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ENVIRONMENTAL IMPACT  
OF AGRICULTURAL DEVELOPMENT

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"SIASA NI KILIMO" -- TANU PARTY GUIDELINES OF  
MODERN AGRICULTURE

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## .1. INTRODUCTION

Discussion of agriculture in Tanzania is usually divided into separate crop and livestock sectors, although there are more than 40 distinct agro-economic zones. Most agriculture is small holder, small scale, although there are a growing number of state ranches and irrigation schemes and some remaining large scale private or company farms.

The main environmental concerns related to agricultural development are: soil erosion, decrease in soil fertility, water conservation, pest and animal problems, and massive ecological change (removal of forests or other ecosystems). Locally there are problems of water and land pollution from agricultural activity, especially in sisal growing areas. Other important environmental issues relate to the fundamental problems of climate and of human and animal disease and pests. In Tanzania the farmer has to contend with hazards of drought and flood and a number of water-borne and/or insect-carried tropical diseases, malaria and bilharzia, for example; the animals are likewise vulnerable and are excluded from some areas because of tsetse fly and other hazards; his crops, on the stem or in storage, are prone to attack by birds, locusts, termites, and wild animals. For the farmer, problems of environment constitute a major part of the struggle--first, of growing a crop, and then preserving it through the year.

Historically, environmental problems related to agriculture in Tanzania have played an important role in agricultural and more general government and party policy. This needs to be appreciated in order to understand the current situation. Under the colonial government, concern about problems of soil erosion or degradation of the natural vegetation began to be expressed in the 1920s. Through the 1930s and early 1940s, the approach to soil conservation was through farmer education and extension services, but in 1945 more direct action was initiated. A soil conservation service was set up and an analysis of the problems in various districts and regions began. In 1951-1952 a review outlined what seemed

to be the major problems and listed a series of major schemes where direct soil conservation measures had been applied (Berry and Townshend, 1972). Problems arose; the schemes were poorly implemented and in many cases did not appear to improve production, although they needed greatly increased labor inputs from the farmer. These schemes became associated in the farmers' minds with some of the more authoritarian aspects of the colonial government and in some areas, especially the Uluguru Mountains, opposition to land conservation schemes provided a major catalyst for the organization of TANU -- to become Tanzania's ruling and only political party.

Soil and water conservation were thus placed low on the explicit policies of the newly independent Tanzanian Government and apart from land use and farm planning teams, did not appear in the job descriptions of officers in the Ministry of Agriculture. Some conservation work was, however, done in relation to state farms and irrigation schemes. Reports from consultants in agriculture and water development continued to stress the severity of the problem of soil erosion and fertility in some parts of the country and a major research project on this topic was initiated in BRALUP, University of Dar es Salaam. EAFRO studies in the 1960s also provided additional scientific data. The political attitude toward agriculture was formally changed in 1972, with the adoption of the party guidelines on modern agriculture: "SIASA NI KILIMO". The following are significant quotations from the paper which is appended in full.

"There is a widespread fall in production per acre. For instance, when Ismani was still a virgin land 20 or 25 years ago, maize production per acre stood at 20 or more bags of maize per acre. Today, Ismani produces an average of only 7 bags of maize per acre" (paragraph 10a).

"Soil erosion has spoiled and continues to spoil the land in many areas" (paragraph 10b).

"We must preserve our land and its fertility, so we must:

"(a) observe the rules of preventing soil erosion by planting ridges and ensuring that the land is covered by vegetation,

"(b) stop clearing hilltops of trees that protect the water springs and to stop farming near river banks,

"(c) stop burning forests and bushes,

"(d) plant trees on open lands" (paragraph 18).

In summary, the problem of soil erosion and water conservation has been acknowledged for many years. In recent years measures to tackle the problem have become a stated Government and Party goal. Other aspects of environmental impact have been given less prominence. Clashes between different parts of government and between the Government of Tanzania and the private sector have occurred over the allocation of land for national parks and game reserves, but encroachment of these has been small. Conflicts over local demand for transformation of forested land into crop production have been important local issues. But in general, land use problems in the broader context have not received much national attention.

The approach in the rest of this document is: first, to review the general environmental setting in Tanzania in the context of crop and live-stock agro-economic systems, and then to present an analysis of the most important environmental concerns at a national, regional-district and local scale. Lastly, present Government of Tanzania actions and awareness and accomplished action, and proposed stance by USAID are outlined. f

## .2. THE GENERAL ENVIRONMENTAL SETTING

Tanzania is located between 2 and 12 degrees south of the equator, but differences in altitude and the anomalies of the East African climate help to account for the diversity of the environment in the country. The range of conditions in the country includes moist, humid, tropical climates along the coast; moist, cool, mountain climates; and extensive, dry, semi-arid grasslands and Savannah in the interior. The areas of highest rainfall are found in isolated mountains and plateaus rising above 4,000 feet. There are thus a number of distinct ecological zones.

### 2.1. Important Climatic Factors

Porter (1974) points out that photosynthesis is a significant environmental factor in Tanzania and that differences in photosynthesis within Tanzania are, he concludes, important in terms of crop yield potential.

The major factors influencing photosynthesis are: length of day, temperature, and plant respiration. Ideal conditions for plant growth are high daytime temperatures when photosynthesis is taking place, and cool nighttime temperatures when loss of energy by respiration is reduced.

The external energy resources in Tanzania thus vary considerably between areas where both daytime and nighttime temperatures are high and there is a high loss of energy at night, and areas where high daytime temperatures and cool nights preserve more energy for plant growth. Studies of maize yields (Allan, 1971) show that higher elevations with cooler night temperatures have a 27 percent advantage over the low elevation zones with respect to potential photosynthesis and a 66 percent longer period between planting and flowering. Yields are over twice as much at higher altitudes than in low altitudes, and there are differences between productive and least productive areas in Tanzania at a ratio of three to one.

Regional specialization in growing crops which best fit the energy conditions might lead to a concentration on grains in the highland and plateau areas and an emphasis on tree crops and dairying along the coast.

Temperature in Tanzania varies mainly with altitude; rainfall, although varying with altitude in the same way is also influenced by many other factors. Despite Tanzania's near-equatorial location, rainfall is variable both in time and space. In much of the country there are two rainy seasons: in November-December and in March-April-May. June, July, and August are dry months. Rainfall is always adequate for crop growth along the coastal zone, in the southwest, around Lake Victoria, and around the higher mountains, with totals averaging 35 inches or more; but elsewhere, there are widespread semi-arid conditions where rainfall totals average less than 30 inches a year and where variability from one year to the next is high. The drier zones with varying degrees of climatic uncertainty are the areas where most of the future acreage expansion of Tanzanian agriculture must take place.

