which is under review in late 2001.

Kenya is the only country in Africa, which has nominated a GTI focal point as recommended by the CBD.

However, no mention of pollinators is included in the NBSAP.

Zimbabwe:

Agricultural Policy - The Bees Act aims at the control of diseases in bees and generally seeks to regulate the conservation of bees found in the wild. The Act makes provision for the declaration of diseased bee areas in which the responsible Minister is empowered to destroy bees. Bee conservation is provided for honeybees, and is to be achieved primarily through measures restricting the removal of bees found in natural hives and creates an offence where this is done without the express consent of the appropriate authority for the land on which the natural hive is located.

NBSAP - Pollination is biased toward agriculture rather than ecosystem functioning in general. It is within this framework, that the valuation is viewed in the NBSAP but limited to some comments on the valuation without any quantifying such as “While wildlife resources such as insect species (e.g. bees) are an important and integral part of the agricultural sector, they do not have easily determined monetary values.”

Other relevant statements include:

- In the Economic values and wood supply in non-commercial forestry section honey is mentioned as a non-timber product;
- In the Effect of technology on biodiversity section “... the decline in the population and species range of soil organisms such as beneficial fungi, bacteria and insects such as bees; which are important in the pollination of certain crops such as sunflowers;”
- Mention of the Bees Act and describes its function.

South Africa:

Agricultural Policy – No mention is made in the White Paper on Agriculture.

NBSAP - The South Africa Pollination Initiative has not yet drawn up an Action Plan but has developed much capacity albeit working in an uncoordinated manner.

Soil biodiversity:

Ethiopia

Agricultural Policy – Soil Husbandry and Sustainable Agriculture policy. The relevant sectoral policies emphasize:

Improving and intensifying existing farming systems particularly traditional land management systems by developing and disseminating technologies which are biologically stable, and economically beneficial for farmers.

Crop breeding from multiple lines to increase the plasticity in adapting to environmental variations and resistance to pests and diseases; (not sure this relates to soil biodiversity- more plant genetic resources).

Increased farmers’ access to land and natural resources with a view to enhancing investment in sustainable land management technologies.

NBSAP - Explore, collect, identify, characterise and conserve authentic cultures of microorganisms relevant to the development of agriculture. With respect to soil biodiversity, *Rhizobium* spp (biological nitrogen) is mentioned.

Kenya:

Agricultural Policy – No national policies exist for soil biodiversity. In the Environmental Management and Co-ordination Bill, 2000, the only mention of soil is in relation to curbing soil erosion (47(2)(c)). Soil is considered a forest product in the existing Forest Act...there is a large phenomenon of people “stealing” soil or extracting it from forests for their farms and gardens.

NBSAP – No specific mention was given, other than references to soil erosion.

Zimbabwe:

Agricultural Policy – It is noted in the Zimbabwean NBSAP that the agricultural regulatory framework measures for the control of soil erosion and that soil conservation is lacking in the legislative instruments regulating the agricultural sector. This is surprising, in that agriculture forms the backbone of the country’s economy and is key to much of its environmental degradation. Soil conservation is solely treated in the Natural Resources Act, which authorises the administering Minister to “carry out steps to prevent or mitigate soil erosion or promote soil conservation.”

NBSAP – Within Zimbabwe’s National Biodiversity Strategy and Action Plan, in the section on Forestry, it is recognised that mycorrhizal fungi are associated with a wide range of exotic and indigenous tree species of Zimbabwe. The role of these fungi in improving tree growth by increasing the absorbing surface of the root system, assisting with nutrient uptake, and making feeder roots is recognised. Entomycorrhizae (mostly produced by mushrooms) and endomycorrhizae (mostly

produced by phycomycetes of the genera *Endogone* and *Glomus*) are often associated with miombo and Kalahari tree species respectively. The plan recognises that very little work has been done on these fungi, nor on bacterial associates of leguminous tree species.

In the plan under Agriculture, relevant microorganisms are noted as,

“ A number of mycorrhizal fungi are known to be beneficially associated with root systems of many crop plants. For example, cassava, citrus, onion, cowpea, asparagus and *Stylosanthus* species have strong dependency; maize, sorghum, and *Paspalum* species have medium dependency, and wheat, barley, potatoes and rice have weak dependency on mycorrhizal fungi. However no detailed studies have been undertaken to determine the quantitative benefits of such associations and how they can be enhanced. With respect to livestock, fungi such as *Saccharomyces cerevisiae* (a yeast) and *Armillaria heimii* (a white rot fungus) are known to increase forage and roughage utilisation in ruminants (cattle, goat and sheep).

Legume crops commonly grown in Zimbabwe (e.g., soyabeans, groundnuts, cowpeas, field beans and pastures) form associations with strains of Rhizobia. These nitrogen fixing bacteria have received a lot of attention with about 540 local and exotic strains of Rhizobia and Bradyrhizobia being kept by the Ministry of Agriculture at Grasslands Research Station primarily for inoculant production.

Associations between bacteria and non-leguminous crops are also known to exist. Such associations involve nitrogen fixing bacterial species such as *Azospirillum* with crops like maize, wheat, rice, sugarcane and sorghum and have demonstrated considerable nitrogen fixing potential.

South Africa:

Agricultural Policy – A soil conservation scheme, in terms of national legislation provides some limited support to farmers in dealing with soil conservation and rehabilitation, and the Government undertakes 'Key Soil Conservation Works' in identified critical areas on state and communal land. The criteria for investing in Key Soil Conservation Works are policy considerations (targeting historically disadvantaged areas), the rotation of work regions, the adding of capacity where it is lacking, the extent of the degradation and the feasibility (including a cost benefit analysis).

NBSAP – N/A

Biodiversity that provides mitigation of pests and diseases

Ethiopia:

Agricultural Policy – no mention is given.

NBSAP – Although the document does not explicitly use the terms Biodiversity that mitigates against pests and diseases, it does refer on several occasions to the importance of traditional knowledge of the characteristics of the germplasm.

Regeneration, characterization, and Evaluation (Section 2.1.3) for *ex-situ* collections:

- “Assessments of germplasm for morphological, physiological, and cryptic variations add to the value of collections and attract breeders and other researchers to further screen and use the germplasm”
- “the germplasm description and evaluation works will include several important traits such as resistance to biotic and abiotic stresses ...”

Research and Germplasm Utilization (Section 3)

- “ systematic and in depth evaluations, which attributes to nutritional qualities, industrial values, biotic and abiotic stresses will be conducted on specific characteristics of the germplasm”

Kenya:

Agricultural Policy – No mention was given.

NBSAP – No mention was given.

Zimbabwe:

Agricultural Policy – Legislation pertaining to the sale of pesticides was first reviewed through Fertilizers, Farm Feeds and Remedies Act (Chapter 111) of 1953. Regulations governing the

compulsory registration and sale of pesticides appeared under Government Notice 241 of 1971, subsequently amended by Government Notice 10 of 1977; which was further amended by Statutory Instrument No. 320 of 1981.

These notices regulate the manufacturing, importing and formulating of pesticides. Zimbabwe has succeeded in complying with international agreements on safety measures on restricted or banned pesticides however there is still a need to strengthen policing mechanisms to ensure that the supply of untested and unregistered pesticides is contained before it reaching hazardous proportions (Chikanda, 1999).

NBSAP – The NBSAP of Zimbabwe notes that:

“The widespread use of traditional crop varieties (landraces) by smallholder farmers tended to have a positive effect on agrobiodiversity. However, the commercialisation of agriculture has led to the adoption of intensive cropping methods such as the use of hybrid seed, inorganic fertiliser, pesticides and monocropping. On the other hand, low-input, low-output agricultural systems such as agroforestry and intercropping used to enhance biodiversity and to guarantee food security at the household level. Further more, the use of plant species such as blackjack (*Bidens pilosa*), marigold (*Tagetes minuta*) and chowa (*Datura stramonium*) instead of inorganic chemicals to control termites, aphids, cutworms and other insects helped reduce the adverse effect of chemicals on the environment.

It is noted that the use of modern technology such as agricultural chemicals has resulted in a decline in the population and species range of beneficial fungi, bacteria and bees. Biotechnology in Zimbabwe has sought to improve the propagation of certain crops such as tobacco, wheat, sugarcane, Irish potato, sweet potatoes and maize through tissue culture techniques for disease elimination, transgenic tobacco and development of biopesticides and biofertilisers.

