# AGRICULTURE AND HIV/AIDS IN MOZAMBIQUE: A DISCUSSION

*Isolde Prommer*

## Introduction

Mozambique is a large, semi-arid to sub-tropical country in the southeastern region of southern Africa, with a wide range of biodiversity and high HIV infection rates (16% of adults aged 15-19 are HIV positive; Wils et al. 2001). This paper discusses the prospects of agricultural development in Mozambique at the beginning of the 21st century within the HIV/AIDS pandemic, which is of widespread concern in Mozambique and sub-Saharan Africa. The study reviews the relevant literature in English, Portuguese, and German, obtained from on-line sources as well as from international libraries, and is in no way a fully comprehensive analysis of the issue. Less attention was given to the interrelationship between the epidemic and agricultural development on a large scale.

The first section describes the natural conditions, which are the basis for agricultural production. Major environmental changes, which would make the environment increasingly vulnerable, are expected to take place. The second section gives the history of agricultural production on the national level and focuses on the production systems of the majority of the rural farmers, the family farms sector, by province. It will be increasingly necessary to maintain components of the varied traditional management systems to minimize environmental deterioration and keep biodiversity as a secure basis for the poorest farmers in the country, especially in the era of HIV/AIDS. The third section summarizes the known impacts of HIV/AIDS on agricultural production and farming systems in the southern African region, made available by a number of empirical case studies and surveys. Finally, conclusions are drawn. The future of Mozambique's agricultural production potential and food security will depend on adopting governance systems that strengthen local-level mechanism and institutions and the links between knowledge, resource managers (farmers), policy makers, NGOs, and other stakeholders.

## Natural Conditions and Demographic Indicators

Mozambique is situated between latitudes 10°7' and 26°52' south and longitudes 30°12' and 40°51' east. It comprises 799,380 square kilometers and has a shoreline on the Indian Ocean of about 2,470 km in length, which is generally sandy and bordered by lagoons, shoals and strings of coastal islets in the north (Gaspar et al. 1998). The country is characterized by a wide diversity of habitats.

Geophysically, the country can be divided into four main land zones:

(a) From the coast to the interior and along some rivers, the plains lie at an elevation of under 200 m and cover more than 40% of the land area. North of the Zambezi River, the plains are between 60 km and 100 km wide. In the Zambezi Valley the plains extend upstream about 600 km. South of the Zambezi River the plains are up to 100

km wide. The coastal area is divided into different sections. The northern part is composed of craggy coasts. In the Zambezi Delta and in the southern area, beaches interrupt mangroves.

(b) A lower and middle plateau, covering about 30% of the land area, extend from the plains in the west (elevation 200 m to 500 m). The biggest area is located in the north of the country.

(c) The middle plateau (elevation 500 m to 1,000 m) covers approximately 26% of the land area and is located in the western part of northern and middle Mozambique.

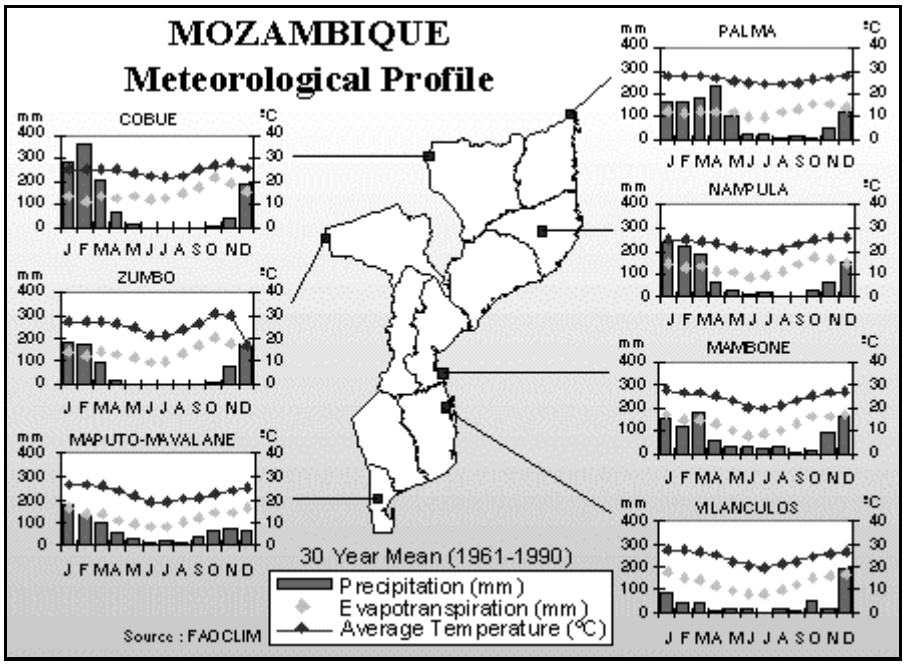
(d) The remaining area is mountainous (with elevations above 1,000 m) and accounts for about 5% of the land area. The mountains of Alto Niassa, Alta Zambézia and Agonia are of importance. The highest point in Mozambique is Monte Binga at 2,436 m.

All of these main land zones are not unique in terms of soils and micro-climate conditions.

About 25 main rivers flow through the country to the Indian Ocean. The largest and most important is the Zambezi River in central Mozambique, the fourth longest river in Africa. Of the 820 km in Mozambique, 420 km are navigable. North of the Zambezi River, important sources of water are the Rovuma (650 km), Liganha, Lúrio (605 km), and Lugenda Rivers. South of the Zambezi River, the Pongue, Buzi (320 km), Limpopo, Save, and Komati Rivers are important resources.

The climate can be described as semi-arid in the south to sub-tropical in the north. The country is affected by the seasonal air circulation of the Indian Ocean and is characterized by one rainy and one dry season per year. The Northern Provinces have a monsoon climate with rainfall between December and March. The Southern Provinces have larger differences in temperature and precipitation. The heaviest rain falls between October and March (see Figure 1).

Figure 1. Meteorological patterns in Mozambique, average 1961-1990. Source: SADC/FSTAU – FAO/GIEWS (2001a).

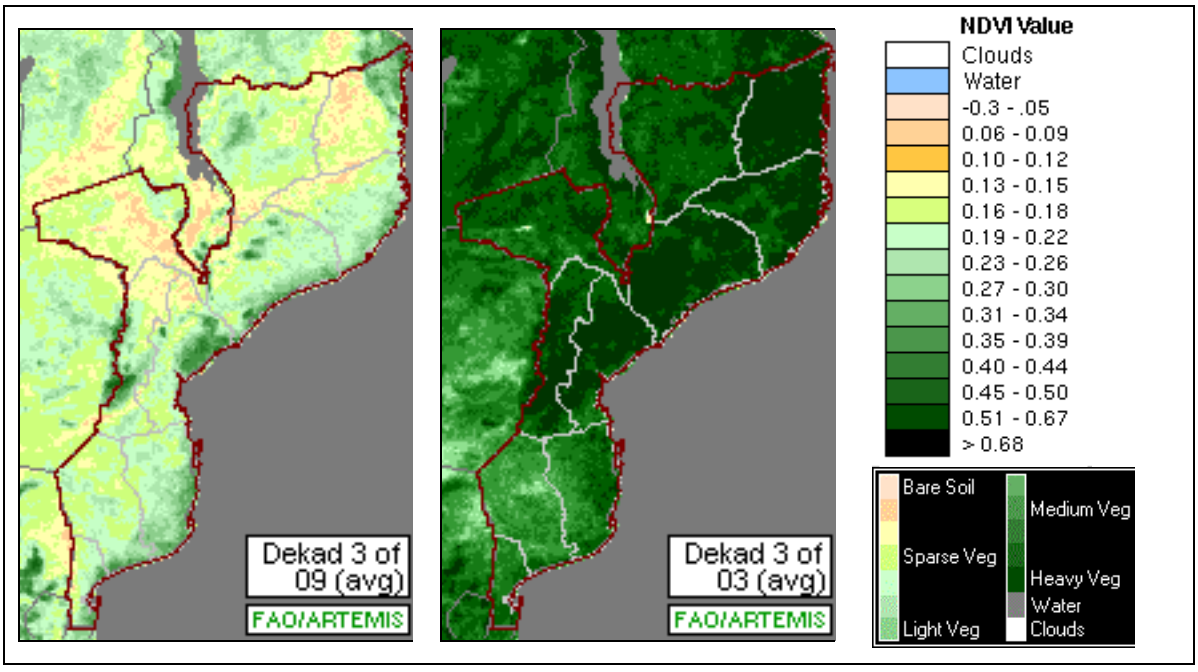


Based on Figure 1, we can analyze the growing conditions, such as the length of the rainy and dry seasons, or the months of water stress and water availability as expressed in the graphs by the evapotranspiration curve (light gray dotted line). We can see that in many regions without irrigation no second cropping season is possible. The limiting factor is water, not temperature.

The whole country is suitable for agricultural production in terms of the length of the growing period, which is 120 to 328 days per year. The highest suitability is in the plains of the Zambezi Valley and Sofala Province. Lower suitability is in the mountainous areas of Tete, Cabo Delgado and Niassa. The "hot spots" in east Gaza are exceptional with a very short growing period of 30-59 days (FAO/IIASA 2000; Fischer et al. 2000).

Another common indicator for analyzing growing conditions is the photosynthetic activity of the terrestrial vegetation. This is done by NDVI, which is gained from satellite images. The NDVI index is a helpful instrument for the analysis of weather conditions for the current cropping period based on comparisons of historical conditions. Figure 2 shows the mean NDVI index for Mozambique at the end of the dry season (mean value September) and at the end of the rainy season (mean value March) for the period 1982-1998. The darker the area on the map, the more green and densely vegetated the area.

Figure 2. Normalized Difference Vegetation Index for Mozambique, average 1982-1998 (Dekad 3 of 09 refers to September and Dekad 3 of 03 refers to March). Source: FAO/ARTEMIS (2001).




According to the FAO/IIASA study (2000), the general soil conditions for crop systems are good: (i) *soil depth* constraints exist partly in Tete Province and in the eastern part of Gaza Province; (ii) for *soil drainage* and (iii) *soil chemistry*, very few and few constraints are documented in Niassa Province, in the Zambezi Delta and in coastal Inhambane; (iv) few and partial *soil texture/stoniness* constraints are found throughout most of the country; and v) within the mountainous and hilly areas, frequent severe *terrain slope* constraints are common.

Figure 3 shows the distribution of the combined soil, climate and terrain slope constraints for Mozambique. The biggest limitations, classified as "unsuitable for agriculture" are in the Province Zambézia; "frequent and severe constraints" are in the mountainous areas of the Provinces Niassa and Cabo Delgado. Those production limitations are mainly due to serious soil fertility, and partly due to soil drainage (frequent and severe category) and texture constraints (unsuitable category). The 'severe climate constraints' in eastern Gaza are due to moisture constraints. Generally, climate conditions, soil chemistry, and soil drainage conditions are good throughout Mozambique.