In much of Tanzania, rainfall comes in localized, sharp, heavy storms which contribute to variability in time and space. In this type of fall, the infiltration capacity of the soil is an important factor in determining how much of the water soaks in to become available for plant growth. As Jackson (1972) points out, soils are more vulnerable to erosion by heavy rainfall at some times of the year: "If heavy storms occur at the start of the wet season when vegetation cover is sparse and soil is not well protected, compaction . . . may lead to considerable run-off and erosion. . . Heavy storms at the middle and end of the wet season, when vegetation protects the soil, will not have so much impact. . . ." Large parts of the country do appear to have moderate or heavy falls of rain at or near the beginning of the rainy season (Jackson, 1972).

A measure of the erosion potential of a storm is expressed by an index  $EI_{30}$ , the energy-intensity value for 30 minutes of rainfall. EI values

have been calculated as part of a study of soil losses near Morogoro. The average annual EI value was 70,000; the same order as the highest calculated for the United States. One storm may account for much of this. A fall in March 1967 lasted 75 minutes with a maximum half-hour intensity of 3.8 inches per hour, producing an EI value of 11,000 (Rapp, et al, 1972). Some studies suggest that rain falling at intensities of more than 25 millimeters per hour is almost totally responsible for surface erosion. Many Tanzanian storms, even in low rainfall areas, surpass this level.

## 2.2. River Systems

Because of the marked seasonality of rainfall in Tanzania and the scattered nature of the main mountain masses, where most rainfall is concentrated, only a small part of Tanzania has permanently flowing streams. Permanent water courses in the higher areas are drained into a few main river arteries which flow through the semi-arid areas to the sea. Surface running water is large in total volume but concentrated into main rivers such as the Ruvuma, Rufiji, Pangani, and the Ruvu. All major rivers except the Pangani have very large fluctuations in volume between the wet season in March-April and end of dry season in October-November. The large seasonal variation means that major dams are necessary to provide year-round water for power or irrigation. As major works are needed, the full utilization of this resource demands major environmental transformation and the development of quite new agricultural systems in Tanzania. The Pangani has already been developed for power and several major dams are contemplated. Any such developments on the major rivers merit close study for two reasons: first, their environmental impact is high, and second, they present major problems in terms of the kinds of development programs associated with transformations of this kind.

Because there are relatively few separate river systems in Tanzania, extra care is needed in dealing with water quality and water pollution problems.

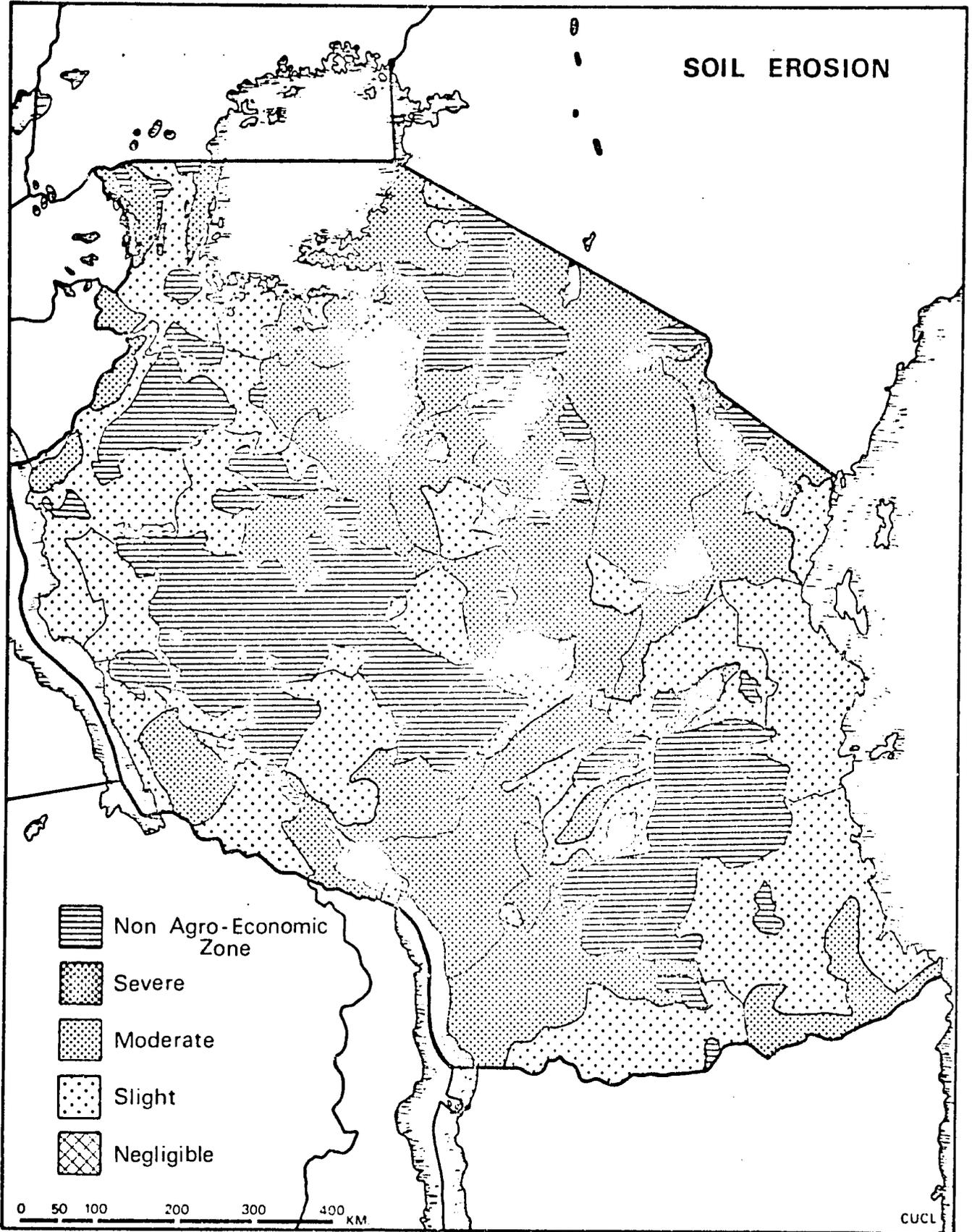
### 2.3. Land and Vegetation in Tanzania

The soils of Tanzania are as varied as other aspects of the environment. Areas of high potential are found in volcanic uplands; as for example, around Mt. Kilimanjaro and Mt. Meru, and in some of the flood plains of the major river valleys. The former are already under intensive cultivation; the latter need major investment to achieve full potential. Elsewhere, pockets of high potential soil mix with larger areas of poor or moderate potential. There is much land but limited good land. Baker (1970) and a number of BRALUP publications make estimates of the distribution of land of different potentials but detailed soil surveys are only available for a few localities.