It is hoped that pesticide use can be reduced in Zimbabwe through , for example, conferring resistance to Cowpea Aphid-borne Mosaic Virus in cowpea by biotechnology.

South Africa:

Agricultural Policy – At this stage, policies for promoting integrated pest management have as yet not been integrated into national development policies.

NBSAP – N/A

Crop and livestock genetic resources

Ethiopia:

Agricultural Policy – Article 88 of the Constitution responds to two aspects: land degradation and erosion of biodiversity and *destruction of local organizations?* by the centralizing state. The Article aims at countering the adverse trends of genetic erosion and strengthening local initiatives respectively.

The Environment Policy promotes *in-situ* conservation of crop and domestic animals, biological diversity, as well as other man made and managed ecosystems, through the conscious conservation of samples of such ecosystems, even when change as a whole is taking place.

The Seed Industry Policy acknowledges use of improved seeds when necessary at the same time it stresses that this should be kept to a minimum thus ensuring that high yielding farmers' varieties continue to be used and encourages the use of native agrobiodiversity, in the development of varieties. In this context, it states.

‘...The accelerated genetic erosion of local land races and farmers' varieties, as a result of aggressive promotions of improved exotic varieties will be minimized and checked through implementing balances, developments in the areas of plant genetic resources conservation, and seed production and supply’.
“The national crop breeding programmes will as much as possible, be based on the principle of using the indigenous crop genetic resources and the agricultural systems as the foundation of the crop improvement work.’ One important implication is the decoupling of seed and other inputs, so as to prevent the giving up of existing genetic resources, in order to have access to agricultural inputs. This is done by preventing ‘private (domestic and foreign) seed enterprises; from having ‘monopoly of the production and supply of seed of any one crop’ and by promoting ‘the active participation of farmers in the seed industry and the sustainable use of local cultivators...’

Nearly all the coffee trees in South America are descended from a single tree from a botanic garden in Holland, *Coffea arabica*. The original plants were first obtained from the now near-extinct forests of southwest Ethiopia (Thrupp, 1998). In event of catastrophe, few wild *Coffea arabica* exist to replenish crops and those that remain will, once again, have limited genetic diversity. Fortunately in Ethiopia, most coffee is still grown by smallholders and they have their own varieties. The government gene bank has a large living collection of coffee as well.

NBSAP – Through the Crop Genetic Resources (CGR) programme there is a focus on *ex-situ* collections and research, identification of the degree and nature of genetic erosion caused under different agro-ecological regions and in areas with unique farming systems.

Kenya:

Agricultural Policy – The Kenyan government, developed its Plant Breeders Rights law in 1991 and in 1993 approached International Convention for the Protection of New Varieties of Plants (UPOV) with a request to accede to the 1978 version of the convention rather than the 1991 version because the earlier version preserved the traditional privilege of farmers to replicate, replant, and exchange protected seed varieties for use on their own farms. Because of the implementation of the Plant Breeders Rights law, Kenya ensured its compliance with the TRIPS agreement in WTO (Paarlberg, 2000).

NBSAP – Restore and re-introduce species and varieties that are already lost by conducting surveys to determine the status of rare or threatened germplasm. Re-introduce and propagate lost species from gene banks and other sources; Promote farming practices that conserve the ecosystem.

Zimbabwe:

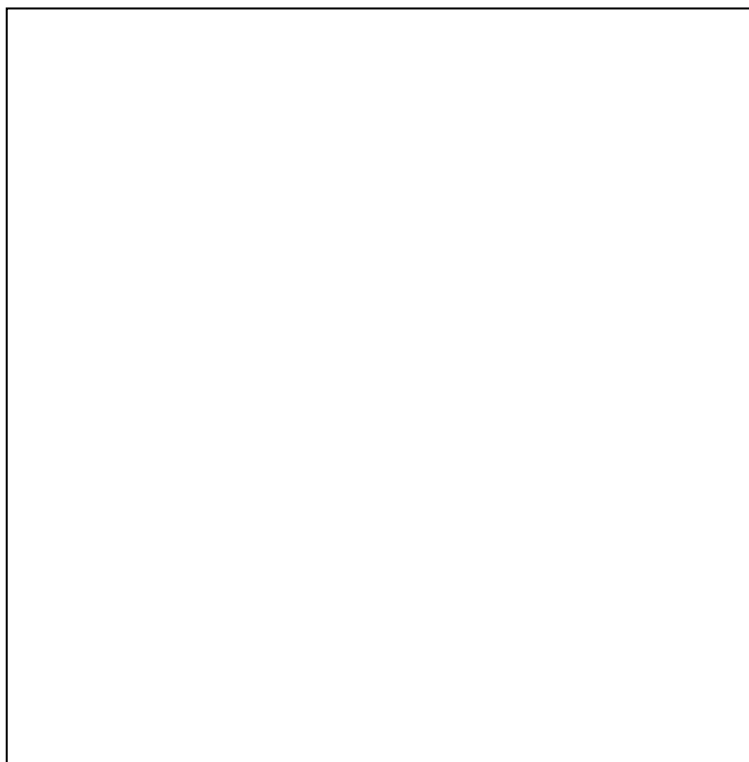
Agricultural Policy –

Key statutes relating to the agricultural environment include the following:

Statute	Description
Plant Pests and Diseases Act	Provides for the eradication and prevention of the introduction and spread of plant pests and diseases in Zimbabwe; applies to both live plants and tubers, bulbs, corn, roots, cuttings, grafts, seeds and fruits.
Plant Breeders Rights Act	Regulates the registration of new varieties of plants and enjoins the holder of a plant breeders right to maintain the reproductive material.
Sericulture Act	Promotes sericulture
Agricultural Research Act	Provides a framework for agricultural research.
Animal Health Act	Provides for the eradication and prevention of the introduction and spread of animal pest and diseases. Includes any class of vertebrate animal whether domesticated or wild. Establishes a strict regulatory framework with regards to the control, importation and destruction of diseased animals.
Bees Act	Aims to control diseases in bees, and seeks to regulate the conservation of bees found in the wild. Diseased areas can be declared, within which bees are to be destroyed. Bee conservation is sought through restriction on removal of bees in natural hives.
Locust Control Act	Seeks to eradicate four species of locust which are harmful to agriculture.
Quelea Control Act	Makes the quelea bird a notifiable pest. In prevention of massive damage to agricultural crops, drastic measures of control are permitted
Noxious Weeds Act	Provides for the eradication of noxious weeds and places a duty on owners of infested land to eradicate noxious weeds.
Fertilisers, Farm Feeds and Remedies Act	

Zimbabwe is rich in domestic plant genetic resources which include cereals, pulses, industrial and horticultural crops, indigenous and exotic vegetables, roots and tubers, and medicinal plants. Wild relatives of some of these crops also exist, including cotton, rice, sorghum, pearl millet, finger millet, cowpeas and bambara nuts. However, very little work has been done to document the diversity and distribution of these wild relatives.

Of major food crops in Zimbabwe, the following accessions have been made:



further committed itself to building two dams per district per year ...” This promise has not moved forward due to financial constraints.”

At present in Zimbabwe, some farmers still use landraces of traditional crops such as sorghum, millet, cowpeas, bambara nuts, pumpkins and water melons for food security. However, agricultural commercialisation has adversely affected this practice. A number of initiatives have been mounted to arrest this trend by government and on-governmental organisations, which include:

- a. Mapping the distribution of local landraces and documentation of traditional knowledge systems in order to facilitate their on-farm conservation, by the Gene Bank of Zimbabwe.
- b. The promotion of on-farm conservation of traditional landraces of sorghum, pearl millet, cowpeas, and bambara nuts by Environment Development Activities (ENDA-Zimbabwe); and
- c. The promotion of *in-situ* conservation and sustainable utilisation of traditional vegetables and fruits by the Community Technology Development Association (COMMUTEC)

These efforts have been rather uncoordinated however, and the NBSAP notes a need to develop capacity in the identification, documentation, conservation and utilisation of these landraces and to coordinate the efforts of the different actors. Additionally, more information on farmer cultivation and storage of landraces is needed. As well, there is a need for a central depository of all agriculturally important plant and animal genetic resources that is linked to all other depositories.