Figure 3. Climate, soil, and terrain slope constraints combined for Mozambique. Source: FAO/IIASA (2000: Plate 28).

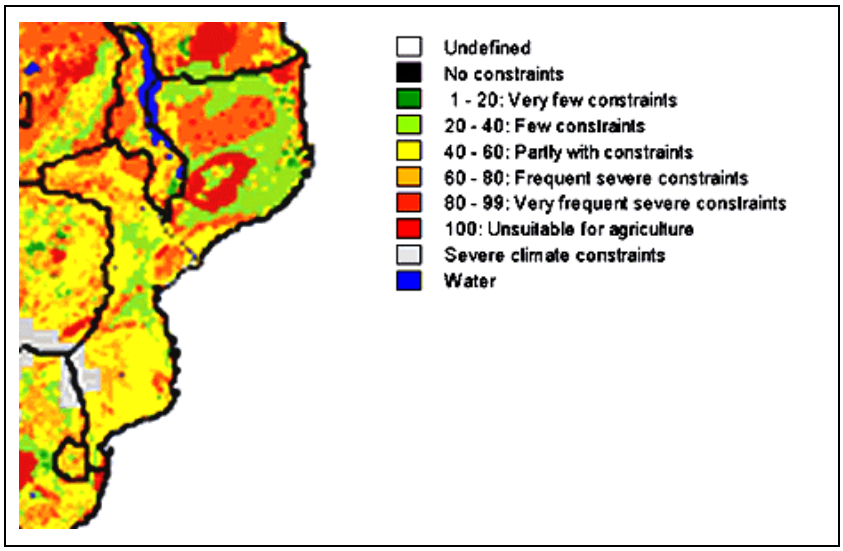


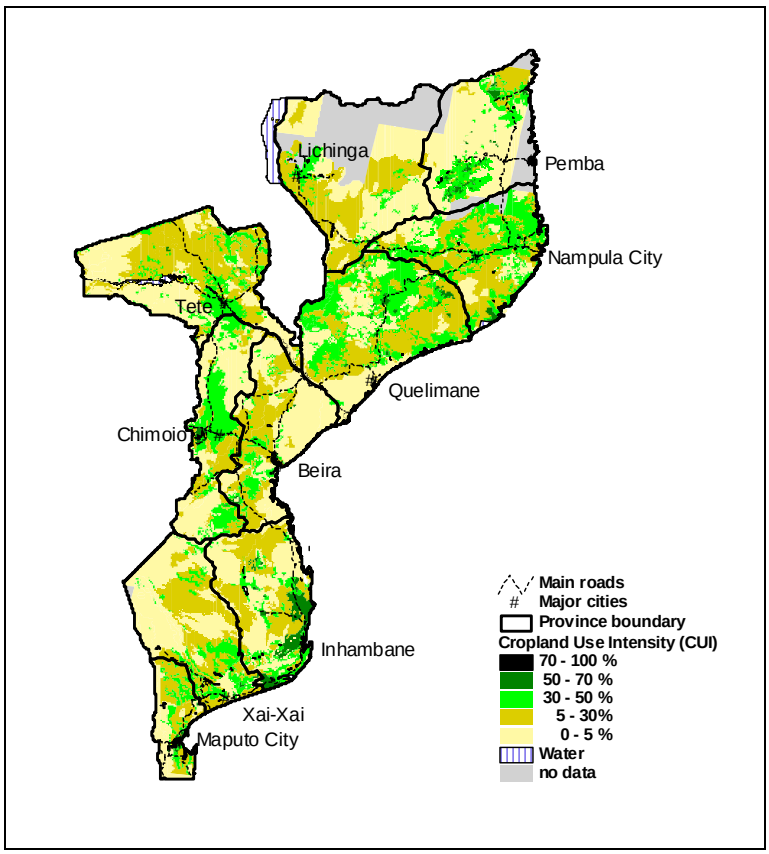

Figure 4 shows the cropland use intensity for Mozambique, evaluated by satellite images, interpreting agricultural land use change over the period 1986-1988.[22] The map shows the percentage of land area used for cropping within each grid space. The highest CUI (70%-100%) occurs along the main infrastructure network and urban agglomerations.[23]

Compared with the NDVI map (Figure 2), in areas with high variation in vegetation growth, such as western Gaza and Tete, the CUI is very low (below 5%). Other regions with low CUI are either sparsely populated or mountainous, or are areas with low soil fertility and other soil constraints (Figure 3), or are badly connected to the infrastructure (Figure 4).

[22] The land use inventory for Mozambique showed high correlations between cropland use intensity and population density.

[23] The transport infrastructure includes only the major roads. Additionally, the hinterland is more or less only accessible via unpaved roads or footpaths.

Figure 4. Cropland use intensity in Mozambique, 1986-1988. Source: EROS Data Center/USGS (1992). Note: Province map, cities and main roads have been added by the author.

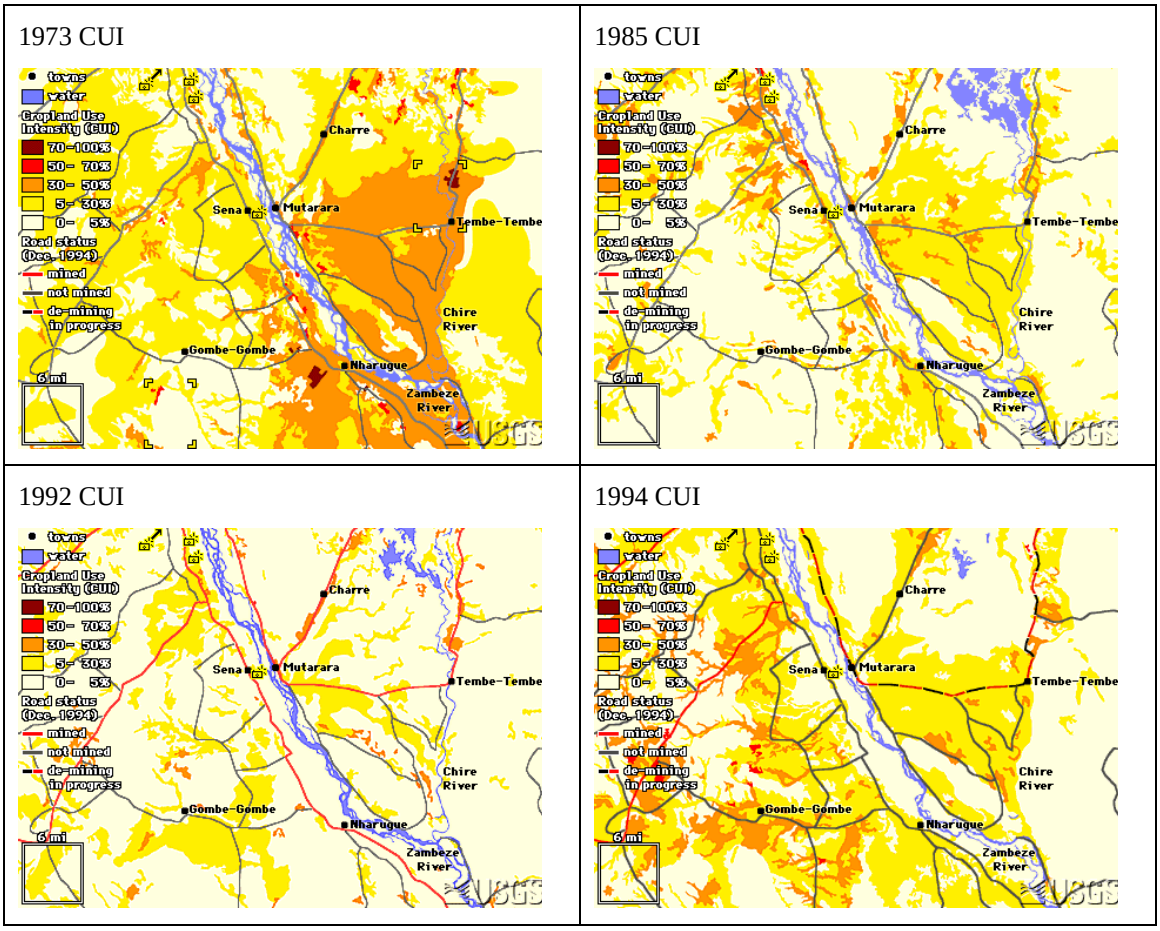



The USGS (1995a) CUI pilot study of the Mutarara/Sena area[24] (see Figure 5) shows the development of the (i) cultivation pattern before independence (April/May 1975), (ii) followed by the post-independence agricultural practices (which were affected by the departure of colonial companies) before war-related destruction and de-population (April/May 1985); (iii) the near-maximal population displacements and drought year (April/May 1992); and (iv) the postwar land use pattern and influx of the returning refugees (April/May 1994). The time series show huge differences in the utilization of land for agriculture (the darker the color, the higher cropland use intensity). The devastating effects of war are clearly visible in the strong decline in both land utilization density and total cropped area during the civil war period, followed by an intensification since the Peace Agreement in late 1992. For instance, in 1973, 16% of the study area was under cultivation. In May 1985, the amount of cropped area is estimated to have been 43% of the area cropped in 1973. Where the CUI range had been 30%-50% before independence, it was generally reduced to between 5%-30%. Areas with a CUI range between 5%-30% were still uncultivated ten years after independence. The CUI

[24] The area includes the towns of Mutarara and Sena in central Mozambique and portions of the Zambezi and Chire Rivers (parts of the Provinces Sofala and Zambézia). The area was studied for several reasons: (i) it is one of the most densely populated areas of the country; (ii) it has good soil and climate conditions; (iii) it was connected by railway to the port of Beira (this railway line has not been reactivated to date); (iv) it was heavily affected by the civil war in terms of refugee and repatriation movements to and from the neighboring Malawi; (v) during the colonial period the area was an important cotton producing center, and (vii) after the Peace Agreement, it was one of the areas with severe food shortages.

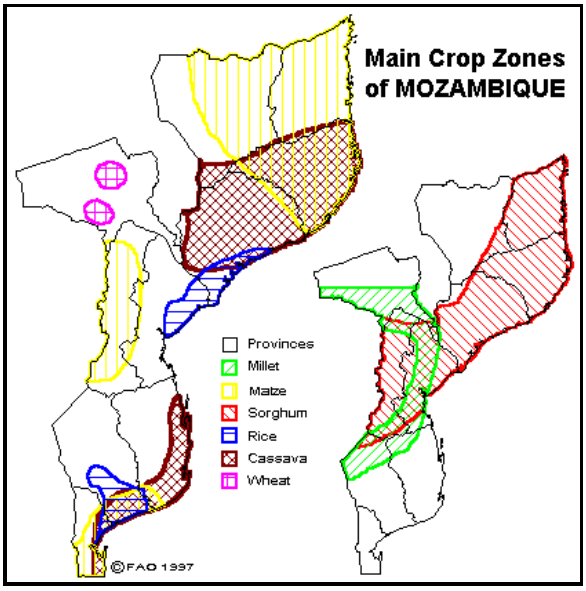
interpretation of 1994 images indicates that the percentage of the study area under cultivation increased to about 10%. Most of the areas cropped between 30%-50% in 1994 were west of the Zambezi River (USGS 1995a, 1995b).