The problem of soil erosion and decline in fertility in Tanzania is well documented (Rapp, Berry, and Temple, 1972). This report of a four-year study provides information on problems of mountain areas in the Ulugurus and Usambaras and in plateau areas around Dodoma and Arusha. The upland areas showed high rates of soil loss under normal conditions but replacement rates were also high and fertility was maintained in most places. However, when heavy storms occur, catastrophic landslides may result at high cost to agriculture and infrastructure. In the plateau areas the problems seemed greater. Overstocking and cutting of vegetation for food had seriously depleted the soil resource in the areas studied. Sedimentation rates were at high levels, silting up dams and stream channels. Although studies elsewhere show good rates of recovery if regrowth is permitted, it is clear that a serious situation exists in some areas. Map 1 illustrates the perception of the soil erosion problem as derived from the Conyers (1973) study of agro-economic zones and other papers. It is clearly of widespread concern, although only a very serious issue in certain environments.

Because of the low average density of population in Tanzania, there are still wide areas which retain their natural vegetation. Game parks and

MAP 1



national reserves occupy large areas of land (Map 1). However, competition for land is intense in those small parts of the country with high rainfall. These areas are important as forest reserves, as catchments for much of the river flow of the country and are also in demand for expansion of cultivation. Some unique forest lands exist, in the Usambara Mountains, for example; and need to be preserved from a scientific as well as a practical viewpoint. One of the major resources of Tanzania is its wealth of wild animals and the Government of Tanzania has taken the lead in the establishment and maintenance of an extensive game park system. It is clear that in the future, even more than at present, land use conflicts will arise in some of these areas.

#### 2.4. Effects of Animal Pests on Agriculture in Tanzania<sup>1/</sup>

Every animal is potentially an agricultural pest, but whether a particular species is described as a pest depends largely on the frequency and magnitude of changes in its numbers and in the damage attributable to it. Thus, species whose numbers vary seasonally, or which swarm or migrate (such as locusts and Quelea quelea aethiopica, the Sudan Dioch or Weaver Bird) are more readily recognized as pests, especially when these numerical changes reflect obvious changes in the extent of crop damage. However, other species, maintaining more constant levels, both in their number and in the damage caused, are less readily perceived as pests, particularly by the small farmer, who tends to accept them as part of the normal environmental hazards against which he carries out his activities. Indeed, production loss due to these pests may be at least as great as that due to the more obviously identified ones. This problem of pest identification is particularly difficult in a country such as Tanzania, in which much land is marginal for agriculture, yet 96 percent of the working population are engaged in agricultural activity; and which has a unique and large concentration of animal life, which is of itself a valuable resource. Thus, wildlife not generally considered a pest is normally protected, and

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<sup>1/</sup> This section is based on a paper by Mascarenhas (1971).

rarely destroyed. There exists a problem of competition between agriculture and wildlife in the use of the land. The East African milieu, with its tremendous wildlife population, is ecologically one of the few places in the world being actively competed for by man and animals. Pest control measures and land use planning must be integrated to enable efficient agriculture, yet retain the wildlife resources.

Because national and international economists have tended in the past to emphasize the value of the tourist trade, while being less aware of the important role of the small farmer in the economy of an agriculturist country such as Tanzania; and because of the strong publicity of the conservationists, the effect of animal pests on all kinds on agriculture has tended to be underestimated, except in the case of large scale, capital intensive agricultural projects where the effect of pests on production has been more readily noticed because these involve export crops. Little publicity has been given to the effect of pests on peasant agriculture, and this is probably due to the lack of attention formerly paid to the role of peasant farmers in the economy. The effect of pests is an important factor in reduced agricultural productivity of indigenous food crops (Worthington, 1958; Scudder, 1962).

The pest problem is difficult to investigate, poorly documented, except in the more obvious cases (such as that of Quelea quelea aethiopica), and costly to eliminate. However, the great frequency of complaints made by cultivators and frequent references in the annual reports of the departments of administration, agriculture, and game testify to the severity of the problem in Tanzania.

Nevertheless, quantitative information relating to pest damage is incomplete, and qualitative statements found in reports of government departments give little indication about the exact magnitude of the problem. This lack of data is exacerbated by deficiencies of other basic agricultural data; thus, statistics on the production of nonexport crops are of very doubtful reliability, so that estimates of crop losses suffered by

indigenous farmers are similarly unreliable. When reports of numbers of pests killed have been made, there has been little or no attempt to correlate them with the extent of the damage, or with increased crop productivity. Collection of pest data has recently improved with the emphasis of the new agricultural policy on the problems of the small farmer. Most regions now have records of pests destroyed, but there are probably underestimates, since not all pests killed are recorded, and migrations of pests to other areas consequent upon their destruction in one area are not measured. Reports of animals killed by the game department (Table 1) represent the most accurate data available on pests, since wildlife not generally considered vermin is normally controlled by protection and is destroyed only as the last resort. However, these figures almost certainly underestimate the pest problem, for the reasons already stated, and because game control usually tries to persuade the herd to move off by killing the leaders. Although animals are destroyed mainly for crop protection, they are also destroyed to save human life and property, and this further limits the applicability of these data.

The major declared pests in Tanzania are listed in Table 2. Besides those species permanently declared to be vermin, game wardens are empowered to declare a species to be so either generally or in a special area from time to time. Such vermin may be hunted without a game license in such an area. Actual control is normally undertaken by game scouts of the Game Division, while crop protection is the responsibility of the Vermin Control Section of the Ministry of Agriculture. However, the overwhelming prevalence of pests means that in practice their destruction is the responsibility of the populace at large.

The extent of crop damage varies with the pest, and with the varying optimum ecological conditions for the pests which determine whether they reach plague numbers. In the case of the smaller pests, it is only at this stage that they are recognized as a serious problem. In Kilwa District, one rat species [*Rattus (Mastomys) Natalensis*] appears to undergo population

TABLE 1. ANIMALS KILLED BY THE GAME DEPARTMENT IN THE PROTECTION OF LIFE AND PROPERTY

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
Elephant	1,923	1,674	2,040	2,599	2,594	2,492	3,171	3,250	3,247	2,993	3,105	2,430	2,656
Rhinoceros	84	22	33	21	20	13	18	6	16	8	19	3	5
Buffalo	212	188	189	203	237	232	263	222	259	318	38	243	139
Hippopotamus	605	552	433	425	394	391	383	136	167	174	111	117	94
Leopard	19	39	28	233	35	116	17	19	33	23	50	27	35
Lion	19	32	24	28	44	36	36	35	38	32	62	34	45

SOURCE: Quoted in Mascarenhas (1971) from Tanganyika Government Game Department Annual Reports.