In addition to documenting the programme of accession and breeding using locally adapted lines of major food crops, and for the *in-situ* conservation programmes mentioned above, the NBSAP makes a strong case for domestic livestock conservation:

“During the evolution of livestock species in Africa, capacity to adapt for survival has taken precedence over increased productivity hence most indigenous breeds cope better with harsh tropical environments than temperate breeds. Consequently, the genotype of indigenous species in countries like Zimbabwe has been overemphasised as a primary constraint to increased production and productivity resulting in huge resources being allocated to conventional breeding programmes with indigenous species involving selection, crossing with exotic breeds and multiplication schemes. However, recent studies have shown that the perceived low genetic potential of indigenous cattle is critical only in terms of their milk production for commercial purposes and not in terms of meat production under comparative management conditions (Tawonezvi *et al.*, 1988). This is also true with small ruminants. Despite this evidence, the advantages of indigenous animals are not widely exploited due to the limited availability of improved indigenous stock and the lack of properly articulated animal breeding policies in the country. Consequently, the greatest need in genetic improvement programmes is not only improvement within indigenous breeds, but also ensuring that the merits of these breeds are widely promoted. In addition, there is need for vigilance to ensure that genes of these breeds are not lost due to overuse of exotic stock in breeding programmes directed at increasing meat and milk production. Consequently, the current conservation efforts of indigenous cattle germplasm being done for Tuli and Nkone cattle at Matopos Research Station and for Mashona cattle at Makoholi Research Station must be maintained as an integral part of the national breeding programme.”

Zimbabwe lacks a policy and legal framework governing intellectual property rights, or to control access to genetic resources and to protect or reward indigenous traditional knowledge and innovations in relation to genetic material. The current plant breeders' rights act applies only to commercial material that is distinct, uniform and identifiable, and not to farmers' landraces that are variable and evolving.

South Africa:

Agricultural Policy – The White Paper on Agriculture states: New varieties produced by hybrid plant breeding techniques and biotechnology may threaten indigenous species cultivated over generations by traditional farmers. The Government will ensure that the law is enforced so that damage to the indigenous fauna and flora is minimised.

The White Paper on Biodiversity states that: Government recognises the irreplaceable and unique value of the traditional knowledge, practices and cultures of South Africa's people, and is acutely concerned about the rapid loss of such systems. The need to formally recognise and protect traditional knowledge is considered to be an issue, which needs urgent attention. Government, in collaboration with interested and affected parties, will: Adopt research, training, and institutional capacity-building activities to empower small-scale farmers and other farming communities in the acquisition, conservation,

development and use of landraces, and of indigenous and traditional livestock breeds and plant varieties.

Concerning the conservation and promotion of the sustainable use of plant genetic resources (PGR), the following major steps and initiatives have taken place since UNCED:

- Major transformation strategies and action plans have been initiated in respect of the Plant Improvement Act, 1976 (Act 53 of 1976) and the Plant Breeders Rights Act, 1976 (Act 15 of 1976);
 - Legislation has been harmonised in order to implement and promote the Convention on Biological Diversity as well as the introduction of additional programmes for increased quality assurance on commercial agricultural plant production;
 - The recognition of Farmer's Privilege (e.g. the retention of harvested material for re-use as propagating material) as an integral component of the traditional seed production system in terms of the Plant Improvement Act;
 - The promotion of on-farm conservation of plant genetic resources as a dynamic strategy towards the conservation and sustainable use of farmers varieties. This will inevitably lead to the conservation and sustainable use of biological diversity, as well as to promotion, development, support and maintenance of traditional farming systems;
 - The introduction of an intellectual rights regime for farmers (e.g. Farmers Rights) to the Plant Breeders' Rights Act, which will legalise a system of benefit sharing as recognition for the past, present and future contributions of farmers towards plant improvement and conservation; and
 - The introduction of a system of access control to all indigenous plant genetic resources in order to implement a regime of sovereign rights over all aspects relevant to plant improvement and plant use.
- Concerning the conservation and sustainable use of animal genetic resources (AGR), the following activities have taken place since UNCED:
- Legislation has been put in place. The Animal Improvement Act 62 of 1998 allows for the declaration of all South African Landrace breeds and future exports will be subject to approval by the national registrar. The Livestock Improvement Act 25 of 1977 determines that all introductions of new breeds should be subjected to a biological impact study to determine the impact on local farm animal genetic resources;
 - International liaison. The promotion of South African Landrace breeds through participation in international meetings and conferences;
 - Establishment of a Breed Conservation NGO. The Farm Animal Conservation Trust (FACT) promotes conservation through sustainable use by distributing information, exhibiting animals, placement of animals in trust and the supply of genetic material;
 - Compiling a catalogue of Landrace breeds. This is nearing completion and will be distributed internationally to promote trade in South African Landrace breeds;
 - Ongoing characterisation of breeds. The ongoing genetic and phenotypic characterisation of breeds by the relevant Institutes of the Agricultural Research Council, together with government, is taking place;
 - Establishment of a national committee for the management of farm animal genetic resources. This forms part of a SADC project on the management of farm animal genetic resources;
 - Information in publications. Various publications of the livestock trade have been used to place articles on indigenous cattle and sheep breeds, especially for emerging farmers;
 - Compilation of a business plan. The Agricultural Research Council together with government and FACT have compiled a business plan for the management of Farm Animal Genetic Resources so as to achieve a holistic and more effective use of animal genetic resources; and
 - Show and Sale of Farm Animals. The first was held in September 1999 and will become an annual event to generate interest and broaden access to markets.

NBSAP – N/A

Diversity at the landscape level

Ethiopia:

Agricultural Policy – Ethiopia's wildlife management policy (amended 1992) explicitly recognizes the use of protected areas to conserve plant genetic resources. It adopts a broader definition of wildlife (plant and animals as well as their ecosystems) (Mugabe, 1998).

The Five-Year Development Plan of the government is more specific on environmental rehabilitation, reforestation and conservation and states ‘...The development strategy chosen should restore the deteriorating environment to its original good quality.’

The Environment Policy states “To ensure that the conservation of genetic resources *in-situ* maintains a dynamic system of genetic variability in an environment of constant selection pressure that is normally present in the natural, or human-made ecosystem;’ and it promotes an *in-situ* system of conservation in a nature reserve, a farmers’ field, as the primary target for conserving both wild and domesticated biological diversity; and also promote an *ex-situ* system in gene banks, farms, botanical gardens, ranches and zoos to supplementary *in-situ* conservation.”

NBSAP – Objectives are:

- Identification of ecosystems and variations within and between species and subspecies;
- Establishment and management of comprehensive and representative systems of protected areas;
- Identification and management of life threatening processes;
- Inventory of ecosystems and identification and management of rare, endangered, and threatened species;
- Conservation management outside natural reserves;
- Bioregional planning and management of conservation;
- Preservation of species and genotypes outside their natural reserves habitats;
- Promotion and recognition of indigenous ethnobiological knowledge of peoples and supporting them in their effort of conserving biological resources.

Kenya:

Agricultural Policy – The Environmental Management and Co-ordination Act (2000) specifies that the Authority shall, in consultation with the relevant lead agencies, issue guidelines and prescribe measures for sustainable use of hill tops, hill slides and mountainous areas (44 & 47(1)); issue guidelines for the management of the environment of lakes and rivers (42(4)); prescribe measures adequate to ensure the conservation of biological resources *in-situ* ...” (51(a-f).

NBSAP – For rehabilitation of degraded ecosystems and recovery of threatened species, there is no mention of agrobiodiversity as a strategy rather the emphasis is much broader stating the need for developing programmes and management plans for ecosystems and supporting communities and private landowners in ecosystem rehabilitation efforts. There is an emphasis of a hierarchy of environmental plans built into the Kenya Environmental Management and Co-ordination Act (2000), from local to district to provincial to the national plan, with the concept that planning should begin at the most local level. This also is the approach which will probably support the greatest degree of landscape level diversity. The act also provides for communities to codify traditional use rights over ecosystems, and develop appropriate management plans.

Zimbabwe:

Agricultural Policy –

NBSAP – The document states that in order to combat biodiversity loss, the policy is away from protectionism to one, which considers communities as integral in the ecosystem and as partners to conservation, management and utilisation. Although agrobiodiversity is not mentioned in anyway, some points were made to indicate that attempts were made to assist communities in setting up nurseries in order that trees become available for farm forestry.

South Africa:

Agricultural Policy – National Environment Management Act (2000) states that the Minister may invite communities to submit offers to enter into community protected area agreements in respect of a particular protected area or areas (B53(2)).