Figure 5. Cropland use intensity, Zambezi Valley, 1973-1994. Source: USGS (1995b).



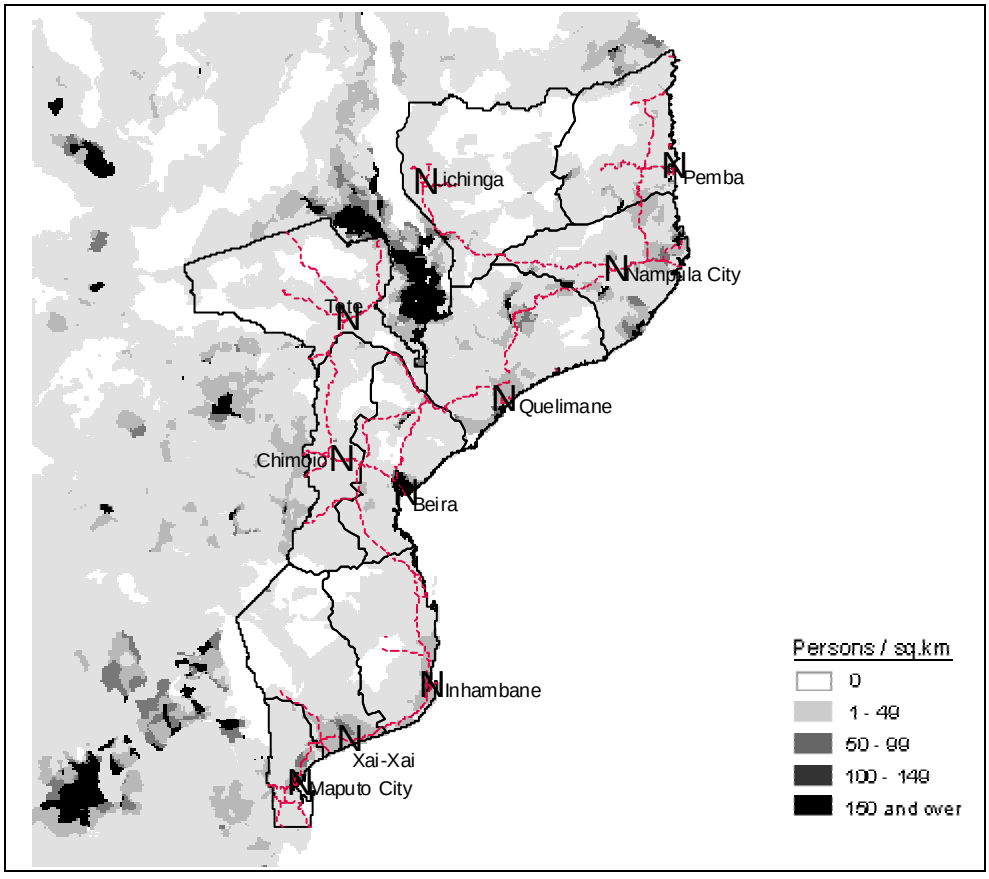

The geographical distribution of the suitability to specific crops depends on natural conditions such as precipitation, plant growth capacities and its variation spectrum (NDVI), soil type, soil fertility, temperature, and others as described above, as well as on socioeconomic, traditional, and institutional conditions (man made environment). The FAO (2000c) provides a cropping zone map for Mozambique (see Figure 6) on its website. The map refers to crop suitability. The website does not provide any information on whether the map has been developed on the basis of suitability due to natural conditions, or if it is based on rainfed or irrigated crops. Furthermore, no information is available on what input level has been taken into consideration. It can be assumed, by comparing this map to the FAO/IIASA (2000) information, that it is based on suitability for rainfed crops at medium input level. This simplified FAO map does not reflect the actual spatial crop distribution.

Figure 6. Main crop zones in Mozambique. Source: SADC/FSTAU – FAO/GIEWS (2001b).




When we compare the cropland use intensity map (Figure 4), which includes the major infrastructure, the climate, soil, and terrain slope constraints map (Figure 3), and the NDVI maps (Figure 2) with the population density map (Figure 7), we can see that the population distribution reflects natural conditions.

Figure 7. Population density in Mozambique, 1990. Source: UNEP/GRID (2001).



In terms of demographic indicators, Mozambique is a typical example of a developing country. Regarding the age structure, a large portion of the population is young: 44.8% of the population is younger than 15. The lowest proportion is in Maputo City (40.5%) and the highest in Tete Province (48.2%) (Instituto Nacional de Estatística 1999; Gaspar, this volume). The combination of the high total fertility rate, which results in a young population, and the HIV/AIDS pandemic will be an important political challenge for the country's economic and agricultural development.

Regarding economic activity, the majority of the population lives in rural areas and is active in agriculture, forestry and fisheries (see Table 1; Instituto Nacional de Estatística 1999); 90% of the rural population is dependent on agricultural activities. Women are practically exclusively dependent on agricultural activities throughout the country. Moreover, in urban areas occupation in agriculture and fisheries is still common and provides either additional household income and food supply in addition to a formal occupation, or it is the only source of income (food and monetary). In urban areas, the number of people who are economically active in agriculture, forestry and fisheries out of a total economically active population ranges from 27.6% in Maputo Province to 66.7% in northern Cabo Delgado. The respective numbers in rural areas are much higher, between 81.8% in Maputo Province and 95.4% in Cabo Delgado. Economic activity outside the agricultural sector in rural areas is low for both sexes, but much lower for women. The best off-farm employment opportunities are in urban areas, particularly in Maputo Province and Maputo City.

The sex ratio (man per woman) of the economically active population in agriculture shows a completely different pattern (see Table 1). According to the official statistics, in Mozambique, twice as many women as men are economically active in agriculture, forestry and fisheries in urban areas. The situation in rural areas mirrors the same pattern with slightly lower differences. In the urban southern provinces, up to four times more women than men, in the central provinces slightly less than twice as many females (with the exception of the most urbanized central province Sofala, which mirrors the situation of the southern provinces), and in the urban northern provinces around one-fourth more women than men are occupied in the agriculture, forestry and fisheries sectors. The situation in rural areas is similar with a slightly lower gender gap of about twice as many women as men in the southern provinces, about one-fourth more women in the central provinces, and about one-seventh more women in the northern provinces.

This gap shows that the poorest in the country are the women in the agricultural sector. This reflects the overall situation in southern Africa. Compared to the sex ratios by province, it is evident that larger portions of the female population are economically active in the primary sector in provinces with very high male out-migration rates (southern provinces) than in provinces with lower labor mobility rates (northern provinces). The population of the southern provinces is already characterized by very low sex ratios due to the high male labor out-migration to neighboring countries and to urban areas (Gaspar, this volume). The sex ratio, for instance, for the total rural population is 0.60 in Gaza and 0.50 in Inhambane Province. Labor mobility is one of the strategies of poor rural households to diversify risk and to secure the basic needs for daily life. In part, mobility is responsible for the fast spread of the HIV/AIDS pandemic in sub-Saharan Africa, and especially in Southern Africa. We have to consider that the poor are not only income- and asset-poor, but they also lack the characteristics of education and good health that are important for a modern economy and society. "It is scarcely surprising that the group experiencing the fastest rate of growth of HIV infection worldwide is women, with in many countries rates of infection in young women under the age of 20 some 5 to 6 times those of young men" (Cohen 1998:5). The behavior that exposes the poor to HIV infection also limits their ability to cope with infection: their lack of

assets/savings; the vulnerability and uncertainty of sources of income; their lack of access to knowledge about the process of infection, including an understanding of opportunistic infections; and their general lack of access to health and other support services.

Table 1. Percentage of the population who are economically active in agriculture, forestry and fisheries, of the total economically active population aged 15 years and over in 1997. Source: Instituto Nacional de Estatística (1999: Table 7.4).

| | Urban | | | | Rural | | | |
|---|---|---|---|---|---|---|---|---|
| | **Total %** | **Male %** | **Female %** | **Sex Ratio[1]** | **Total %** | **Male %** | **Female %** | **Sex Ratio[1]** |
| Niassa | 64.5 | 49.5 | 85.6 | 0.82 | 93.8 | 89.7 | 97.8 | 0.91 |
| Cabo Delgado | 66.7 | 49.3 | 89.9 | 0.73 | 95.4 | 91.8 | 98.7 | 0.84 |
| Nampula | 56.8 | 39.1 | 86.9 | 0.77 | 94.6 | 90.0 | 99.0 | 0.87 |
| Zambézia | 58.9 | 39.2 | 86.7 | 0.64 | 93.3 | 87.5 | 98.4 | 0.77 |
| Tete | 44.7 | 27.5 | 71.9 | 0.60 | 94.1 | 90.0 | 97.7 | 0.81 |
| Manica | 39.5 | 24.9 | 66.4 | 0.69 | 88.1 | 79.4 | 95.5 | 0.72 |
| Sofala | 39.0 | 17.3 | 72.8 | 0.37 | 88.7 | 78.7 | 97.1 | 0.68 |
| Inhambane | 53.0 | 34.7 | 68.2 | 0.42 | 90.4 | 80.5 | 96.3 | 0.50 |
| Gaza | 63.8 | 34.6 | 81.6 | 0.26 | 91 .9 | 80.5 | 97.5 | 0.41 |
| Maputo Province | 27.6 | 12.4 | 47.2 | 0.34 | 81.8 | 69.3 | 91.4 | 0.58 |
| Maputo City[2] | 9.6 | 5.2 | 16.6 | 0.49 | - | - | - | - |
| *Mozambique* | *41.0* | *25.1* | *63.1* | *0.55* | *92.7* | *86.6* | *97.8* | *0.73* |

[1] Calculated by the author from the total number of people employed in the agriculture, forestry and fisheries sectors.
[2] 100% of the Maputo City population is classified as urban.