TABLE 2. ANIMALS DECLARED VERMIN

Animal	Area
Baboon, <i>Papio anubis</i> (J.B. Fischer)	Throughout Tanzania
<i>Papio cynocephalus</i> (Linnaeus)	Throughout Tanzania
Bush pig, <i>Patamochoerus porcus</i> (Linnaeus)	Throughout Tanzania
Crocodile, <i>Crocodiloticus niloticus</i>	Throughout Tanzania
Pied crow, <i>Cervus albis</i> (P.L.S. Muller)	Throughout Tanzania
Seed-eating birds (other than those included in the Third Schedule)	Throughout Tanzania
Spotted hyena, <i>Crocota crocuta</i> (Erxleben)	Throughout Tanzania
Vervet monkey ("tumbili"), <i>Cercopithecus aethiops</i> (Linnaeus)	Throughout Tanzania
Hippopotamus, <i>Hippopotamus amphibius</i> (Linnaeus)	Throughout the Southern Region and in the Bagamoyo, Rufiji, Kisarawe, Ulanga, Morogoro, and Dar es Salaam districts of the Eastern Region.
Jackal, <i>Canis mesomelas</i>	Throughout the Southern Highlands Region and the Western Region.
Lion, <i>Panthera leo</i>	In the Songea District of the Southern Region. In that part of the mainland of Ukerewe District in the Lake Region, lying to the west of the road from Kibara village on Speke Gulf to Iramba village on Baumann Gulf.
Zebra, <i>Equus burchelli</i> (Matchie)	Around Mount Meru
All animals of the order Rodentia, except those of the family Sciuridae	Throughout Tanzania

SOURCE: Tanganyika Laws, Cap 302. Fauna Conservation Ordinance (Revised), Supplement 58. (Quoted in Mascarenhas, 1971)

explosions when there has been a heavy rainfall in the breeding months of February, March, and April. Another species appears to thrive under the opposite conditions (Tanganyika, Game Department, 1954).

Birds commonly consume grain, without subsidiary damage. Elephants, however, not only consume food crops, such as banana, maize, sugar cane, and cereals, but frequently cause greater crop loss by trampling. (A single raid by an elephant can easily destroy a subsistence field of one hectare.) Similarly, wart hogs and pigs frequently destroy far more than they consume, and can put the farmer in a vulnerable position due to destruction of cassava--the main relief crop.

Quelea quelea has probably replaced the locust in severity of damage. As a pest it affects nearly 20 percent of Africa south of the Sahara, including Tanzania (FAO, 1966). As with locusts, quelea are extremely gregarious, tend to swarm, devastate large areas, have breeding and roosting grounds, invade areas spasmodically, and constitute an inter-territorial problem. The bird normally inhabits dry bush country, which is common in Tanzania. They feed on seeds of various grasses and thus increase rapidly in numbers during years of adequate rainfall. When drought follows, the birds invade farming areas. Eradication measures include the use of drummer boys, chemical repellents, molasses, explosives, flame throwers, and aerial chemical spraying. These methods, however, are frequently uneconomic for the small farmer, or pose problems of pollution of water supplies. Advance information of bird migrations is not always available due to the isolation of the breeding grounds, but would facilitate eradication. Total quelea damage in Tanzania is unknown, but farmers report crop yields to have fallen by one-half or more following a plague. It is estimated that a roost of one million birds can destroy 54,329 kilograms of grain per day. However, as with most pest problems, eradication measures have been taken only in the last resort, and national expenditure on the problem represents only a small proportion of the financial loss due to it. Because

of the inter-territorial nature of the quelea problem, and because of its effects on large scale farmers, rather than peasant farmers, it has been better publicized and studied than other pests.

Many control methods are used and considerable variation is found; trapping and hunting with the aid of simple weapons is common and communal hunts are increasingly used. More specific measures depend on the nature of the pest. Poisons and other biological (e.g., introduction of disease) methods are rarely used because of the damage to other wildlife and to man. Poison control is, however, effective for rodents, and also for porcupine control in the Lake Victoria cotton areas. Methods where pests are kept out of the field entirely appear more effective than those involving the destruction of the pests. Sisal hedging is frequently used as it requires little attention (it can withstand drought, and is self-propagating; it also has domestic utility). Electric fences are only economical in large scale, heavily capitalized plantations (e.g., Kilombero Sugar Plantation). The cost of constructing fences and ditches is also prohibitive for the small farmer. Shooting is expensive and frequently ineffective because most pest raids occur at night. Settlement patterns and changed agricultural practices (for example, planting bitter cassava at the periphery of cassava fields protects from pigs) could do much to reduce pest damage, as also could the provision of motorized vermin control units for all areas. These units appear to be economically effective in heavily infested areas.

The economic emphasis on small agriculture in Tanzania, and the increase in the population involves increased agricultural use of land. While this change of use is occurring there will be more contact with animals; but as the agricultural use becomes established, wild animals will decrease, except, as now, in areas adjacent to forest and game reserves. Forest reserves land harbors increasing animal populations as more land is claimed for agriculture; but, particularly in the case of elephant and buffalo, damage caused by these animals lowers the productivity of the forest reserve. It

will probably prove necessary to control the animal population of forest reserves if production is not to be severely affected.

The extent of crop damage by wildlife and vermin varies with the environment, human population, type of settlement pattern, duration and intensity of agriculture, organization and attitude of the people to the pests, and the nature of the pests themselves. The dispersed settlement pattern prevalent over much of Tanzania makes cultivation particularly prone to pest damage (for example, in Ulanga, Nachwingea, eastern Songea, Tunduru, western Rufiji, and Mpanda districts). In more densely settled areas, the larger game move off, leaving pest species such as pigs and monkeys.

The settlement patterns and agricultural practices, particularly in areas newly claimed for agriculture, must be managed so as to allow efficient agriculture, yet permit conservation of the important wildlife and scenic resources, in a balanced pattern of land use.

### 2.5. Environment and Man

In developed countries we have grown used to the idea that people can, through economic activity, cause harm to the environment. Air and water pollution, soil deterioration and pollution, pollution of the sea and coast, are all familiar problems. Some of these problems are shared by some developing countries but in nations such as Tanzania, there is a clear two-way interaction between people and the environment. Much of the life of a farmer in Tanzania is a struggle against the environment. The problem of water supply is basic to life. Will the rains come on time to provide moisture for crops, animals, and drinking? When is the best time to plant in view of the uncertain timing of the rainy season? When the crops begin to grow, problems of insects, birds, pests, and animal intrusions add to the farmer's concerns. Finally, after harvest, problems of storage continue until the next round of planting and production. The herder similarly works against problems of water and forage, animal disease, and drought.