The White Paper on South African Land Policy (1997) deals directly with three key elements of the land reform programme - restitution, redistribution and tenure reform as each is a constitutional requirements. Within this context small farms are favoured over large farms.

NBSAP – N/A

Wild biodiversity in agro-ecosystems

Ethiopia:

Agricultural Policy – No mention is made.

NBSAP – The reference made in the NBSAP is to three pilot projects for *in-situ* conservation which will be undertaken in bioregions representing traditional systems and natural environments. A system of community-based *in-situ* landrace conservation will be designed in different bioregions to maintain indigenous crop cultivars and their wild/weedy relatives in a dynamic agro-ecosystem. Crop germplasm samples originally collected from the community based *in-situ* sites and maintained at the seed bank will be restored at their respective sites to allow landraces to continue their adaptation at farm level through indigenous breeding and natural selection.

Kenya:

Agricultural Policy – Wildlife policy discourages community control over wildlife, which makes sustainable use of wildlife difficult.

On the other hand, Kenya has openly acknowledged that 80% of its wildlife population occurs outside of protected areas, in human dominated landscapes, and that means of extending the benefits of wildlife to local communities need to be found.

NBSAP – The First National Report simply discourages deforestation and protecting areas with high genetic diversity, the government tries to check the genetic erosion rate. Refugees and their livestock in Northern parts of Kenya increase loss of wild biodiversity. Outside help is requested to combat these effects.

Zimbabwe:

Agricultural Policy - In 1975 provisions were introduced into the Parks and Wildlife Act which allowed the “custodial ownership” of wildlife to private landowners. In addition the Parks and Wildlife Act was further amended to give appropriate authority status to Rural District Councils (RDCs) so that they can manage and benefit from wildlife within the communal area. This policy saw the inception of the CAMPFIRE programmes (see best practices), and 33 of the country's 55 RDCs are currently participating in this programme, as well as a number of private land conservancies.

Game ranching has been on the increase since the passing of the Parks and Wildlife Act of 1975. This Act introduced flexibility in the government's control of wildlife in Parks and Reserved areas by allowing private landowners to manage and benefit directly from wildlife on their land and greater participation of communal area residents in the management and utilisation of wildlife by granting Rural District Councils similar rights to those of farmers on private land.

NBSAP – The NBSAP recognizes that the critical issue in wildlife numbers is the uncontrolled human population growth. The protected areas that are set up are marginal for agriculture.

The CAMPFIRE programme is discussed as a way forward for community and wildlife co-existence.

South Africa:

Agricultural Policy – The White Paper on Biodiversity states in section 2.3.11. Recognition and Protection of Traditional Knowledge, Practices and Cultures that traditional knowledge, practices and cultures supporting the conservation and sustainable use of biodiversity will, where possible, be recognised, protected, maintained, promoted, and used with the approval and involvement of those who possess this knowledge. Benefits arising from the innovative use of traditional knowledge of biological diversity will be equitably shared with those from whom knowledge has been gleaned. This is in relation to the section below.

NBSAP – N/A

Traditional knowledge of agrobiodiversity

Ethiopia:

Agricultural Policy – The five-year development plan also proposes to develop capacity for self-administration among the local organizations. It proposes to support more development in the less developed regions, so as to work towards equality of opportunities and strengthening democratic organizations, especially at the lowest level of administration and at grassroots levels. This plan should if implemented, place the initiative for land conservation back in the hands of the peasants and the pastoralists to make a quick reversal in favour of conserving biodiversity.

NBSAP – The plan supports:

- Collection of specimens based on indigenous knowledge of farmers especially focused on the collected cultivars and livestock production systems;
- Carrying out of Participatory Rural Appraisal techniques during the exploration and collection schemes to encourage active community participation and application of indigenous knowledge in forage genetic resource management;
- Conservation of medicinal plant genetic resources with emphasis on *ex-situ* conservation approaches and large scale propagation for those species that have shown sufficient evidence of therapeutic efficacy;
- Promotion and recognition of indigenous ethnobiological knowledge of peoples and supporting them in their effort of conserving biological resources.

Kenya:

Agricultural Policy – The Agriculture Act, the Crop Production and Livestock Act, The Seeds and Plant Varieties Act all deal with some aspect of agrobiodiversity. However, the Environment Management and Coordination Act, 2000 has precedence over the other acts so that if any such law conflicts with it the provisions of the Environmental Management and Coordination Act prevails. Specifically in regards to traditional knowledge of agrobiodiversity, the Act only alludes to this topic. It does specify use of appropriate farming methods (47(2)a) but does not specify agrobiodiversity or any other farming method as appropriate. More importantly though, the Act states that “The Director-General shall not take any action, in respect of any forest or mountain area, which is prejudicial to the traditional interests of the indigenous communities customarily resident within or around such forest or mountain area” (48(2)). Other important Articles are: “protect indigenous property rights of local communities in respect of biological diversity” (50(f)) and “integrating traditional knowledge for the conservation of biological diversity with mainstream scientific knowledge” (51(f)).

The Environment Management and Coordination Act, 2000 contains a provision related to Article 8(j) however it does not reflect the obligation as required in the Convention text of preserving, maintaining and appropriately promoting traditional knowledge. Article 51 of the Act states that “The Authority shall, in consultation with the relevant lead agencies, prescribe measures adequate to ensure the conservation of biological resources *in-situ* and in this regard shall issue guidelines for ... integrating traditional knowledge for the conservation of biological diversity with mainstream scientific knowledge.”

NBSAP – One of the immediate objectives of the NBSAP is: to conserve agricultural biodiversity through increased support to local communities in the production and sustainable utilization of indigenous and/or traditional species for food and other uses. A strategy proposed to reduce poverty and the effects of poverty on biodiversity-dependent communities is to initiate and diversify income generation activities by increasing agricultural production of indigenous/traditional crops, and providing credit access to rural traditional farmers.

Zimbabwe:

Agricultural Policy –

NBSAP – the NBSAP notes that smallholder farmers in Zimbabwe possess a unique understanding and knowledge of their natural environment. The farmers’ knowledge of the environment and its inherent production factors such as soil, fauna, flora and climatic conditions enables them to make appropriate decisions on the sustainable use of natural resources. For example, crops such as okra, pumpkins, tsunga (*Brassica juncea*) and sweet sorghum which require considerable moisture and high soil calcium and potassium were grown exclusively on ant hills, which are more fertile and retain more water.

Women also play a key role in agro-diversity conservation as they comprise 75% of the smallholder farmer population in the country. They select seed with preferred characteristics such as colour, size, genetic stability, disease tolerance, palatability and good processing qualities for planting. Furthermore, they grow women’s crops” such as groundnut, pumpkins, leafy vegetables, cowpeas, cucumbers and sweet potatoes, which has the effect of raising biodiversity and food security. It is critical to fuse this indigenous knowledge with contemporary knowledge systems.

South Africa:

Agricultural Policy – The White Paper on Agriculture states: “Farmers in the commercial as well as the noncommercial sector have a wealth of knowledge. Farmers use local varieties of seeds and adapt their practices to local conditions, and this knowledge can be as important a source of research and development material as biotechnology. Researchers need to be more sensitive to the local

knowledge of farmers, to check whether this knowledge has applicability and value in the wider system, and to incorporate this knowledge into the design of research programmes. At the same time researchers should acknowledge the source of knowledge used, and give due credit to those who have developed the information base. International conventions on biodiversity draw attention to the importance of recognising indigenous knowledge systems, and to recognising intellectual ownership of material which is utilised in biotechnology and other agricultural research. " what authority does the White Paper actually have?

The National Environmental Management Act (2000) recognises traditional knowledge and intellectual property rights but no clear connection is made with agrobiodiversity.