Population density roughly doubled by total agricultural area in the period 1960 to 1997, from 14.2 persons per km$^2$ to 34.0 persons per km$^2$, but these are concentrated in dense pockets of cultivation.[25] The Ministry of Agriculture and Fisheries (personal communication, Mr. Domingos Diogo 1998) quotes the amount of potential agricultural area as 36 million hectares, which is similar to the FAO (2000a) figures. Further, according to the Ministry, in 1997 only 4.7 million hectares were actually cultivated, i.e., 13% of the potential area (personal communication, Mr. Diogo). This means that population density in the cultivated areas – supposing that the whole population lives in real cultivated areas – was 342.5 persons per km$^2$ in 1997. In other words, the per capita cultivated area was 0.29 hectares in 1997. According to the FAO (2000a), 3.35 million hectares (classified as permanent and arable land) were under cultivation between 1992 and 1998; the population density of the area was 480.6 persons per km$^2$; and per capita cultivated area was 0.21 hectares in 1997. With these values, Mozambique would lie between the high input and mechanized agricultural systems of North America and Europe. For example, the United States has a density of 149 persons per km$^2$ and 0.67 hectares of cultivated land per capita, and Germany has 678 persons per km$^2$

[25] The figures for 1965 were calculated from the 1960 total population of 6,603,653 (Gaspar 2001). The FAO total agricultural area in 1961 was 46,649,000 hectares. The figures for 1997 were calculated from the 1997 census showing a total population of 16,099,246. The FAO total agricultural area in 1997 was 47,350,000 hectares.

and 0.15 hectares per capita. Mozambique's figures are very close to its former colonial power of Portugal, which has 364 persons per $km^2$ and 0.27 hectares per capita. But Mozambique has substantially smaller yields than these countries, e.g., 830 kg/ha for cereals compared to 6,000 kg/ha in the U.S., which explains parts of the food insecurity in Mozambique.[26]

Labor migration and its history should be kept in mind (for more details, see Gaspar, this volume), when we discuss the potential of agricultural development. The country experienced almost three decades of war and civil strife, which ceased in late 1992 with the signing of the Peace Agreement. Hence, the total number of displaced people and refugees is the largest in Africa, and the third largest in the world after the Afghans and Palestinians. According to official data, about 1.7 million refugees fled to the six neighboring countries (mainly to Malawi) and an estimated 4 million people were internally displaced. Many of them were small-scale farmers who had sought sanctuary in the relative safety of the urban areas (for instance, in the provincial capitals, Maputo City, and the Beira corridor). Practically all of Mozambique was affected by refugee movements during the war, and by the influx of returnees after the war (UNHCR 1998, 1995).

## Production of Selected Crops from 1961 to 1999

The agricultural sector in Mozambique is divided into the family sector, which cultivates about 93%-95% of the area, and the commercial sector, which is divided by the Ministry of Agriculture and Fisheries into state farms, private, and mixed farms (personal communication from Mr. Diogo in 1998).[27] Crop composition, total harvested area, yields, and total production in metric tons are characterized by significant changes over time, especially during the long lasting civil war period. This section describes the overall national production development and provides a short description of the family farm sector.

The governmental development planning strategies have changed several times since independence in 1975. They had to deal with the heritage of the Portuguese colonial system. Upon independence the government recognized the importance of the development of the agricultural sector – the mainstay of the country's economy. During the first years of independence the government focused on the development of the state farm sector. During the whole civil war period, most of the development investments in the agricultural sector went to the state and commercial farm sectors, and the family farm sector was neglected. Since the Peace Agreement in 1992, the Ministry of Agriculture and Fisheries has focused on the development of the family farm sector (e.g., Hanlon 1996; Wenzel and Weyl 1992).[28] Since the 1980s Mozambique has been faced with several structural adjustment programs of the World Bank and IMF. Governmental programs were established, such as the 'Economic Rehabilitation Program' from 1987 to 1989, the 'Mozambique Emergency Program,' the 'Priority District Program' in 1989, and the 'Comprehensive Program for the Agricultural and Natural Resource Sector' (PROAGRI) in the late 1990s.

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[26] Calculated from data in FAO (2000a) and United Nations (2000).

[27] The official figure for arable land in Mozambique is 36.6 million hectares, i.e., 47% of the total land area.

[28] Agrarian policies are not discussed in this chapter. See, for example, Braun 1989; Davison 1988; Dejene and Olivares 1991; Hanlon 1986, 1984; Hillebrand 1990; Meyns 1988; Rauch 1990; United States Department of Agriculture 1980; Weyl 1990; World Bank 1990, 1989; Wuyts 1989; and PROAGRI publications by the Republic of Mozambique.

## Major staple and cash crop production according to FAO data[29]

The country's most important food crops are maize (*milho*), millet (*mapira)*, sorghum (*sorgo*), rice (*arroz*), cassava (*mandioca*), sweet potatoes (*batata doce*), potatoes (*batata reio)*, and to a certain extent wheat (*trigo*). It is notable that sorghum is not listed in the national Mozambican statistics but plays an important role in the FAO statistics. Cassava is, in terms of calorie intake, presently the most important crop, as it provides 36% of the total calorie intake on the national level. Maize, the next most important crop, provides 29% of the total calorie intake. It is followed by wheat and rice (5% each), and sorghum and millet (5% together) (FAO 2000b). The calorie intake composition differs from region to region, depending on the farm systems and cropping patterns, which in turn depend on natural conditions. Other factors that influence calorie intake are household composition and socioeconomic factors such as tradition, access to markets, and storage possibilities. Most of the calorie intake from wheat comes from imported wheat: it is a negligible crop in terms of domestic production. The major vegetable crops are beans (*feiões*), tomatoes (*tomate*), and onions (*cebola*). The vegetables are grouped in the national statistics as *hortículas*. Along the coastal areas in the Provinces Gaza, Sofala and Zambézia, rice cultivation is common in the plains, which are adaptable for rain-fed rice production.

The total production of the most important staple crops, roots and tubers, shown in Figure 8, increased after the end of the civil war in 1992. By contrast, most cash crops continued to stagnate. This may be the result of the focus of the government and development cooperation agencies to ensure food security before increasing the productivity of the cash crop sector, and/or the resistance of the local population to planting "colonial crops."

Figure 8. Total production of the main staple crops in 1,000 metric tons in Mozambique, 1961-1999. Source: FAO (2000a).

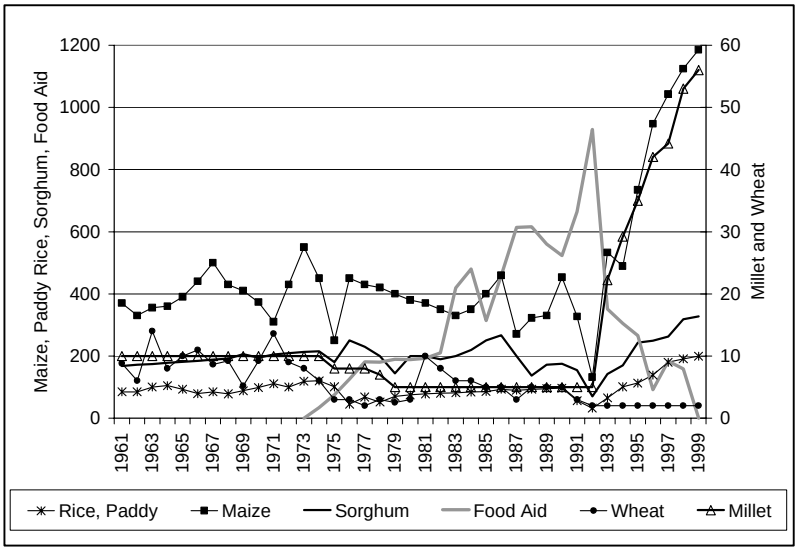



Figure 8 also shows the total amount of cereal food aid that arrived in the country between 1974 and 1998. At the peak of the food aid in 1992, 929,089 metric tons of cereals arrived, compared to only 132,047 Mt of locally grown maize. In total, four times as much food aid arrived in the country in that year than cereals were produced. Two factors led to the

[29] All data in this section come from FAO (2000a) unless otherwise stated.

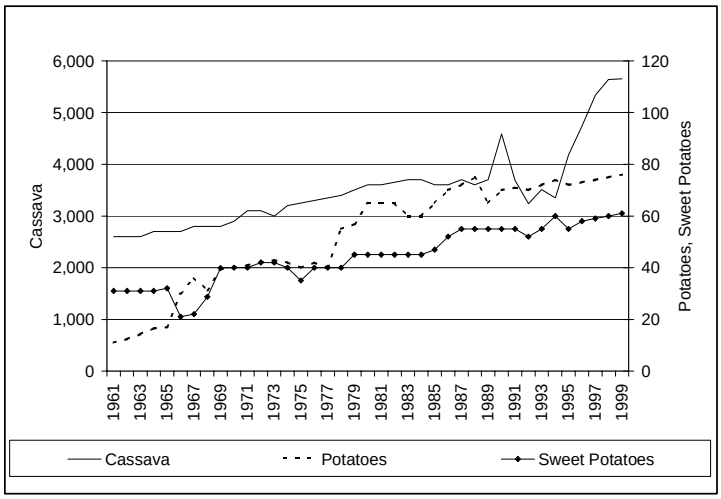
food shortage crisis. Historically, 1992 saw one of the most severe droughts, and the civil war had, by that time, displaced about one-third of the total population. This lead to a significant reduction in yields per hectare and total harvested area for all staple crops. These factors resulted in a reduction in seed availability, which made the planting of the same area as the year before almost impossible. From 1992 onwards, however, food aid declined precipitously, reflecting the rise in local production, better food distribution, and slow reconstruction of the markets and infrastructure.

At first glance, total production of the two most important staple crops, maize and millet, increased astoundingly after 1992. Compared to the mean production of the pre-independence period (1961-1974) and civil war period (1975-1992), maize production tripled and millet production increased 5.6 and 10 times, respectively. The per hectare production in 1999 for maize and millet reached approximately the same level as reported in the colonial period (0.94 Mt/ha for maize and 0.54 Mt/ha for millet in 1999, mean value of 0.92 Mt/ha and 0.53 Mt/ha in 1961-74) after a constant decline during the war period (0.16 Mt/ha for maize and 0.29 Mt/ha for millet in 1992). According to the FAO (2000a), the harvested area increased from 425,000 ha in 1961 to 1,260,000 ha in 1999. Millet shows the same pattern. That means that the steep increase of total production after 1992 is the combined result of yield increases and the increase of total harvested area.

Other staple crops, such as wheat and rice (paddy), have not shown a significant increase over the last ten years. In fact, wheat decreased constantly, both in production and in harvested area, from about 10,000 Mt to 2,000 Mt in the 1990s. Production declined sharply after 1975 and reached its peak in 1981. The steep reduction from 1971 to 1975 resulted from a sharp decline in yield, not from fewer harvested areas. The sharp increase in 1981 and 1982 was due to the national state-farm policies, and this level has remained constant.