In many cases illness and disease seriously handicap the individual in his struggle to produce.

In these circumstances it is clear that improvement in agriculture must also modify the harmful effects of the environment on the farmer. Removal of tsetse fly, improvement of rural water supplies, etc. all provide new opportunities for agricultural development. At the same time it is important that the natural resources of the rural areas be maintained and enhanced, for on these resources the future of most Tanzanians depends.

### .3 . CROP AND LIVESTOCK PRODUCTION SYSTEMS:

#### AN OVERVIEW

Agricultural practices in Tanzania, as elsewhere, are influenced to a large extent by the local environment. Tanzania is characterized by quite sharp environmental changes occurring over short distances, producing a varied pattern and environments; and the distribution of agro-economic systems reflects this. Furthermore, the homogeneous agro-economic areas which can be described do not nearly fit present administrative boundaries, although most descriptions of such areas take the administrative pattern into account and are somewhat modified to fit it. One study (Conyers, 1973) described 16 separate agro-economic systems, corresponding to 16 largely coterminous areas, and 46 further subdivisions of these areas (6 of the 46 subdivisions could not be classified into any of the 16 systems). In some cases, large areas are readily described as one agro-economic system, while other agro-economic systems are found in scattered units throughout the country. Because there are significant changes in agro-economic systems from one area to another, often over short distances, even within the same administrative district, agricultural and environmental policies need to be fine-tuned in response to this situation. An understanding of the major agro-economic systems and the areas in which they operate should logically form the basis of all forward planning in the agricultural sector. At the time of preparation of Tanzania's Second Five Year Plan, such information was not completely available. Since then, more complete agro-economic data for Tanzania has been collected, although much of it remains incomplete and is based on forecasts and estimates. Nevertheless, the available data does permit the description of the major agro-economic systems operating. These have been described by Conyers (1973) as follows:

#### 3.1. Densely Populated Mountainous Areas

This group includes the mountain slopes of Kilimanjaro and Meru; the Pare, Usambara, and Uluguru Mountains and the Tarime, Rungwe, and

Matengo Highlands. These mountainous areas are characterized by heavy rainfall and high population density. At present, coffee is the major cash crop and bananas are the major food crop. The main problems are: the shortage of cultivable land in relation to the population density, soil erosion, and the overdependence on one cash crop. Tea, vegetables, and cardamon are being encouraged as crops to reduce the dependence on coffee. Dairy farming, largely on a small holder basis, is also important.

### 3.2. Highland Areas of the Northwest

This system is found in Kigoma and West Lake Regions of the country. Eastern Bukoba, Kigoma, and Ngara Districts have a high population density. Coffee and bananas are major cash crops, but geographical isolation reduces the volume of cash production. Eastern Bukoba area has a high coffee production, and in the wetter parts, tea is being introduced as an alternative crop. The other parts of West Lake Region have a lower population density and coffee production is less important.

### 3.3. Southern Highlands

This system also has a localized geographical distribution, including the highland areas of Iringa and Mbeya Regions, excluding Sumbawanga. Maize is the main food crop. Pyrethrum and some wheat and coffee are grown for cash. There are many large estates, yet no significant land shortage. Animal husbandry is of minor importance. The new Tanzam road and railway will greatly affect this area.

### 3.4. Northern Highlands

This localized system covers the greater part of Arusha Region (excluding the Masai pastoral areas) and the northeastern part of Kondo Region. This is a system where animal husbandry is of major importance. Arusha Region has mainly a low population density and there are many large mechanized farms and estates producing wheat, maize, and seed beans. Wheat is grown on a small holder basis in Mbula District. The Iraqw and Kondo Regions are densely populated, have small farms, and mainly

subsistence production of maize, millet, and beans, and have major soil erosion problems.

### 3.5. Other Highlands

The remaining highland areas have low population densities, are isolated, and have poor communications. Maize is the main crop, produced mainly for subsistence, but also for cash in the more accessible areas. Oilseeds and small quantities of tobacco, wheat, and coffee are grown for cash as minor crops. Animal husbandry is of little importance, except in Mpwapwa, Kilosa, and southwestern Handeni Regions. The areas in this system are Mpwapwa, Kilosa, northern Iringa, Sumbawanga, southern Kigoma, and Mpanda; and the steeply dissected areas of the upper Kilombero and Ruhuhu valleys on the borders of Iringa, Morogoro, and Ruvuma Regions.

### 3.6. Northern Coastal Region

This system operates in the wet coastal parts of Tanga and Coast Regions. Major cash crops are: coconuts, cashew nuts, and citrus fruits. Paddy and cassava are the main foods. Livestock farming is negligible, but fishing is an important activity along the coast. There are many sisal estates and a mixed population, with hired labor being common. The system includes Tanga and Pangani Districts and Coast Region, and also the area around Mtwara and Mikindini towns. In the Tanga and Pangani Districts and the coastal part of Coast Region, population density is high and where there are estates, there arises the problem of land shortage. Population density is lower in the inland part of Coast Region. The area around the city of Dar es Salaam is influenced by the city economy.

### 3.7. Southern Coastal Region

In the Southern Coastal system cashew nuts are the main crops, supplemented by sesame and groundnuts. Animal husbandry is insignificant, but fishing is an important activity along the coast. Sorghum, cassava, and paddy are important food crops. This agro-economic system is greatly

influenced by the poor communications with the rest of the country. The region includes most of Newala, Masasi, Lindi, Nachwingea, Mtwara, Tunduru, southern Songea, Kilwa, and Rufiji Districts. The population density is generally low. Newala, Mtwara, Masasi, Tunduru, and southern Songea Districts have a nucleated settlement pattern and many Ujamaa villages.

### 3.8. Eastern Cotton Belt

Cotton production, while declining and at a lower level than in the Lake Victoria area, is nevertheless the major cash crop of a large area of Eastern Tanzania, although grown by only a small proportion of the population. Maize is the main food crop and secondary cash crop; other cash crops include: oilseeds, citrus fruits, and kapok. In the flatter plains of Morogoro and Kilosa, paddy is also an important crop. There are many sisal estates in the area. Animal husbandry is of negligible importance. Population density is low. This system includes most of Handeni, and parts of Bagamoyo, Kisarawe, western Rufiji, and Korogwe Districts, together with Morogoro and Kilosa.