NBSAP – N/A

Policies, regulatory mechanisms and the implications of agricultural development plans on agrobiodiversity management

Economic policies and programmes:

Many analysts point to poverty as a cause of food and environmental problems. While this has some element of truth, the underlying roots of poverty are unsustainable patterns of economic development, including the following:

- a. Market and pricing policies, including subsidies for grains and agrochemicals, price distortions created through fixed prices, and credit policies, have hampered the ability of rural populations to gain access to food (Maxwell and Lirensen, 1994; Barraclough, 1996; Pretty *et al.*, 1996). Pricing policies and subsidies for pesticides, water and other inputs have also contributed to environmental degradation and to wasteful use of resources in agriculture and livestock systems (Lane and Pretty, 1990; Parrlberg, 1994; McNeely *et al.*, 1995). Market malfunctions and an unjust credit system were root causes of famine in the Sudan, for example (Olsson, 1993) Moreover, unfettered market liberalisation policies, without integration of social and environmental provisions, tend to aggravate unfair competition and inequitable terms of trade, which compounds food insecurity and increases pressures on resources (Barraclough, 1996).
- b. Inappropriate development programmes, particularly large scale settlement projects and Green Revolution agricultural programmes have contributed to social and environmental problems. Although they sometimes have benefited special interest groups and boosted yields in some zones, they have seldom alleviated food and environmental insecurity. Uniform varieties and monocultural cropping systems imposed in top-down extension programmes are often unsuited to local conditions and needs, and are usually unaffordable or unacceptable to local people.

Examples:

Unsuccessful agricultural and development programmes are found during both colonial and contemporary periods in both the Horn of Africa and southern Africa. Many involve nationalisation and state control of land resources or privatisation and land concentration. In the Sudan, mechanised agricultural programmes, which have been established over many decades, have favoured large-scale producers and export production. They virtually ignore local food needs and the traditional sector, which employs about 70 to 80 % of the population (Olsson 1993). Although Sudan was exporting food during the 1980s, local people were suffering from grain deficit and food insecurity because of policy and programmematic biases (Maxwell 1991).

The Awash River valley, covering 10 % of Ethiopia's land, has been transformed by dams and commercial plantation schemes, including sugar, banana, and tobacco plantations. These schemes, along with the Koka Dam, were justified by the government as a means to settle and modernise the Afar pastoralists, to reduce population pressure on land elsewhere, to provide water to Addis Ababa. These farms leased out land to foreign or large concessionaires and increased mechanisation and irrigation by giving them tax-free imports. Yet, these initiatives aggravated the 1973 drought, famine and land degradation, displaced Afar pastoralists and smallholder migrants in the Awash, and created an inappropriate balance between staple food crops and commodity export crops, thus increasing food insecurity.

In the Greater Horn of Africa, many policies over time to settle traditional pastoralists have undermined customary natural resource management practices and reduced critical mobility and

flexibility of the livestock, leading to overgrazing and degradation (Steinfeld *et al.*, 1996). Cropping programmes in these areas have also degraded soils and eroded biodiversity.

c. Structural adjustment policies (SAPs) have cut off funding for social services, education, and for rural credit, dismantled institutional support and social networks for rural peoples, and imposed austerity measures, while creating pressures to increase export production. SAPs have seldom lead to poverty/hunger alleviation; rather, food insecurity has continued or even increased in the many countries, while debt remains high and the poor are displaced (Bagachwa *et al.*, 1996). In Tanzania, for example, after SAPs were established, input prices increased dramatically; debt became 28 % of GDP and deforestation increased in miombo woodlands, up to 2 % per year, after farmers expanded cash crop cultivation to take advantage of market liberalisation policies. At the same time, reforestation and agricultural extension programmes were cut (Bagachwa *et al.*, 1996)

Inequities in the distribution of resources and income.

Disparities in access, control, and distribution of resources underlie food insecurity and environmental degradation. Serious inequities in resource distribution exist not only between the North and the South, but within Greater Horn countries, between classes, ethnic groups, and between men and women. The control of resources by the state and wealthy sectors prevents poor people from gaining access to income opportunities and to resources and food (Paarlberg, 1994). Income distribution is highly skewed in some countries, such as South Africa, Kenya and Zimbabwe, which aggravates constraints for the poor. Credit policies and other government policies aggravate such inequities, by favouring capitalised producers/businesses and excluding the poor (Olsson, 1993; Reardon and Shaikh, 1995). Competition over resources also increases inequities in many areas, since wealthy enterprises and landowners and state entities usually have competitive advantages (Watts, 1987; Lane and Pretty, 1990; Hutchinson, *et al.*, 1991; Barraclough, 1996).

Inadequate distribution systems, including lack of markets, market bias, infrastructure weaknesses, and lack of social services, are also causes of disparities in food supplies. In the Sudan, for example, 'the famine of 1984-1985 was not primarily caused by a shortage of food, but rather by poor distribution of food, transportation costs, middlemen, abuses in the customary sheir credit system, hoarding that caused prices to sky-rocket, and a government doing nothing to protect those affected,' according to Olsson (1993). Women face particular constraints in this sense, affected by heavy restrictions on legal rights, access to land, capital, and education. Such gender disparities can contribute to agricultural decline and harm society overall (Cleaver and Schreiber, 1994; IFPRI, 1995). Distributional inequities also contribute to resource degradation. As one observer noted, 'social inequality allows for different motivations for degradation- the greed of the rich and the desperation of the poor' (Steinfeld *et al.*, 1996). Poor people who lack access to resources often have no choice but to overuse resources and are often forced to use marginal lands.

Developed countries perhaps should not give undue protection to domestic industry and should encourage import of environmentally friendly products, from developing countries by giving special incentives (CUTS, 2000).

World Trade Organisation (WTO)

In regard to the WTO negotiations, agrobiodiversity policies may be impacted by trade measures, including TRIPs (Trade Related aspects of Intellectual Property) if these policies do not permit local determination of production methods and priorities nor recognize the importance of protecting agrobiodiversity for sustainable food production, biological or life support systems and ecological and social services (FAO, 1999). The main concern with TRIPs in relation to on-farm agrobiodiversity is that the treaty destroys community rights, community knowledge, innovations and traditional lifestyles, since the treaty neither recognizes them, nor provides any form of protection for them. The treaty also does not make any provisions for communities to fight for their rights in case of piracy (Plahe, 1999).

CBD COP Decision 11/11 encouraged the WTO to consider developing a better appreciation of the relationship between trade and agrobiodiversity and recommended collaboration with the CBD. By decision IV/6, the COP requested the Executive Secretary to report on the impact of trade liberalization on the conservation and sustainable use of agrobiodiversity. The report is pending.

African Regional Industrial Property Organisation

In Eastern and Southern Africa (Botswana, Kenya, Lesotho, Malawi, Somalia, Sudan, Swaziland, Uganda, Zambia, Zimbabwe), the African Regional Industrial Property Organisation deals with intellectual property complementing national legislation in the protection of the principle objects of intellectual property namely patents, trademarks, industrial designs and copyright. However, these

rights pertain to industry and ignores indigenous knowledge as a technology even though this knowledge contributes significantly to the majority of rural livelihoods and whose owners are increasingly involved in market economies. As a result these countries and the indigenous people are losing benefits that could provide incentives for them to conserve indigenous knowledge and genetic resources (Mutta, 1999).

The global economy

Economies of scale often necessitate ever-larger firms operating in global markets. And for such economies of scale, small, lesser-developed countries, having internal markets with low purchasing power, are clearly at a disadvantage. Bad roads and broken down, intermittent transportation networks create excessively small and segmented markets in remote areas of a country, usually leading to market failures. It is easy then for local suppliers to take advantage of temporary monopoly situations to hoard supplies and increase prices of goods they supply. This often results in worse sales conditions such as higher prices and poor quality of services (CUTS, 2000) increasing poverty and the time available for conservation activities.

While the global economy is shaped by these complex issues, two main processes appear to promote biodiversity loss:

- An increased reliance on natural resources to meet macroeconomic goals and foreign capital needs, leading to ecosystem conversion and unsustainable levels of consumption;
- A failure to acknowledge and address long-term environmental costs associated with economic growth objectives, leading to the adoption of environmentally destructive practices (Wood *et al.*, 2000).

Impacts from the liberalisation of agricultural trade as a result of Structural Adjustment Policy and the Uruguay Round Agreement are:

- Food will increasingly be subject to international trade policies and practises;
- Agriculture support mechanisms will be removed in Southern countries and local farmers will be fully exposed to the market power of subsidised institutionalised Northern exports;
- Northern governments and trading blocs will continue to protect their agricultural sectors and limit access to their markets in the immediate future.

In Kenya, the impacts of these policies will be:

- Reduction in public investment and support of producer prices and credit, resulting in decreases in crop production due to low market determined prices;
- The further opening of domestic markets and resultant dumping of highly subsidised agricultural products like sugar, rice and cotton and the collapse of agro-based factories which has resulted in the loss of income and livelihood sources of many small farmers and rural wage earners;
- Income transfers to producers of tradable agricultural commodities such as horticulture, teas and coffee benefiting those in a few agro-ecological zones and reduction in producer incomes to smallholder farmers who produce less tradable commodities like maize and beans (Aritho, 1999).