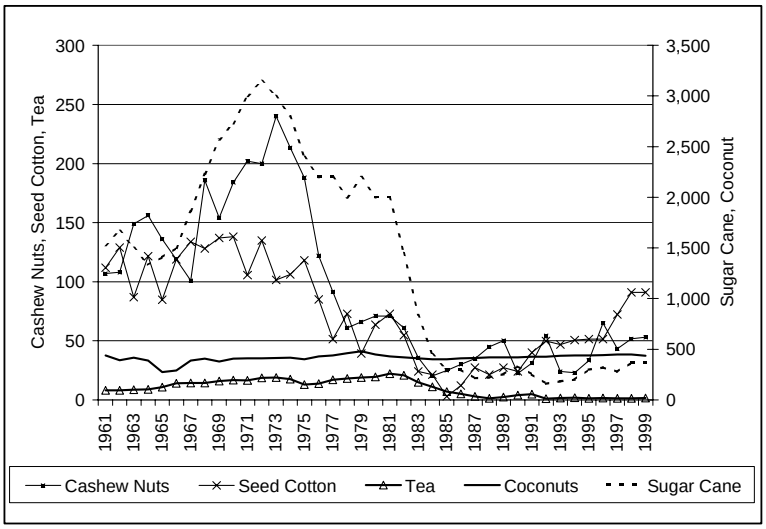
The production of cassava, sweet potatoes and potatoes increased constantly between 1961 to 1999 with almost no visible impact of the civil war (see Figure 9). Furthermore, there are no significant signs of drought or flood impacts, except for cassava in 1992-1994, but this was also related to a reduction in harvested area in 1993-1994. It is important to note that the increase in cassava production is based more on an increase in yield (Mt/ha) than on the harvested area, and the potential for higher yields still exist. The improvement of cassava, both in terms of productivity and nutritional value, is one of the main targets of the FAO (for more information, please see http://www.fao.org/NEWS/2000/000405-e.htm). In addition, sweet potatoes can be combined seasonally with rice. According to FAO data, the harvested area for sweet potatoes stagnated from 1976 to 1991, with a slight increase after 1995, following a reduction during the drought years.

Figure 9. Total production of main root crops in 1,000 metric tons in Mozambique, 1961-1999. Source: FAO (2000a).




The main cash crops in order of export earnings in 1998 are: cotton lint (US$ 15 million), cashew nuts shelled ($10 million), sugar total raw equivalent (US$ 5.7 million), and tea (US$ 0.23 million) (see Figure 10). Cash crops are important for the family farm household income in some districts. In the last years of the colonial period, there were considerable increases in sugar cane, cashew, tea and tobacco production. Following independence, production levels plunged heavily as a result of factors such as the breakdown of the market and the destruction of the processing companies due to the return of the Portuguese settlers, and the disappearance of the colonial forced labor production (*chibalo*). The much slower production gains of the 1990s are an interesting contrast to the real increases of the staple crops.

Figure 10. Production of main cash/export crops in 1,000 metric tons in Mozambique, 1961-1999. Source: FAO (2000a).




Cotton has been and still is the main cash crop in northern Mozambique (Cabo Delgado, Niassa, Nampula and Zambézia Provinces). Production of seed cotton was 118,000 Mt in 1975, then fell to less than 33,000 Mt in 1985, and increased to 51,500 Mt in 1994 and

91,000 Mt in 1999. The harvested area shows about the same pattern, with a slower increase in the post-war period than the per hectare production. A program for rehabilitation of the cotton sector is part of the national planning policy. It is interesting that yield decreased in the drought years 1981-84 and 1986-87, but in the drought period 1991-92 the yield increased.

Sugar was produced by large cane companies (plantations), such as Sena Sugar Estates Ltd., Companhia Colonial do Buzi (Sofala Province), and the Sociedade Agrícola do Incomati (Maputo Province). Production reached its maximum in 1972 with 3.15 million Mt. All the companies were nationalized after independence. The total sugar production decreased to a minimum of 215,000 Mt in 1987 (to 1/14th of the 1972 level) and since then has hovered around a level of 200,000 to 350,000 Mt. The government and the African Development Fund have been planning the rehabilitation of the sugar sector since the beginning of the 1990s with massive foreign monetary aid.

In 1986, Mozambique ranked eight, after Kenya, Malawi, Tanzania, Zimbabwe, Rwanda, South Africa and Mauritius, among African tea producers (EIU 1996). The main production areas are the Zambézia hills and mountains close to the Malawi border. The country produced 19,000 Mt in 1973, then fell to a minimum of 13,500 Mt in 1975, and increased strongly until 1981 (22,190 Mt). It is currently on a level of about 15,000 Mt per year. The civil war was one of the most important reasons for the severe decline in production. In 1987, RENAMO destroyed the equipment of five tea-processing factories. The principal markets for tea are the United Kingdom and the USA.

Production of cashew nuts was 360,000 Mt in 1975 and declined almost to zero in 1984 (20,300 Mt). In an attempt to increase production levels, the government doubled producer prices for the crop. In late 1991 the government authorized the export of cashews in unprocessed form for the first time since 1976. But still, the cashew nut production remains quite low, about 50,000 Mt per year.[30]

Coconut and copra is mainly produced on plantations in the coastal belt of the Zambézia and Nampula Provinces. Coconut production varied in the period 1970 to 1999 between 410,000 to 450,000 Mt total production per year. Coconut is a popular crop for subsistence farmers who use the oil and other products in everyday life and for income.

### Agricultural production by province according to national statistics

Data sources used in this section are the *Agricultural Survey of the Family Sector 1996* (MAP 1996), the *District Development Profiles* of the UN System in Mozambique (2000) and the *Agrarian Statistics 1996* (MAP 1997). The first two sources provide data for the family farm sector, for instance, on farming systems, yields and cropped area, auto-consumption and marketing, without a time series. The third provides information back to the year 1986 for the commercial sector, namely, the state, private, and cooperative sector, for instance, on crop and livestock production, commercialization and forestry. The family sector is not of importance in these statistics and consists of irregularities in terms of errors, either of total area harvested

[30] For a critical analysis about the failure of cashew rehabilitation by the IMF, see Hanlon (1996, 1995).

or total production.[31] The following paragraphs describe agricultural characteristics by province, starting in the northern part of the country.[32]

In **Cabo Delgado**, the mean size of the cultivated area[33] per household in the family sector is 2.28 ha or 0.62 ha per household member. In order of production, the main food crops are maize, cassava, millet, groundnut, beans and rice. Significant is that the majority of the food crops are auto-consumed, about 99% of the total rice production, 93% of cassava, 90% of millet, and 78% of maize production. Commercialized food crops are butter (wax) beans (100% of total production), followed by other beans (82%), maize (22%) and groundnut (15%). Cash crops are cotton and coconut, which are commercialized by 100% and 21%, respectively. Of interest is the market value for tobacco and sesame, although no cultivated area is reported in these statistics. Major crops in the commercial sector (MAP 1997) are rice, beans and cotton, millet and groundnut. The total production for the first three crops constantly decreased until 1992 and recovered to the 1986 level in the year 1996/97. Millet and groundnut production has been recorded since 1993/94.

In **Niassa**, the mean size of the cultivated area per household in the family sector is 2.37 ha, or 0.56 ha per household member. Important food and staple crops are maize, millet, beans, cassava, and groundnut. The majority of production is auto-consumed, about 98% of the total millet production, 98% of cassava, and approximately 80% of the maize production. Commercialized food crops are sweet potatoes (68 % of total production), followed by maize (about 29%) and beans (21%). Important cash crops are tobacco and cotton, which are commercialized by 160% and 99%, respectively (the 160% might be explained by tobacco import from the neighboring Malawi). Listed crops in the commercial sector (MAP 1997) are maize, beans and vegetables, rice and groundnut. The cultivated area for the first three crops constantly declined between the cropping seasons 1986/87 to 1995/96.

In **Nampula** Province, the mean size of the cultivated area per household in the family sector is 2.60 ha, or 0.64 ha per capita. Ordered by importance of total production, the main staple and food crops are cassava, beans, maize, groundnut, and rice. Almost the complete harvest of the following staple crops is auto-consumed: 95% of the total cassava production, 97% of millet, and 67% of maize. Each household consumes 66% of the groundnut production and 77% of all beans. Important cash crops are cashew, cotton and coconut, which are commercialized by 70%, 99% and 22%, respectively. The low commercialization rate of coconut and the limited commercialization of cashew may be a combination of the importance of these products in the daily household diet, and the absence of markets. The small production of tobacco is 100% commercialized. Recorded crops in the commercial sector (MAP 1997) are maize, beans (with a significant production peak from 1987/88 to 1993/94), vegetables, and groundnut. Millet and cassava production are reported in this province, too. Cotton is the leader of the cash crop production, followed by tobacco and sunflowers.

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[31] The calculated yields per hectare from this data vary too much and must be adjusted before they can be used in the analysis.

[32] For comparison with the water model chapter by Hellmuth et al. in this volume, the country was split into three Socioecological Regions: SER-A encompasses the northern districts Cabo Delgado, Niassa, Nampula, and Zambézia, and covers approximately 50% of the total land area, with 52% of the total population. SER-B encompasses Tete, Manica and Sofala Provinces, and covers about 29% of the total land area, with approximately 20% of the total population. SER-C is defined by the Provinces Inhambane, Gaza and Maputo, and covers about 21% of the total land area, with approximately 28% of the total population. SER-C also includes the capital city Maputo.

[33] Here, cultivated area includes annual crops, permanent culture, pastures and fallow ground. For comparison, pastures are not included in the data in the first paragraph after Table 1.

In **Zambézia**, the mean size of the cultivated area per household in the family sector is 2.19 ha, or 0.49 ha per household member. The main food crops, according to the order of mean planted area, are maize, cassava, millet, rice, beans, meixoeira[34] and groundnut.[35] As in most provinces, the main part of production is auto-consumed: about 76% of the total maize production, 100% of millet, almost 100% of meixoeira, 96% of cassava, 92% of rice and 82% of beans. The most important commercialized food crops are groundnut (45% commercialized), maize (23%), and sweet potatoes (13%). Important cash crops are cotton and cashew, of which 100% and 62%, respectively, are sold. Listed food crops in the commercial sector (MAP 1997) are rice, beans, cassava and since 1989/90 millet and groundnuts. Of importance for the commercial sector, which includes the state farm sector, is cotton, copra and tea production.

In **Nampula** the cultivated farm area with trees accounts for about 20% and the fallow ground for about 13% of the total area. Cabo Delgado's distribution is about 3% and 22%; Niassa's distribution is about 3% and 17%; Zambézia's distribution is about 27% and 10%. This indicates that there is more shifting cultivation in Niassa and Cabo Delgado. Characteristic for all four northern provinces is that beef production is almost non-existent in the family farm sector (MAP 1996). Therefore the amount of the household's total agricultural area devoted to pastures is almost 0%. In all four northern provinces, almost every household keeps chicken, followed by goats or ducks, and swine or ovine, with more importance on ducks in Nampula and Zambézia and on goats in Cabo Delgado and Niassa. Livestock is used for auto-consumption and for marketing purposes. Ranked by the number of sold heads, chicken are first, followed by goat, swine and ducks.

In **Tete**, the highest and most interior province of the central region, the family farm sector has a mean size of 2.10 ha of cultivated area per household, and 0.40 ha per capita. Manica, bordering Zimbabwe, has a mean cultivated area per household of 2.42 ha, or 0.42 ha per household head. Sofala has a mean cultivated area per household of 3.05 ha, or 0.57 ha per household head. The difference between the provinces is the amount of land that is fallow – 12% in Tete, 10% in Manica and 4% in Sofala. Sofala is the only reported province of the central region with a mean area of 0.74 ha under tree cultivation (that is about one-fourth of the total cultivated area); Manica has a mean area of 0.03 ha under pasture. In general, most of the farm area is used for annual crop cultivation.