### 3.9. Older Lake Victoria Cotton Belt

The Sukuma (Mwanza, Geita, and Kwimba Districts) and the Jita (Ukerewe and southwestern Musoma) are the predominant tribes in this long settled major cotton growing area. There is a high population density and much out-migration. Land shortage and overgrazing are problems. The area borders the Lake and has a fairly high rainfall. Other cash crops besides cotton are: paddy and chick-peas. Subsistence crops are: maize and cassava. Land shortage means that farms are small and intensively cultivated (ridges are commonly used). Livestock are fewer than in the newer cotton areas.

### 3.10. Newer Lake Victoria Cotton Belt

This area is peripheral to the older cotton-growing areas of Lake Victoria and the settlement is more recent. There is a medium to low population density and no acute land shortage. Farms are larger, almost every farmer growing cotton; methods of cultivation are more extensive; there are larger numbers of cattle. The predominant tribe are the Sukuma. In some areas of relatively longer settlement (most of Geita, Mwanza, southern Kwimba, Shinyanga, and Maswa Districts), overgrazing has already become a problem and outmigration has begun; other parts of the area (southwestern Geita, eastern Biharamulo, northern Kahama, northeastern Nzega, eastern Maswa, and western Iramba Districts) are still being settled, and here cotton production is expanding rapidly. These different areas making up this region receive different rainfall and land use for secondary purposes other than cotton growing varies in accordance with this:

Parts of Geita, Mwanza and eastern Biharamulo, and northern Kahama have relatively high rainfall. Few cattle are kept, cassava and paddy crops are fairly important, and ridges are often used.

Southern Kwimba, Shinyanga, Maswa, northeastern Nzega and western Iramba have low rainfall. There are large numbers of cattle, Millet and sorghum are the predominant crops; mechanized, flat cultivation is widespread.

### 3.11. Marginal Lake Victoria Cotton Belt

This system is found on the borders of the main cotton growing areas; the area comprises southwestern Shinyanga, eastern Kahama, and Nzega Districts (medium to high population density), together with Musoma District and the lowland part of North Mara (medium to low population density). The areas are of fairly long settlement.

In the more densely populated areas, paddy is the main cash crop, although cotton is of major importance in Shinyanga and Kahama, and there is a high groundnut production; cattle are few.

In the less densely populated area some cotton is grown, but is not of much importance. Paddy is the main cash crop in coastal areas. Some wheat is grown inland. There are many cattle.

### 3.12. Miombo Woodlands; Tobacco Areas

This system is found in the extensive miombo woodlands of western and southwestern Tanzania, where the major cash crop is tobacco (both flue- and fire-cured). It is an area of generally low population density. Tsetse flies are a major problem, leading to very low population levels in some areas. In most areas, the tobacco is grown by only a few farmers; paddy, groundnuts and oilseeds are also produced as cash crops; while millet, sorghum, and cassava are grown for food. Honey collection is an important activity. In southern Nzega and Kahama and in eastern Tabora, there are few tsetse flies and relatively large numbers of cattle. Flue-cured tobacco is grown, mainly in Ujamaa villages, and paddy and groundnuts are also important.

Western Tabora, Kahama, Mpanda, Kigoma, and Chunya are isolated, sparsely populated and heavily infested with tsetse flies. There are few livestock. Most crop production is for subsistence, although flue-cured tobacco is being encouraged.

The western part of Iringa Region is a dry, fairly hilly area with few tsetse flies and relatively large numbers of cattle. Flue-cured tobacco and oilseeds are important cash crops, also.

Ruvuma Region produces fire-cured tobacco; paddy; and, to a lesser extent, oilseeds are important cash crops, also. Although there are few tsetse flies, animal husbandry is not of major importance.

### 3.13. Central Tanzania

This area includes most of Dodoma and Singida Regions and is semi-arid, so that crop production is hampered by lack of rain, and animal husbandry is of major importance. In most parts, population density is

high because of the low carrying capacity of the land, and there is much overgrazing. The main cash crops are groundnuts and oilseeds; vines are grown around Dodoma and paddy near the Bahi swamp. There is some cotton production in Singida and Iramba Regions. Maize, sorghum, and millet are the main food crops.

On the borders of Singida and Manyoni Districts, soil quality is poor. Eastern Singida and most of Kondoa have low rainfall. These parts of the area have low population and crop productivity, and tsetse fly infestation hampers animal husbandry.

### 3.14. Dry Pastoral and Semi-pastoral

This agro-economic system operates in the driest parts of the country where animal husbandry is the major, or even the only activity. Little or no land cultivation occurs and the inhabitants own large herds of cattle and other livestock. They practice seasonal and continuous migration, although there are some permanent farmers. Human population density is very low; because of the low rainfall and large numbers of cattle, there is much overgrazing and soil erosion. In the pastoral areas of Masailand and the Mangati plains, crop production is negligible, although permanent settlement and some land cultivation is being encouraged. The marginal areas bordering Masailand are being used increasingly by permanent mixed farmers as well as by Masai pastoralists. The permanent farmers tend to have fairly large farms, and practice modern methods of cultivation, sometimes using irrigation. The crops grown vary, but paddy and small quantities of cotton are common cash crops.

Also included in this group is an extensive area of mbuga constituting the floor of the Rift Valley, stretching from Lake Eyasi in the North to the southern part of the Wembere in Tabora and Manyoni Districts. Most of this is suitable for grazing only, although there is some cultivation on the margins, particularly in Nzega and Iramba, where cotton is grown. The area is often used for seasonal grazing by people from neighboring zones. Tsetse flies handicap animal husbandry in the extreme south of the region.

In the Ruaha plains of southern Dodoma, Mpwapwa, and Manyoni and northwestern Iringa, occupied mainly by the Gogo with a few Masai, animal husbandry is the predominant activity, with some shifting cultivation.

### 3.15. Floodplain Areas

Despite physiographic similarities, there is considerable variation in agricultural patterns between the floodplains of the various rivers and lakes.

The floodplains of the Wami, Ruvu, Rufiji, Kilombero, and Ruvuma rivers are seasonally flooded and thus, settlement is often only temporary, many of the farmers owning other land and permanent homesteads in neighboring areas. The main crops are paddy and, in the Rufiji and Kilombero valleys, cotton. The temporary nature of settlement means that animal husbandry is seldom important.

The floodplains of Lake Rukwa have a very low population density, due to isolation, low rainfall, and a high incidence of malaria and other diseases. Most crop production is for subsistence (millet is often the staple food) although small quantities of cotton and oilseeds are grown for cash. In the eastern part some animals are kept, but their numbers are reduced in the western part, due to the presence of tsetse flies.

### 3.16. Shores of Lake Tanganyika and Lake Nyasa

On the narrow plains along the shores of these lakes, population is concentrated at the mouths of rivers, where local land shortage sometimes occurs. The major activity is fishing and agriculture tends to be secondary. Crops vary, but cassava is usually the staple food; and paddy, coconuts, and oilpalms are cash crops. Animal husbandry is seldom important. Isolation is a major problem; the main form of communication is by boat.