Donor policy

The primary objectives of agricultural development in Africa under the sustainable development paradigm encourages growth, equity and conservation and de-emphasizes industrialization. This paradigm places great emphasis on the widespread degradation of the agricultural resource base and the relationship of such degradation to externalities. The latter, such as the issues bound up with property rights and degradation of common land, show conflicts between a casual approach to market reform and sustainable development. The main elements of the widespread interest in sustainable development are that rapid population growth, agricultural income stagnation and environmental degradation of rural areas are part of a nexus. The three go together, and solutions to any one of them will involve solutions to the other two as either a consequence or a cause. The main policy instruments offered are ensured access for rural women to education, health, and agricultural production services; improved property rights, including land tenure and pricing of common pool resources; and increased attention to urban development to provide an outlet for rural labour (Delgado, 1995).

Sustainable Development has been the theme for the last two national Development Plans (1994-96 & 1997-2001) in Kenya. Although numerous policies geared towards poverty alleviation are in existence, their implementation is hampered by inadequate community involvement in their formulation, inadequate sectional linkages in the policy framework and lack of legal instruments for their enforcement.

Regional Conventions

On a regional basis, the African Convention on the Conservation of Nature and Natural Resources of 1968, covers plant genetic resources and recognises the role of scientific and technological knowledge in conserving the resources. Its focus is on *in-situ* conservation however there is no mention of agriculture or conservation of related wild species. In addition, there is no evidence that the convention is being implemented to promote the conservation of plant genetic resources and nature in general. It lacks a strong institutional mechanism to oversee its enforcement (Mugabe, 1998).

Land Tenure Issues

In Zimbabwe, the communal land tenure system is governed by the Communal Lands Act and is applicable to 42% of the land area, where approximately 66% of the country's population resides. 74% of the communal sector is located in lower rainfall areas while the bulk of the large scale commercial sector is in high rainfall areas. According to the Communal Land Act, all communal land is vested in the State Presidential Act. Resettlement areas cover 10% of the country and are a product of the post independence period targeted at relieving population pressure in communal areas and have no title. It is often argued that the communal land tenure system is a disincentive to long-term investment in agriculture and other key natural resources. To address these land tenure related problems, government set up a Land Tenure Commission in 1994 to review the current land tenure systems and make appropriate recommendations. However, some of the key recommendations related to the communal land tenure system have not yet been or have just begun to be implemented. How the disputes are resolved in Zimbabwe will likely have an effect on this issue in other countries of the region.

National Accounting Policy

Agricultural biodiversity contribution in national accounting systems is not included as such, there are no policy incentives for agrobiodiversity conservation (Mutta *et al.*, 1998). Current policies and market activities fail to reflect the economic value of plant genetic resources and particularly the socio-economic values of wild plants used in rural economies (Mugabe, 1998). Incentives are normally still based on short-term economic interests rather than long-term sustainable considerations including public value. "Market prices do not yet reflect the real value of biological resources and their services because of a failure of internalization of external costs" (Thies, 2000).

Incentives

Zimbabwe has carried out an exemplary process of prioritising its needs with respect to biodiversity conservation, and – relevant to agrobiodiversity-, its second greatest constraint is "inadequate incentives for local communities and individuals to undertake biodiversity conservation and sustainable use initiative", for which the actions to create incentives will include frameworks for protecting and rewarding local innovations and indigenous technology transfer. The fourth need- "limited appreciation of the importance of biodiversity to the national economy and policy makers" is to be met through actions which include on-farm conservation efforts.

Input subsidies and rural credit programmes are usually tied to 'modern' seeds and chemical inputs, which pushes farmers to use these inputs instead of using agrobiodiversity to sustain their agricultural systems and policies that promote the cash economy and modernisation push farmers to leave behind their traditional local knowledge and practices, including agrobiodiversity in favor of selling crops in the market to buy factory-made goods (ITDG, 1999).

In Kenya, the Population and Food Policy aims at increasing food self sufficiency through the promotion of monoculture cropping systems especially of introduced crops and their varieties mainly of coffee, tea, and pyrethrum (Mutta *et al.*, 1998).

The CBD does not deal specifically with the issue of plant variety protection but it is of direct relevance to the setting up of protection regimes for plant varieties since its scope encompasses all biological resources. Generally, it constitutes the central instrument concerning biodiversity at the international level. In this context, it broadly delimits the rights of states and other relevant actors over biological resources. It generally affirms the sovereign rights of states to exploit their own resources pursuant to their own environmental policies, a direct reflection of the principle of permanent sovereignty over natural resources. The sovereign rights of states over their biological resources are limited by the recognition that these resources are a common concern of humankind.

National policies

Ethiopia:

- Concern about the loss of plant genetic resources led to the establishment of the Plant Genetic Resources Centre (PGRC/E) in 1976. The centre is involved in exploration, collection and

preservation of crop germplasm together with the provision and exchange of germplasm for crop breeding programmes. Collection of plant genetic resources include the collection of land races from drought prone areas for storage at seed reserve centres and redistribution to farmers when required. This is an insurance measure to prevent major losses of crop genetic diversity by consumption of seed in times of famine or the replacement of traditional varieties by imported seeds distributed through relief agencies;

- Ethiopia has the most specific and extensive policy documents in Eastern Africa, as far as agrobiodiversity is concerned. Detailed in the constitution, the five year development plan, the environmental policy and seed industry policy, are remedial measures responding to genetic erosion, impact of the green revolution, marginalisation of local governance systems as well as addressing issues of community participation and environmental rights.

Kenya:

- The Environment Management and Coordination Act (2000) allows any Kenyan citizen the right to file suit on the basis of harm to the Kenyan environment. As an outcome of the Act, the National Environment Management Authority (NEMA) was set up. This body though is mainly made up of Permanent Secretaries of the Ministries and a small gathering of hand picked university, private sector and NGO representatives. The successful implementation of the Act lies in this top-down, highly bureaucratic team;
- There is no Act of Parliament that addresses specific environmental concerns associated with bad land use planning for example The Agricultural Act, CAP 318 only provides rules for maintaining stable agriculture, conservation of soil and its fertility, and stimulating the development of Agricultural Law;
- With reference to agriculture, is the Population and Food Policy which aims at increasing food self sufficiency through the promotion of monocultural cropping systems. The focus is on introduced crops and their varieties, with limited attention on indigenous food crops;
- The Forest Act and Wildlife Act encourage conservation and sustainable use of natural resources whereas the Agricultural Act and the National Food Policy encourage the expansion of land under agriculture;
- In the draft Sessional paper on National Wetlands Conservation and Management (January 2001 Version) sustainable use of wetlands as well as restoration, and public awareness of the benefits of wetlands and its biodiversity is promoted. This document focuses on wetlands per se and fails to note comprehensive measures for livelihood alternatives for communities living on wetland peripheries. In this document, agrobiodiversity in general is mentioned in the following contexts:

5.2 Environmentally Sound Management – promoting wetland edge gardens

5.14 Poverty reduction - Development and promotion of sustainable land use practices based on a participatory agroecological approach; Develop local capacities to enforce sound indigenous rights, legitimizing appropriate traditional patterns of local management that enable sound resource use and food security.

National Environment Action Plans (NEAPs)

The NEAP, written in June 1994 by the Ministry of Environment and Natural Resources, Government of Kenya, suggest actions relating to agrobiodiversity such as the need for

“efficient and appropriate use of fertilizer, pesticides, tillage methods, crops and cropping patterns to avoid environmental degradation. In the long run, greater use of animal and compost manures need to be promoted as a supplement to mineral fertilizers. Integrated pest management strategy should be given high priority. To reduce pollutants reaching water bodies, the run-off water should be filtered through the soil as an integral part of soil conservation structures. Greater attention needs to be given to drought-resistant indigenous food plants;”

“Intensify crop yields and reduce dependence on imports by encouraging integrated pest management, multiple cropping, agroforestry and organic compost and manures in agriculture. At the same time, train extension workers in these techniques;”

“Increase and diversify agricultural production by promoting the use of and improving the productivity of indigenous plant species and animal breeds. Provide incentives for farmers to maintain local crop varieties and animal breeds.”

Although the policy is stated, technical capacity for *in-situ* conservation is lacking.