Ordered by total production the main food and staple crops in **Tete** are maize, millet, meixoeira, and root vegetables such as potatoes, sweet potatoes and cassava. In addition, vegetables such as groundnut, onions, lettuce, tomatoes and garlic are grown. The auto-consumption rate is almost 100% for the majority of the food crops (especially cassava, millet, and meixoeira). Income is generated from selling groundnut, beans and maize (53% of the total production, 19% of all bean varieties and about 12% of maize production) and sugar

[34] Meixoeira: African tree with edible seeds.

[35] The order of importance of crops can be different when they are based on the mean planted area or on total production. But for all four provinces, the ranking does not really change based on mean planted area by household or total production. Also, the ranking is almost the same, when looking at the order by percentage of households which plant these crops. For the Province Zambézia for example, the order for total production in metric tons would be: maize, cassava, rice, millet, meixoeira, beans and groundnut, instead of maize, cassava, millet, rice, beans, meixoeira and groundnut. This result is based on the following factors: a) the observable and evident importance of these crops for food consumption – the "typical" diet composition; b) the quite low hectare productivity, which means that the differences between the crops are small; and c) the "absence" of consumer goods markets, which means that farmers are forced to produce their own food.

cane.[36] Tobacco and cotton are the two typical cash crops, but are not of significant importance in the family farm sector. Major crops in the commercial sector (MAP 1997) are maize, millet, groundnut, beans, and vegetables. According to the production data for the commercial sector, only maize is of importance. Irrigation is recorded only for vegetable production and in small areas for rice production.

In **Manica** the main food crops in order of importance are maize, millet, meixoeira, beans, sweet potatoes, cassava and groundnut. The typical food and staple crops have a high auto-consumption rate. Households consume roughly 87% of the total maize production, 99% of millet, 92% of cassava, and between 75% and 88% of beans. Besides the commercialization of the mentioned food crops of between 2% and 25% of the total production, cotton (100%) and sesame (42%) are of importance for income generation. The MAP (1997) database also records maize, millet, groundnuts, sunflowers, cotton, and citrus fruits.

In **Sofala** Province, in order of importance of total production and area under cultivation, the main staple and food crops are maize, millet, cassava, rice, all sorts of beans, meixoeira and groundnuts. Typical cash crops are cashew, coconut, sesame, cotton and tobacco. The majority of the people in Sofala Province live along one major road (the Beira corridor) and in Beira, the second largest city of Mozambique. The auto-consumption rates in the family farm sector are as high as in other provinces. The households consume about 97% of the total millet production, 96% of meixoeira, 94% of cassava and rice, and 87% of maize. Family farms sell about 30% of the groundnut production, 36% of the cashew, about 45% of the wax beans, 77% of the tobacco production if existent, and more or less the total cotton production. Recorded food and staple crops in the commercial sector (MAP 1997) are maize, millet, vegetables, beans, cassava, and groundnut, and main cash crops are cotton, sugar cane, and of less importance sunflowers and tobacco.[37]

Chicken, goats and ducks, in order of importance, are the main source of livestock in the family farm sector in the central provinces for both auto-consumption and marketing. Cattle are common in all three provinces, but are most common in Manica where livestock production has a long tradition.[38] Still, present livestock production is below pre-independence levels. The major loss of livestock was reached by end of the civil war in 1993. Several drought years and especially the 1992/93 drought reduced the already war-affected herds. According to MAP (1997), meat production counted by head of animals is big in the family farm sector. Cattle are not only a source of protein, but also particularly important as draft power and transport, and to provide manure for fertilizer.

In the **Gaza** Province the mean size of the cultivated area per household is 3.80 ha, or 0.87 ha per capita. Inhambane, with its main road connecting to Maputo City to the north, has a mean cultivated area per household of 2.66 ha, and 0.46 ha per household member. Maputo Province, the smallest and most urbanized province, has a mean farm size per household of 2.55 ha, and 0.46 ha per household head. Maputo Province has the lowest proportion of land under fallow, which is about 2% of the total area. Inhambane, with quite good infrastructure,

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[36] Many small-scale farmers (family sector) plant sugar cane along small rivers, the more moist areas of their land, and it is part of their daily diet. Quite often sugar cane is sold at the local market (just three sticks) to generate additional farm income. In this context sugar cane is not the classical plantation cash crop.

[37] During the Portuguese colonial period the important sugar cane and cotton plantations and factories were located in Sofala Province. Many of the factories were destroyed during the civil war and former plantation areas are now occupied by small-scale farmers.

[38] Two-thirds of Mozambique (most of SER A and SER B) are affected by the Tse Tse fly.

has about 5% of the area under fallow. Gaza has the highest rate of fallow land (12%) in the southern region. Even though the region is more suitable to cattle production, only small areas in the family sector area are classified as pastures: 2% in Gaza, 3% in Inhambane, and 0% in Maputo Province. The majority of the farm area is devoted to the annual cropping system (18%), tree farming (4%) and pastures (18%).

In **Inhambane**, the main food and staple crops, ranked by total production, are maize, beans, groundnut, root vegetables such as cassava, potatoes and sweet potatoes, millet, rice, sesame and meixoeira. Almost the total harvest of the following staple crops is auto-consumed: 92% of total maize, 91% of beans, 82% of cassava, 99% of millet and 93% of groundnut production. Of importance for household income is the sale of sweet potatoes (more or less the complete harvest) and some vegetables, such as onions, tomatoes, cabbage, lettuce, garlic, peri-peri, pepper, pumpkin and carrots. Important classic cash crops for a few farmers are cotton (Govuro and Homoine district), cashew and coconut along the coast. Also to a lesser extent tobacco and sunflowers are reported. Major crops in the commercial sector (MAP 1997) are maize, cassava, groundnut, beans, vegetables and rice, and cash crops such as copra and sunflowers.

In **Gaza** the main food crops in order of importance are maize, cassava, beans, and groundnut. For a small number of farmers, rice is a significant staple crop, which is marketed by 30%. The other typical food and staple crops have the same high auto-consumption rates as the other provinces. Almost 100% of the total millet production, 91% of cassava, 79% of maize, 20% of sweet potatoes, and about 50% and 92% of the beans (depending on the variety) are consumed by the households. Besides the commercialization of the mentioned food crops between 0% and 50% of the total production, cashew and copra are of importance for income generation. Vegetables are mostly grown in the cool season. Reported constraints are irregularity in rainfalls, pests, lack of seeds and lack of capital (UN System in Mozambique 2000). The MAP (1997) database records maize, groundnut, vegetables, beans, onions, industrial tomatoes, cassava, and cotton.

In **Maputo** Province, in order of total production and area under cultivation, the main staple and food crops are maize, beans, groundnut, cassava and sweet potatoes. Vegetables include pumpkin, lettuce, garlic, onion, cabbage, cucumber, okra and tomatoes. Even in Maputo Province, despite its proximity to the nation's capital, auto-consumption rates in the family sector are high: 87% of the total maize production, 100% of groundnut and beans, 75% of sweet potatoes, and 63% of cashew. The small remaining amounts are sold on regional markets. Rice, sunflower seed, sugar cane, bananas and vegetables are grown by the family sector as cash crops. Recorded food and staple crops in the commercial sector (MAP 1997) are maize, rice, cassava, vegetables, beans, groundnut, water lemons, and sugar cane. Irrigation and fertilizers are used in the commercial farm sector, while the family sector uses traditional methods such as manure, inter-cropping, and crop rotation.

The main domestic animals for household consumption are chicken, goats, ducks, swine and rabbits, in various order depending on the district (except chicken and goats, which always rank first and second). Goats, pigs, cattle and chicken are important for marketing. Cattle are common and used for meat and as draft and transport animals. As mentioned at the beginning of the section, the main factor favoring the development of livestock farming is the existence of large pastures, suitable climate and a cattle-ranging tradition. Current differences in livestock sizes by districts are the result of the civil war combined with drought years. Reported constraints on livestock production are animal diseases, lack of extension services and shortage of money to buy stock (UN System in Mozambique 2000).

## HIV/AIDS and Agricultural Development: General Discussion

Looking at the agricultural transformation process in Africa, Richards (1985) says that farmers have had neither the time nor inclination to homogenize their land for machines or chemical-intensive plant ideotypes. Furthermore, Africa has suffered more from labor shortages than lack of land. Mitchell et al. (1997) observe that agricultural science, which is based on an one-at-a-time isolation of significant variables, has found it hard to conceive ways of working with the huge diversity of crops and land types as is found in the African "subsistence agriculture." Instead, development efforts have favored the transfer of technology, the introduction of mono-cropping systems, and an "under-investment" in locally innovative agricultural research.

Barnett et al. (1995) and the FAO report (1995) elucidate that farming systems vary in the vulnerability to the challenge of HIV/AIDS. Studies in West African grain cropping systems (Richards 1986) and Eastern African banana/maize/root crop farming systems (Barnett and Blaikie 1992; Barnett et al. 1995) show that in areas with a large HIV infected population, the Eastern African systems are less affected by the disease. The West Africa rainfed farming systems as described by Richards (1986) tend to abandon upland rice production and switch to small survival patches of "garden" and dry-season wetland crops, such as sweet potatoes. The East African systems seem to be more flexible to the loss of labor of family members who have to nurse a household member with an AIDS-related illness.

The greatest impact is not felt by the weak. "HIV/AIDS, in a way, 'selects' for the strong – for the professional classes, for household breadwinners. This is a reflection of the strong connection between mobility and wealth generation in African society. HIV/AIDS is, in effect, a network disease, especially associated with the urban notes and major transport arteries." (Richards 1999: 98)

In economic terms, households nursing members with AIDS are affected in various ways – often scarce reserves of rural capital are depleted. For example, households of post-AIDS survivors have to struggle to survive with cattle and other assets gone. Often only the land remains, especially in areas with customary tenure system (Rugalema 1998).

HIV/AIDS may have several effects on agricultural production, which is dependent upon the social, socioeconomic, and farming systems, as reported in several studies.

1) The situation is worsened by the fact that HIV/AIDS is transmitted heterosexually in Africa (FAO 1995; World Bank 1999). The probability that both parents die is very high. According to the results of the IIASA Population-Development-Environment case studies in Botswana (Sanderson et al. 2001a), Namibia (Sanderson et al. 2001b), and Mozambique (Wils et al. 2001) the ratio of the population group aged 40-49 to children will stay more or less constant, even in the behavioral change scenario (i.e., reduction of HIV transmission). However, the overall size of the rural population will decrease, and the remaining population will consist of children and elderly.

2) HIV/AIDS may deplete the scarce monetary resources of affected households through payments for medical treatment (traditional and/or conventional treatment), funeral costs and special food (mourning customs). Some of those resources would have been used for purchasing agricultural input (agro-technical improvements, seeds, occasional extra labor, family assets such as livestock, etc.).