There remain six areas which are not readily classified into the above groups. These are:

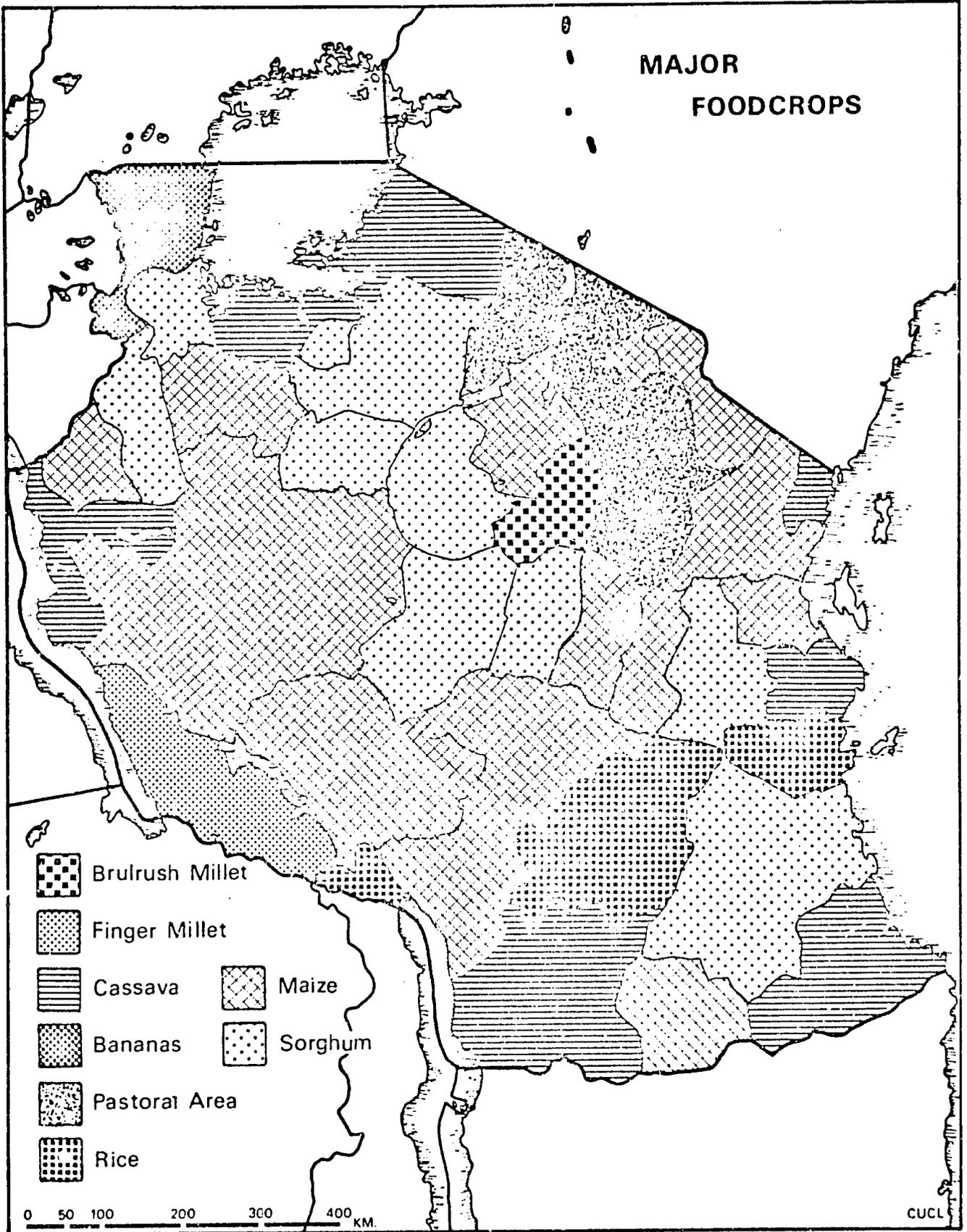
- Plains north of Mount Meru
- Ismani area of Iringa
- Usangu plains in Mbeya
- Rungwe plains bordering Lake Nyasa
- Rondo plateau in Lindi
- Ukara Island

Details of these agro-economic systems and of the others outlined above are found in the various BRALUP papers by Conyers. They indicate a complex pattern of use of a complex environment. In terms of agricultural policy it is important to note that a crop, maize for instance, fits into different agro-economic systems--although it may be the food crop for many of the districts in Tanzania (Map 2), it is grown under widely different circumstances and in a range of different combinations of crops.

The most important maize growing systems include the Sukuma maize-cotton-cattle system, the Iringa-Mbeya maize-cattle-tobacco system and the eastern maize-cotton belt.

Livestock likewise are found over wide areas of the country. The only truly pastoral system is in Masai District of Arusha Region, but livestock are a vital part of the economy in much of the area south of Lake Victoria, in Dodoma-Singida, and in many other parts of the country.

The current agro-economic zones represent a situation in which a long period of crop experimentation and adaptation has resulted in a differentiation of agricultural activity in relation to environmental, cultural, and socio-economic factors. In some areas such as Ukara Island in Lake Victoria, a high level of soil conservation has been achieved and intense cultivation is taking place with heavy labor and capital investment in land.



In other areas the prevailing agro-economic systems appear to be operating in ways which stress the local environment. Processes of change in agriculture are placing heavy demands on these systems.

#### .4. FACTORS INVOLVED IN AGRICULTURAL CHANGE

Of the many factors involved in agricultural change in Tanzania, five are particularly stressed in this section: population growth, villagization/ujamaa, growth of government-sponsored state farms and ranches, environmental problems, and new technology. The purpose of this discussion is to set out the range of important change factors and to assess in a preliminary way their impact on environmental problems.

##### 4.1. Population Growth

Population in rural Tanzania is growing at about 2.7 to 3 percent per annum. A large percentage (over 44 percent) of the population is under the age of 15 and as this group moves into adulthood a growing number of new heads of household will need land to cultivate. Careful estimates show that rural population may reach 27 million by 1995. Prospects of many of these people finding employment outside agriculture are poor. Thus, there must be a continued growth of the number of people in farming in Tanzania for many years to come. The additional population will be accommodated in some areas through intensification of land use and in others, by the opening up of new land. In terms of space there is a great deal of underutilized and unutilized land in Tanzania; there is very little unused fertile land except in areas where major flood control, drainage, or irrigation work is necessary to make the land available.