Seed and Plant Varieties Act

Under Kenyan law plant varieties are protected under the Seed and Plant Varieties Act Cap 326 administered by the Kenya Plant Health Inspectorate Services (KEPHIS under the Ministry of Agriculture and Rural Development).

South Africa: The Bill of Rights in the new Constitution states (in section 24) that a healthy environment is a basic right of South Africans. It says that everyone is entitled to legislative or other measures to 'prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development'

Environmental rights were included in the Constitution, and in the mid 1990s a number of new environmental policy processes were initiated. The Consultative National Environmental Policy Process culminated in a White Paper on Environmental Management Policy, later put into effect by the National Environmental Management Act (1998). This represented a paradigm shift from narrow conservation to people-centered sustainable development, including the integration of social, economic and environmental factors.

The April 1997 White Paper on Land Policy, was published, which recognised that one of the challenges to the land reform process was to relieve land pressure without extending environmental degradation. However, as in many other areas of its work, the government was soon confronted by the gap between its policy commitments on paper and its practical achievements on the ground with regard to integrating environmental concerns into land reform.

In a review of environmental issues in land reform that was carried out by the Land and Agriculture Policy Centre in 1996-97, it was emphasised that little progress would be made in integrating environmental concerns into land reform procedures and programmes if the land reform process itself were not better integrated into broader local programmes of rural development planning, land management, environmental care and local government (Turner, 1998). The review did help heighten concern and commitment in the government with regard to environmental issues. Then in 1998, an internal programme aimed at heightening awareness, building expertise and piloting more effective action to assure proper attention to environmental impact and sustainability in land reform was initiated (Turner *et al.*, 1997).

In June 1999, one of the national policy goals set by the Government for agriculture is: To support the emergence of a set of more diverse farming systems, which facilitate the emergence of a black agricultural sector.

Constraints to the use of sound policies and practices

- Government corruption;
- Political commitment to the process is weak regardless of the signing of agreements and international conventions;
- Institutions with programmes on biodiversity management often lack institutional and technical capacity and coordination;
- Weak linkages among the Ministries of Agriculture, farmers, research institutions and NGOs constrained by frequent structural changes and staff turnover;
- Protected areas, which contribute to the conservation of biodiversity are often poorly planned and managed;
- Failure to internalise environmental costs in economics;
- Externalities that spill into other sectors are rarely taken into account;
- Failure to integrate environmental concerns into planning and management of resources and resource use;
- Failure to plan at a landscape level;
- Insensitive and fragmented land-use planning with increasing demands for, and conflict over land and natural resources leads to unsustainable consumption and production patterns;
- Failure to maintain protected areas near farming areas as any viable land is likely to be converted to agriculture;
- Lack of contingency plans for flood control, and climate change in national policy;
- Cultural attitudes that view wild ecosystems as unexploited;

- Many new laws implying that land stewardship might be awarded to local farmers and communities are vague as to the details and make little attempt to set out the constructs or procedures through which such developments might be realised (Wily, 2000);
- Donor driven rather than sustainable implementation from the local people;
- Dependency culture in rural areas (e.g. In the past, the Kenyan government has supported soil conservation activities by providing agricultural implements and fertilizer subsidies. These subsidies and other incentives have largely been discontinued. Currently, farming implements, in a few cases, are given to soil conservation catchment groups however, it appears that this has brought on a dependency syndrome (Source: Ministry of Agriculture, Kenya, 19?);
- Lack of achieving a critical number of scientists in a discipline creates an inability to influence government to become sympathetic to environmental concerns;
- Limited communication systems and other infrastructure.

Kenya signed the WTO Agreement on Agriculture (AoA) while it was in the process of implementing the NBSAPs and hence the country had already liberalized its markets and eliminated subsidies on agricultural inputs. Still the AoA posed new challenges for Kenya, such as domestic support programmes. The reduction in government support has had major implications on agricultural growth. Kenya is concerned by the use of non-trade barriers, which limits access to developed countries' markets, for example as has been the case with restrictions on horticulture exports to EU on environmental concerns and banning of fish products to EU on health reasons (Nyangito, 1999).

Agrobiodiversity in Zimbabwe has been affected by an array of colonial and contemporary policies that by and large have not been very supportive of its conservation. The colonial legacy of locating smallholder farmers in the low rainfall areas with inherently infertile soils limits their potential to diversify agricultural production. They are limited to the production of basic food crops like maize, sorghum, millet and groundnuts. Lack of security on communally owned grazing land significantly contributes to land degradation.

The setting up of producer pre-planting prices by the government before market reforms tended to limit the range of crops planted and in this sense, market reforms have supported agrobiodiversity conservation.

A number of other policy frameworks try to broaden the crop range have been put in place by the government since independence. For example, the land redistribution programme aims at allocating more productive land to communal farmers. In addition to easing land pressure in the communal areas, such relocated farmers can diversify their agricultural production base and increase their contribution to the national economy. Credit is still substantially subsidised by the government through the Agricultural Finance Corporation, which encourages the use of improved technologies and diversification in to higher value crops. Government investment of Z\$10 to Z\$20 million annually into smallholder irrigation development may permit smallholders more options with higher value crops, although it has an adverse effect on the low value but traditionally important food crops. The NBSAP notes that there is a need to speed up the land redistribution scheme, adopt appropriate land use scheme, and institute policies that encourage production systems that enhance biodiversity on smallholder irrigation schemes.

Examples of best practices

1) *Ethiopian Flora Project*: The project's objective "is to provide information for scientifically-based utilisation and conservation of the country's plant resources."

The project has developed capacity on plant taxonomy and is publishing the Flora of Ethiopia through the National Herbarium based on its collection which started with 14,000 plant specimens in 1980 and now counts to well over 70,000 in 1998. Through this capacity, specimens are now identified in country by the largest number of plant taxonomists in sub-saharan Africa except South Africa.

The expertise in country is now influencing decision-making in the country.

2) *Agrobiodiversity used as pest management*:

Parasitic weeds of genus *striga* infest 40% of arable land in the African savannah region causing an annual loss of \$7 to \$13 million. Among 23 species of *striga* in Africa, *Striga hermonthica* is the most important parasiting species of crops such as maize, sorghum, millet, fonio, rice and sugarcane. Using agrobiodiversity, insects are repelled from the main crop and are simultaneously attracted to a discard or trap crop planted around fields. These trap crops include molasses grass, *Melinis minutiflora*, that

permanently releases parasitoid-attractants. Ideally, the 'intercrop' species is something useful, such as food for livestock or legumes that return nitrogen to the soil (ICIPE, 1997).

This method makes the control of *striga* as well as stemborer within the reach of African farmers tailored to the diversity of African cropping systems, based on the management of habitat through the manipulation of grain and legume crop diversity and the natural enemies of pests in and around the cropping environment. In farm trials, farm yields increased by 60-70 %.

The Ugandan government has indicated that it will be promoting this method, Malawi is interested, and Ethiopian farmers have taken it up of their own accord.

3) *Reduction of chemical fertiliser use*: Through trial and error, Henri de Laulaine, a local Catholic priest in Madagascar developed a method to raise rice yields from 3 to 12 tonnes per hectare. He has been training farmers to transplant seedlings earlier and in small numbers so that more survive; to keep paddies unflooded for much of the growing period; and to help the plants grow using compost rather than chemical fertilisers. By doing so, the reduction of environmental degradation by chemical fertilisers is markedly reduced.

4) The South African Government has initiated a National Landcare Programme for South Africa. This is a community-based programme supported by both the public and private sector through a series of partnerships. It is a process focussed on the conservation of the natural resources (soil, water and vegetation) through sustainable utilisation and the creation of a conservation ethic through education and awareness. The programme has five elements including an awareness element that is a communication and information strategy geared primarily for the farmers and secondarily for the broader land-user communities and young people. The purpose of this element is to promote a better understanding of factors that can lead to unsustainable use of resources in agriculture and of policies and institutions, which can address this.

Sufficient funding from the national budget is a major problem for the implementation of the National Landcare Programme, in view of the tremendous need to fund priority areas such as education and health. Sufficient technically trained capacity is another major problem as there is a drain of experienced persons from the public to the private sector.

5) *Supportive agricultural extension policies*: In Zimbabwe, national level encouragement of pro-agricultural biodiversity action has strengthened community capacity in some Districts. In Mudzi and Mutoko, local agricultural extension agents now actively encourage farmers to maintain on-farm crop biodiversity and farmers say this significantly influences their agricultural biodiversity decisions. District Councils have also decided to include competitions for greatest number of crops and varieties in the local agricultural shows and this has publicly validated the efforts of farmers to maintain crop biodiversity on-farm (Cromwell and van Oosterhout, 1999).