3) The decrease in labor force due to AIDS deaths or the loss of time incurred by nursing sick HIV-positive family members (reduced labor quantity and labor quality) may result in: changes in the cropping system; reduction of the cultivated area; minimal soil conservation measures; decreases in productivity; abandonment of cash-crop

production in favor of food or subsistence crops; change to labor-saving time crops which could result in a strong decrease of vegetable cultivation; and less intensive livestock production, which can result in a less varied and less nutritious diet. Other impacts can be the reduction in the ability to control pest diseases; the delay in farming operations such as tillage, planting and weeding; and the loss of agricultural knowledge and management skills. It can be assumed that the effects of labor loss due to AIDS deaths are similar to labor loss due to male rural out-migration (Prommer 1998). And, as is mentioned in the FAO report (1995), the transmission of acquired skills and knowledge will be affected by both, within an age cohort and from generation to generation.

4) In rural regions, where there is a high risk of HIV/AIDS and where the land tenure reform is pursued rapidly and aggressively, the number of landless households might grow.

5) Traditionally, the extended family network has developed successful coping mechanisms for emergency situations, such as natural disasters. Simplified, the system is based largely on the exchange of labor in the farm, family, and community units, as well as in the form of gifts, food and monetary help. But we have to bear in mind that these systems have their limits and can collapse.

6) As a result of AIDS deaths in the rural households, children can be forced to increase their labor contribution. This can result in higher school drop out rates or even no school attendance at all, especially for female children. HIV/AIDS has already worsened the indicators of economic and human development (i.e., Human Development Index). It has increased poverty by depleting the middle income-producing generation in households. It has increased poverty in communities and caused changes in the social household structure (World Bank 1999).

7) We know from other more severely hit countries that many children will be orphaned. What happens to these young orphans? It is likely that the social relocation follows matrilinear lines, which often means being cared for by the grandmother (FAO 1995). Does this lead to an increase of relocated orphans to households headed by middle age or older women? Or even worse, child-headed households?

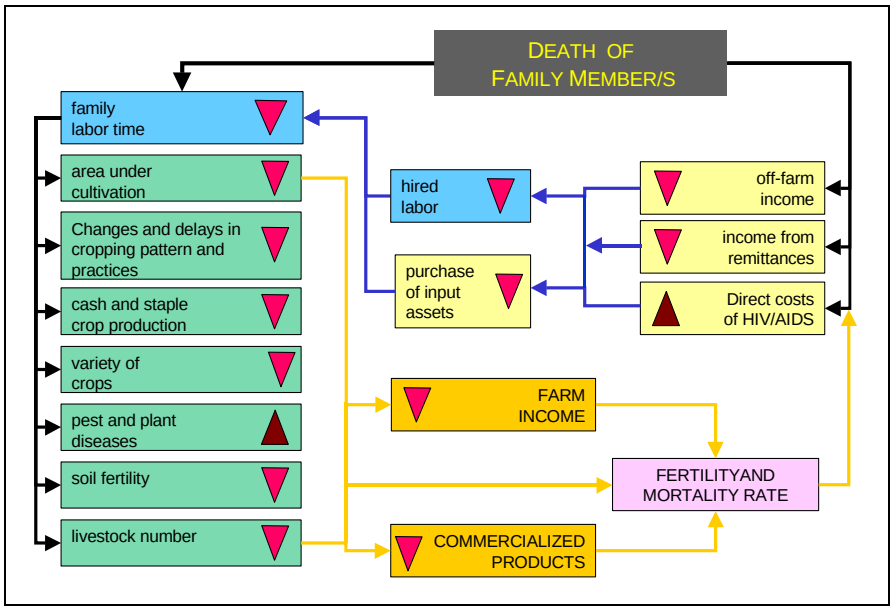
8) The impacts for widows might be different than for widowers. Women can lose access to land and assets, labor, inputs, credit, and support services (Baier 1997). Legal frameworks are not sufficient by reason of existing communal laws and traditions, which are still imposed in most rural areas. For example, the brother-in-law might “inherit” the widow; the brother-in-law might take over the livestock, leaving the widow with no possibility to support her family; the widow might be forced to move back to her parents place; and many others.

9) How will the international donor organizations react to the impacts of HIV/AIDS affected households? As De Waal (1997) notes, the alliance between humanitarian organizations and “neo-patrimonial” African regimes is as unhealthy for democracy and human rights as it is for agricultural development. The challenge to guarantee sustainable development, good governance and human rights will, therefore, be dependent on the international community and the willingness of governments to deal with this issue on all levels.

Figure 11 shows a simplified diagram of the possible impacts of HIV/AIDS on farming systems, presented as a descending circle. A farming system dependent upon family

labor may face serious decreases in production because of such factors as direct loss of labor force, decreasing area planted and harvested, and direct costs of HIV/AIDS.

Figure 11. Impact of HIV/AIDS on agriculture, represented as a vicious cycle.




## Conclusions

The evidence of the spread of HIV/AIDS in rural areas has often been overlooked because of poor data, irregular spread of the disease, and assumed lower prevalence rates than in urban areas. It is important to note that countries that rely heavily on agriculture, such as Mozambique, may lose their knowledge of soil conservation, erosion control, and farm, crop, and livestock management skills – so-called brain drain – because of AIDS deaths of the most active population group. Studies on the loss of vertical knowledge transfer should be conducted in order to better understand the impacts of HIV/AIDS on household compensation strategies.

We can assume that the effects caused by changes in cropping pattern will be similar to those caused by rural out-migration (Prommer 1998) with one important difference – the additional loss of remittances due to AIDS deaths. This will be worsened by increasing HIV incidence rates for African women, with women under 25 representing the fastest growing group. The highest rates of rural out-migration are in the age groups 20 to 40 years, which leads to an erosion of the male labor force. The labor loss is higher in the southern provinces due to traditional labor migration movements to South Africa and other African countries. Both factors combined may lead to substantial labor losses in the non-mechanized and household labor intensive family farm sector (where the majority of the population is active), especially in the poor and barely literate families.

Production and yields have increased considerably since the Peace Agreement in 1992. The family farm sector is still dependent on household labor and labor exchange. The households still depend on their own production and have limited purchasing power, which becomes visible when we look at the auto-consumption rates of the major staple crops and so-called cash crops. Mechanization and the input of a modern means of production, such as fertilizers and herbicides, are rare (FAO 2000a). It cannot be expected that the situation will improve because of the financial burden of direct HIV-related costs for the households.

A recent vulnerability assessment study on food and nutritional insecurity for 1997/98 (Republic of Mozambique 1998a) suggests that a large number of districts are vulnerable to both transitory and chronic food insecurity.[39] The most food-vulnerable households have other sources of income such as petty trading (the most important one), ganho-ganho (labor exchange for food or cash), and the sale of cash crops. This means that they are dependent upon their own production and low paid, insecure job opportunities. The food-secure households have a more diversified income and production strategy, which includes livestock production, fishing, and formal employment (Republic of Mozambique 1996, 1998a, 1998b; Instituto Nacional de Estatística 1998; Tschirley and Weber 1994).

What does this mean for Mozambique, which, according to the official statistics, is not as seriously hit by the HIV/AIDS pandemic as the other southern African countries? According to Wils et al. (2001), the HIV/AIDS epidemic will not lead to an economic catastrophe. These overall national results do not provide insight in the existing production system. Using the descriptive analysis of the existing data, we can assume that Mozambique will have to formulate agricultural development plans and implement strategies to minimize the negative impacts of the disease to a particular part of the population. Future strategies to reduce the annual number of new infections should continue to be one of the core issues. Detailed studies on how households can cope with the loss of the most active population group – namely the adults, who do the majority of the agricultural work – could be helpful. The absolute number of possible affected households may be considerable because of the population size. The author proposes to provide a framework in which the farmers can diversify their production (risk-reducing strategy for economic and natural crisis periods). This includes multi-cropping systems based on traditional (but improved) varieties, and the knowledge to 1) reduce seasonal labor peaks, 2) lower the risk of soil depletion and erosion, and 3) decrease the risk of total harvest loss, for instance, due to irregular rainfall (flood or drought). Further, access to markets, crop storage, seed access, health centers, schools, and other infrastructure are of major importance.

In the discussion on poverty and HIV/AIDS we have to recognize that this is a bi-causal relationship, which needs to be understood by those involved in policy and program development. The evidence reveals the interdependence of the social, economic and political systems, and it is precisely the capacity to function normally that is being undermined by the epidemic. In this context, principles for action have to include the eradication of inequalities, including women in decision-making and mitigation processes, a good judiciary, and civil society organizations. In the reported and observed responses by communities and families, the first line of action was to create volunteer structures to offer assistance. These groups are promoting other needed changes as well, such as increasing the acceptance of women and young people in the power structure, opening and strengthening civil society, and expanding the acceptance of development programs in agriculture, education, and health. These groups need support and a clear legal and flexible framework within which to work according to their specific needs, considering that the epidemic affects each village in a different way. Furthermore, the actions taken by one single country are less effective than actions taken jointly by several countries. Cross-learning is necessary to develop and implant policy, programs, and a regional supply of technical expertise. We have to keep in mind that the

[39] The southern provinces are most affected, especially all Gaza districts (food availability below 6 months), followed by the districts in the interior, Inhambane, Maputo Province, Sofala, and the districts south of the Zambezi River in Tete Province (food availability mostly below 9 months, with a few districts below 6 months). All districts north of the Zambezi with the exception of Mutarara and Chinde districts, Manica Province, and the southern coastal districts of Inhambane are listed with a food availability over 12 months, and a few between 9 and 12 months (Republic of Mozambique 1998a:19ff).

dimension of the HIV/AIDS pandemic in Africa, from a psychosocial to a socioeconomic standpoint, can also be a threat to international security (UN Security Council) and requires a rethinking of the position of the western countries. Desmond Cohen, former Director, now Senior Advisor of the HIV and Health Development Programme of the UNDP, said: "While past efforts have largely focused on predicting what might happen, the world and the epidemic have moved on and reality is now only too often worse than any prior predictions" **(**Cohen 1999:1).

## References


Baier, G. Erich. 1997. *The Impact of HIV/AIDS on Rural Households/Communities and the Need for Multisectoral Prevention and Mitigation Strategies to Combat the Epidemic in Rural Areas.* Rome: FAO.

Barnett, T., J. Tumushabe, G. Bantebya, R. Ssebuliba, J. Ngasongwa, D. Kapinga, M. Ndelike, M. Drinkwater, G. Mitti, and M. Haslwimmer. 1995. The social and economic impact of HIV/AIDS on farming systems and livelihoods in rural Africa: Some experiences and lessons from Uganda, Tanzania and Zambia. *Journal of International Development* 1995/7/1: 163-175.

Barnett, Tony and Piers Blaikie. 1992. *AIDS in Africa: Its Present and Future Impacts.* London: Belhaven Press.