6) *Removal of agricultural subsidies*: The measure for the promotion of crop diversification at the farm level applied in South Africa to date has been the removal of agricultural subsidies. For example the Marketing of Agricultural Products Act 47 of 1996 came into effect in January 1997 and is based on the view that state intervention in agricultural markets should be the exception rather than the rule. Another example is that with the termination of the General Export Incentive Scheme in July 1997, export subsidies in respect of agricultural products are now zero. These radical reforms have had two aims, namely, increasing efficiency and productivity, and increasing opportunities for access to markets for small and medium-scale farmers. It is believed that in the medium and long-term, this will lead to crop diversification at farm level.

7) *Community seed bank*: In Ethiopia, the Tigray communities' efforts specifically address the problem of loss of traditional seeds and the traditional knowledge for selection and conservation. The Tigray farmers have established a community seed bank that currently holds seeds of a wide range of traditional crops. The seeds are selected by the local farmers based on specific cultural, technological and ecological criteria.

A partnership between breeders and the gene bank in Ethiopia is returning farmers' varieties to areas from where they had disappeared. The best yields are selected from seed originally collected from the area where the reintroduction will take place and mix it to form a multiline mixture. On land, which had been planted to pulses as in traditional fertility management, these composites yielded better than their counterparts, improved varieties planted in the same area with the application of the recommended amounts of fertilizer

The farmers are also interested in new seeds and knowledge. Moreover, they stress the importance of transmitting the selection skills to new generations. This ensures that technological knowledge and skills for genetic resources conservation are retained in the community. Institutional memory is sustained through generations of social change (Berg, 1996).

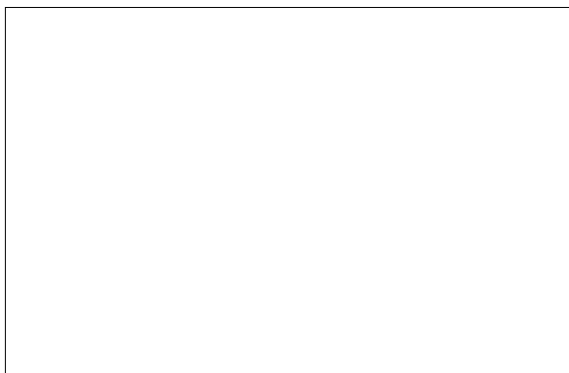
7) Since 1975, Zimbabwe has allowed private property holders to claim ownership of wildlife on their land and to benefit from its use. Zimbabwe has pioneered consumptive uses of wildlife with its Communal Area Management Programme for Indigenous Resources. CAMPFIRE, designed and managed entirely by Africans, emerged in the mid-1980's with the recognition that as long as wildlife remained the property of the state no one would invest in it as a resource. CAMPFIRE is a programme that has sought to give rural communities an alternative to destructive uses of the land by making wildlife a valuable resource, on the thesis that wildlife is the most economically and ecologically sound land use in much of Zimbabwe. Through CAMPFIRE, Zimbabwe seeks to involve rural communities in conservation and development by returning to them the stewardship of their natural resources, harmonising the needs of rural people with those of ecosystems. Under CAMPFIRE, people living on Zimbabwe's impoverished communal lands, which represent 42% of the country, claim the same right of proprietorship. Conceptually, CAMPFIRE includes all natural resources, but its focus has been wildlife management in communal areas, particularly those adjacent to national parks, where people and animals compete for scarce resources. Since its official inception in 1989, CAMPFIRE has engaged more than a quarter of a million people in the practice of managing wildlife and reaping the benefits of using wild lands.

CAMPFIRE begins when a rural community, through its elected representative body, the Rural District Council, asks the government's wildlife department to grant them the legal authority to manage its wildlife resources, and demonstrates its capacity to do so. By granting people control over their resources, CAMPFIRE makes wildlife valuable to local communities because it is an economically and ecologically sound land use. The projects these communities devise to take advantage of this new-found value vary from district to district.

Most communities sell photographic or hunting concessions to tour operators - under rules and hunting quotas established in consultation with the wildlife department. Others choose to hunt or crop animal populations themselves, and many are looking at other resources, such as forest products.

The revenues from these efforts generally go directly to households, which decide how to use the money, often opting for communal efforts such as grinding mills or other development projects. The councils, however, have the right to levy these revenues.

The Parks and Wildlife Act gives privileges to owners or occupiers of private land and rural district councils in the case of communal areas to utilise and exploit plants and animals on their land. Conservancies are mostly located in areas of low agricultural potential where wildlife is the only viable and sustainable form of land use. Its success, next to the traditional competition between agriculture and wildlife, is seen in the following results: domestic stock predators such as lion, cheetah and leopard which were being eradicated to safeguard domestic stock before the legislation and policy changes were put into place, have now started to increase in numbers. For example, surveys on 206 game and game/cattle ranches (for leopard) and 37 ranches (for cheetah) showed the following changes between 1985 and 1996:



On average CAMPFIRE projects in Zimbabwe generate over Z\$20 million annually. In addition to income directly accruing to participating households from the CAMPFIRE programme, local authorities have put up schools, grinding mills, electric fences and sales depots using revenue from the programme.

Communities which include both the large scale commercial farmers running conservancies/game ranches and smallholder farmers involved in the CAMPFIRE programme are key players in sustainable wildlife management. The large scale farmers have also provided space for relocated animals such as rhino from the Zambezi valley, and permit the wildlife department with opportunities to carry out research on their farms.

Results and lessons learned

Although it is too premature to judge whether the activities on the ground or the policy changes are increasing agrobiodiversity, there are a few considerations to be made. These include:

- Agrobiodiversity is limited through national and international policies that promote monocultures, chemical and pesticide inputs and uniform high yielding varieties. Within this context, the lessons learned are that:
 - Disrespect for indigenous knowledge and traditional agroecosystems leads to policies that limit the use of agrobiodiversity;
 - Old outdated policies that promote only the mechanization of agricultural practices, irrigation, pesticide and fertilizer use in small scale, cash crop production leads to limited use of agrobiodiversity and often negatively effecting health especially of children;
 - Forcing rural areas into the global economy encourages agricultural systems based on high yielding, low diverse crops more vulnerable to fluctuations in market forces as well as climate;
 - Limited capacity of extension workers in number, time available and knowledge on agroecosystems makes quick fixes more likely to be taught further encouraging the private market forces for chemical and pesticide distribution;
- Inequitable distribution of land and resources and the conversion of land titles without adequate education on land management could have serious environment damage;
- Demographic pressures are a root cause of biodiversity loss.

Guidelines or policies that have resulted from this experience

- Ethiopia has integrated agrobiodiversity concerns into the main policy documents – the constitution, development plan and various policies. However, the development of legislation to put macro-level policies into effective micro-level policies has been slow (Mutta *et al.*, 1998);
- Historically, the Kenya Agricultural Research Institute focused on the needs of farmers in the high-potential areas and within this group, there was a bias towards the needs of large scale farmers. The research emphasis has gradually shifted to reflect more the needs of small farmers on medium and low potential areas;
- From the Environmental Policy of Ethiopia (2 April 1997), a framework environmental law has been drafted. Drafting of a law on community rights and on access to biological resources is being finalised;
- The Forests Bill of Kenya provides for Forest Associations to be created but is ambivalent as to their legal status or likely powers. Although the Bill was drafted in 1999, it is still waiting to be tabled in Parliament.
- Ethiopian Flora Project: herbarium staff have been involved in developing the national policy documents on Biodiversity, Genetic Resources, and the Seed Industry (UNDP, no date);
- EFP representatives at OAU/STRC have drawn up draft Legislation on Access to Biological Resources and Community Rights and the Draft African Convention for the Protection, Conservation and Sustainable Use of Biological Diversity and Genetic Resources and Related Knowledge which was adopted by the OAU Council of Ministers' Meeting in Ouagadougou in June 1998 (UNDP, no date);

- The Organization of African Unity (OAU) and FAO urge specific new policies to develop and popularise agroecosystems, noting that a greater variety of food sources makes Africa far less vulnerable to seasonal shortages and climatic shifts. (Mutta *et al.*, 1998).

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