Braun, G. 1989. IWF-Reformen in Mosambik: Die Stabilisierung einer Kriegswirtschaft. *Nord-Süd aktuell,* 2nd Quarter, pp. 244-250 (in German).

Cohen, Desmond. 1999. *Responding to the Socio-Economic Impact of the HIV Epidemic in Sub-Saharan Africa: Why a Systems Approach is Needed.* New York: UNDP, HIV and Development Programme.

Cohen, Desmond.1998. *The HIV Epidemic and Sustainable Human Development.* New York: UNDP, HIV and Development Programme, Issues Paper No. 29.

Davison, Jean, Ed. 1988. *Agriculture, Women, and Land: The African Experience*. Boulder, CO: Westview Press.

Dejene, A. and J. Olivares, Eds. 1991. *Integrating Environmental Issues into a Strategy for Sustainable Agricultural Development: The Case of Mozambique.* Washington, D.C.: World Bank, Technical Paper No. 146.

De Waal, A. 1997. *Famine Crisis: Politics and Disaster Relief Industry in Africa.* London: Currey.

EIU. 1996. *Country Report: Mozambique, Malawi.* 1st Quarter. London: The Economist Intelligence Unit.

EROS Data Center / USGS. 1992. http://edcsnw4.cr.usgs.gov/adds/c1/r3/mz/doc/cuil/

FAO. 2000a. *FAOSTAT – Statistical Database of the FAO*. http://faostat.fao.org/

FAO. 2000b. *Mozambique Country Profile.* Access date December 2000. http://www.fao.org/giews/english/basedocs/moz/mozgen1e.stm

FAO. 1995. *The Effects of HIV/AIDS on Farming Systems in Eastern Africa.* Rome: FAO Farm Management and Production Economics Service.

FAO/ARTEMIS. 2001. *Normalized Difference Vegetation Index for the Growing Season in Mozambique. Average 1982-1999 (September to April).* Access date March 2001. www.fao.org/giews/english/sat_ndvi/pages/mozdvav.stm

FAO/IIASA. 2000. *Global Agro-Ecological Zones. CD-ROM, Version 1.0.* Rome: FAO, Land and Water Digital Media Series 11.

Fischer, Günther; Harry Van Velthuizen, and Freddy O. Nachtergaele. 2000. *Global Agro-Ecological Zones Assessment: Methodology and Results.* Laxenburg, Austria: IIASA and FAO.

Gaspar, Manuel da Costa, H.A. Cossa, C.R. dos Santos, R.M. Manjate, and J. Shoemaker. 1998. *Moçambique Inquérito Demográfica e de Saúde 1997. (Mozambique Demographic and Health Survey 1997.)* Maputo and Calverton, MD: Instituto Nacional de Estatística and Macro International Inc. (in Portuguese).

Hanlon, Joseph. 1996. *Peace Without Profit. How the IMF Blocks Rebuilding in Mozambique.* Oxford: Currey.

Hanlon, Joseph, Ed. 1995. *Mozambique Peace Process Bulletin*. Issue 15 (February). Amsterdam: AWEPA, the European Parliamentarians for Southern Africa. http://www.mozambique.mz/awepa/

Hanlon, Joseph. 1984. *Mozambique. The Revolution under Fire.* London: Zed Books.

Hillebrand, Ernst. 1990. *Sowjetische Theorie – Afrikanische Praxis: Zu den sowjetischen Konzepten einer sozialistischen Agrarpolitik in Afrika.* Hamburg: Institut für Afrika-Kunde (in German).

Instituto Nacional de Estatística. 1999. *Il Recenseamento Geral da População e Habitação 1997*. (*National Demographic and Household Survey 1997.)* Maputo: INE (in Portuguese). www.ine.gov.mz/censo2/Recens.htm.

Instituto Nacional de Estatística. 1998. *Inquérito Nacional Aos Agregados Familiares Sobre Condições de Vida - 1996-1997. Relatório Final.* Maputo: INE (in Portuguese).

MAP. 1997. *Estatísticas Agrárias 1996. (Agrarian Statistics 1996.)* Maputo: Ministry of Agriculture and Fisheries, Republic of Mozambique (in Portuguese).

MAP. 1996. *Trabalho de Inquérito Agrícola ao Sector Familiar 1996. (Agricultural Survey of the Family Sector 1996.)* Mimeo. Maputo: Department of Statistics, Ministry of Agriculture and Fisheries, Republic of Mozambique (in Portuguese).

Meyns, Peter, Ed. 1988. *Agrargesellschaften im portugiesischem Afrika.* Saarbrücken: Breitenbach, Sozialwissenschaftliche Studien zu internationalen Problemen 129 (in German).

Mitchell, Donald A., Merlinda D. Ingco, and Ronald C. Duncan. 1997. *The World Food Outlook.* Cambridge, UK: Cambridge University Press.

Prommer, Isolde. 1998. *Rural Out-migration and Cultural Land Loss.* Vienna: University of Agricultural Sciences, Department of Tropical Agronomy.

Rauch, T. 1990. Auswirkungen der Strukturanpassungspolitik in Zambia auf die ländliche Bevölkerung. *Zeitschrift für Wirtschaftsgeographie* 1: 18-26 (in German).

Republic of Mozambique. 1998a. *Vulnerability Assessment for Mozambique 1997/98. An Initial Analysis of Current Vulnerability to Food and Nutritional Insecurity*. Maputo:

Intersectoral Vulnerability Assessment and Mapping Group, MAP, MPF, MISAU, FEWS, WFP.

Republic of Mozambique. 1998b. *Estimativas e Perfil da Pobreza em Moçambique: Análise dos Dados do Inquérito Nacional aos Agregados Familiares Sobre as Condições de Vida do Instituto Nacional de Éstatistica, Fevereiro 1996/Abril 1997. Tabelas de Resultatos*. Maputo: Departamento de População e Desenvolvimento Social do Ministério do Plano e Finanças, International Food Policy Research Institute, and Faculdade de Agronomia e Engenharia Florestal da Universidade Eduardo Mondlane (in Portuguese).

Republic of Mozambique. 1996. *Mozambique: Rural Poverty Profile*. Maputo: Ministry of Planning and Finance, Poverty Alleviation Unit.

Richards, Paul. 1999. Food security in Africa: Technology and the challenge of HIV/AIDS. Pages 95-104 in P. Bindraban, H. van Keulen, A. Kuyvenhoven, R. Rabbinge, and P. Uithol, eds., *Food Security at Different Scales: Demographic, Biophysical and Socio-economic Considerations*. Wageningen, the Netherlands: Deutsch Labor Organization, Research Institute for Agrobiology and Soil Fertility.

Richards, Paul. 1986. *Coping with Hunger: Hazard and Experience in West African Rice-Farming System.* London: Allwin & Unwin.

Richards, Paul. 1985. *Indigenous Agricultural Revolution: Ecology and Food Production in West Africa.* London: Hutchinson.

Rugalema, G.H.R. 1998. *When Disaster Unfolds: Coping with HIV/AIDS in Smallholder Agriculture in Bukoba District, Tanzania.* Ph.D. Thesis. Wageningen, the Netherlands: University of Wageningen.

SADC/FSTAU – FAO/GIEWS. 2001a. *Mozambique Meteorological Profile.* http://www.fao.org/giews/english/basedocs/moz/mozmet1e.stm

SADC/FSTAU – FAO/GIEWS. 2001b. *Main Crop Zones of Mozambique.* http://www.fao.org/giews/english/basedocs/moz/mozcul1e.stm

Sanderson, W.C., M.E. Hellmuth, and K.M. Strzepek. 2001a. *Botswana's Future: Modeling Population and Sustainable Development Challenges in the Era of HIV/AIDS*. Executive Summary. Laxenburg, Austria: IIASA.

Sanderson, W.C., B. Fuller, M.E. Hellmuth, and K.M. Strzepek. 2001b. *Namibia's Future: Modeling Population and Sustainable Development Challenges in the Era of HIV/AIDS*. Executive Summary. Laxenburg, Austria: IIASA.

Tschirley, David L. and Michael T. Weber. 1994. Food security strategies under extremely adverse conditions: The determinants of household income and consumption in rural Mozambique. *World Development* 22(2): 269-173.

United Nations. 2000. *World Population 1950-2050. The 1998 Revision*. New York: United Nations, Population Division, Department of Economic and Social Affairs.

UNEP/GRID – Sioux Falls. 2001. *Africa Population Distribution Database, 1990.* http://grid2.cr.usgs.gov/clearinghouse/datalist.html

UN System in Mozambique. 2000. *District Development Profiles.* www.unsystemmoz.org/districts/

UNHCR. 1998. *Refugees Magazine.* Issue 112. www.unhcr.ch/pubs/rm112/rm11202.htm

UNHCR. 1995. *The State of the World's Refugees. In Search of Solutions.* Oxford: Oxford University Press. www.unhcr.ch/refworld/pub/state/95/

United States Department of Agriculture. 1980. *Global Food Assessment, 1980*. Foreign Agricultural Economic Report, No. 159. Washington, D.C.: United States Department of Agriculture.

USGS. 1995a. *1995 Pilot Study: Cropland Use Intensity Interpreted from Satellite Imagery of the Mutarara/Sena Area, Mozambique.* http://edcftp.cr.usgs.gov/earthshots/slow/Mozambique/Mozarticle

USGS. 1995b. *1995 Pilot Study: Cropland Use Intensity Interpreted from Satellite Imagery of the Mutarara/Sena Area, Mozambique*. http://edcftp.cr.usgs.gov/earthshots/slow/Mozambique/MozambiquewideCUImap

Wenzel, Hans-Joachim and Ulrich Weyl. 1992. *The Sector of Small-Scale Farmers in Mozambique. Development and Concepts of Development Against the Background of Colonialism, Socialism and Structural Adjustment.* Dissertation. Osnabrück, Germany: University of Osnabrück.

Weyl, Ulrich. 1990. *Labor Migration in Malawi as a Barrier to Development*. Dissertation. Osnabrück, Germany: University of Osnabrück.

Wils, A., M. da Costa Gaspar, M.E. Hellmuth, M. Ibraimo, I. Prommer, and E. Sebastião. 2001. *Mozambique's Future: Modeling Population and Sustainable Development Challenges*. Executive Summary. Laxenburg, Austria: IIASA.

World Bank. 1999. *Why Strategies to Reduce Poverty in Africa Should Focus on Sexual and Reproductive Health*. Discussion Draft. Washington, D.C.: World Bank, Human Development Sector, Africa Region.

World Bank. 1990. *World Development Report 1990*. New York: Oxford University Press.

World Bank. 1989. *World Development Report 1989*. New York: Oxford University Press.

Wuyts, Marc. 1989. Money, planning and rural transformation in Mozambique. *Journal of Development Studies* 22: 180-207.

**Personal Communications:**

Mr. Domingos F.R. Diogo, Agronomist, Head of the Department of Statistics, Ministry of Agriculture and Fisheries, Maputo, Mozambique, 1998.