For the most part, new land to be utilized will be marginal land--of limited fertility and needing special care in use and conservation. The situation in terms of land availability and land pressure was summarized by Moore in 1971--his work is based on reasoned estimates and provides the best available overall picture.

The most pressing man-land problems do not necessarily occur in the most densely populated areas, as soil fertility, climate, and the types of crops and technology are also important. ". . . the whole of Dodoma Region would appear to have excessive population in relation to its limited

agricultural potential. . . The problem is even more acute in those which are experiencing rapid rates of growth. In those areas there is a risk that the increase in population numbers may outstring measures designed, by resettlement or improved agriculture." (Moore, 1971, page 4)

Table 3 modified from Moore's calculations, divides the Districts (using 1971 boundaries) into three groups: a land-stress group where the ratio of the computed land-carrying capacity and the 1967 population is less than 0.80; a land balance group (ratio 0.80 to 1.49); and a land surplus group (ratio 1.50 and over).

No less than 14 Districts involving over 3.1 million people fall into the land stress category. These 1967 census figures have, in the interim, increased by about one-third.

The detailed effect of population changes has been calculated for Dodoma Region (Berry, 1971). In the inter-censal decade 1957-1967, there was a 37.44 percent increase in rural population in the Region, but some parts of the area doubled their population in the decade, while others showed 10 to 20 percent increases. In this Region the changes in density since 1957 may be a major factor in the soil erosion and overgrazing situation, especially when they are linked with increase in animal numbers necessary to support the growing population.

#### 4.2. Villagization

In the last five years the Government of Tanzania has accelerated the campaign to move the rural population into Ujamaa villages. In some cases, this has meant a reclassification and reorganization of existing settlements, more or less in situ. Some communal fields have been cultivated and other cooperative enterprises established, but the basic farming system and layout has not been radically altered. In other cases, people have physically moved from isolated homesteads into nucleated villages, often transferring from one environmental setting to another in the process.

TABLE 3. TANZANIA BY DISTRICTS: POPULATION-LAND RATIO, DENSITY AND GROWTH COMPARISONS

Land Stress - Ratio Under 0.80					
High Density - Over 25.0 per sq. km.			Density Under 25.0 per sq. km.		
<u>Rapid Growth</u>	<u>Average Growth</u>	<u>Slow Growth</u>	<u>Rapid Growth</u>	<u>Average Growth</u>	<u>Slow Growth</u>
Kilimanjaro Newala	Arusha Korogwe Lushoto Femba Island Shinyanga	Malya - Kwimba Mwanza Ukerewe		Kondoa Mpapwa	Dodoma Iramba
Land Balance - Ratio 0.80-1.49					
High Density - Over 25.0 per sq. km.			Density Under 25.0 per sq. km.		
<u>Rapid Growth</u>	<u>Average Growth</u>	<u>Slow Growth</u>	<u>Rapid Growth</u>	<u>Average Growth</u>	<u>Slow Growth</u>
Geita Mzizima	Bukoba N. Mara Rungwe	Ngara Tanga Zanzibar Island	Handeni Maswa Mbulu Musoma Same-Pare	Kilosa Nzega	Kasulu Lindi Singida
Land Surplus - Ratio 1.50 and Over					
Density over 10.0 per sq. km.			Density Under 10.0 per sq. km.		
<u>Rapid Growth</u>	<u>Average Growth</u>	<u>Slow Growth</u>	<u>Rapid Growth</u>	<u>Average Growth</u>	<u>Slow Growth</u>
Karagwe Mbinga Mbozi Mufindi	Bagamoyo Masasi Njombe Pangani	Kisarawe Mafia Morogoro Mtwara	Iringa Nachingwea Sumbawanga	Bihara - mulo Manyoni Masai Mbeya Mpanda Songea Tunduru	Chunya Kahama Kibondo Kigoma Kilwa Rufiji Tabora Ulanga

TABLE 3. TANZANIA BY DISTRICTS: POPULATION-LAND RATIO, DENSITY AND GROWTH COMPARISONS (Continued)

Class limits for rates of population growth are:

Rapid	-	Over 2.8% per annum 1948-1967
Average	-	2.0 - 2.8% per annum 1948-1967
Slow	-	Under 2.0% per annum 1948-1967

SOURCE: Moore (1971). Rural Population Carrying Capacities for the Districts of Tanzania, BRALUP Research Paper No. 18, Dar es Salaam.

In 1974 at least 20 percent of the rural population was stated to be in Ujamaa villages and although the emphasis has slowed down considerably in face of drought and crop production problems, the 1975 figures are likely to be considerably higher. Village sizes range from 30 to 1,800 people, though there is a tendency for the later formed villages to be larger. In general, Ujamaa mobilization has been more complete in regions with lower per capita GDP; the 6 regions with the highest GDP have less than 10 percent of Ujamaa population; the 5 poorest have 70 percent.

The environmental and agricultural implications of Ujamaa are two sided, most particularly where physical relocation of population has occurred. On one hand, there is the possibility of creating a new pattern of agro-economic activity with good soil and land use practices, based on well-devised land use and agriculture. On the other hand there is the danger of both production and environmental problems arising at least in the short run because of the new setting.

#### 4.3. Government Ranches and State Farms

Parallel with the mobilization of the rural population towards Ujamaa, the Government of Tanzania has also established a number of

large-scale, government sponsored enterprises--most in ranching. In many cases, these have occupied land formerly little used because of tsetse flies or other hazards and have made little impact on the traditional sector. In other cases, land has been diverted from private grazing use and resulted in the opening up of new lands by the displaced herds.

These government enterprises can, however, be important in setting standards of land use and grazing control, and the land planning teams of Kilimo have provided valuable advice in this area.

#### 4.4. Environmental Problems and Agricultural Change

Environmental problems are often one of the catalytic forces in agricultural change. Rather generally, the 1960s in East Africa were years of more than average rainfall. The drought of 1960 was followed by several years of "good" rains broken by the 1969 drought in Central Tanzania and the more general dry conditions in 1974/75. Projections for long range climatic change are still unreliable, but most observers judge that the changed pattern which resulted in the Sahelian drought and other worldwide temperature changes may be the beginning of a new cycle. The 1960s saw a considerable growth of numbers of people and livestock in Tanzania and during the wetter years these were somehow accommodated within the existing agricultural systems, though with considerable local stress on the environment and with expansion of the area under use.

A drier sequence of years will mean that in some areas, transformation, not only of agricultural settlement, such as Ujamaa, but also of agricultural systems, will occur. This is already occurring to some extent; for example, in Dodoma, where intensive cultivation of vines and vegetables is, in small areas, replacing the extensive cattle-grain system.

In assessing prospects for agricultural production, care is needed to fully take into account the climatic record and the climatic prognosis for the future.

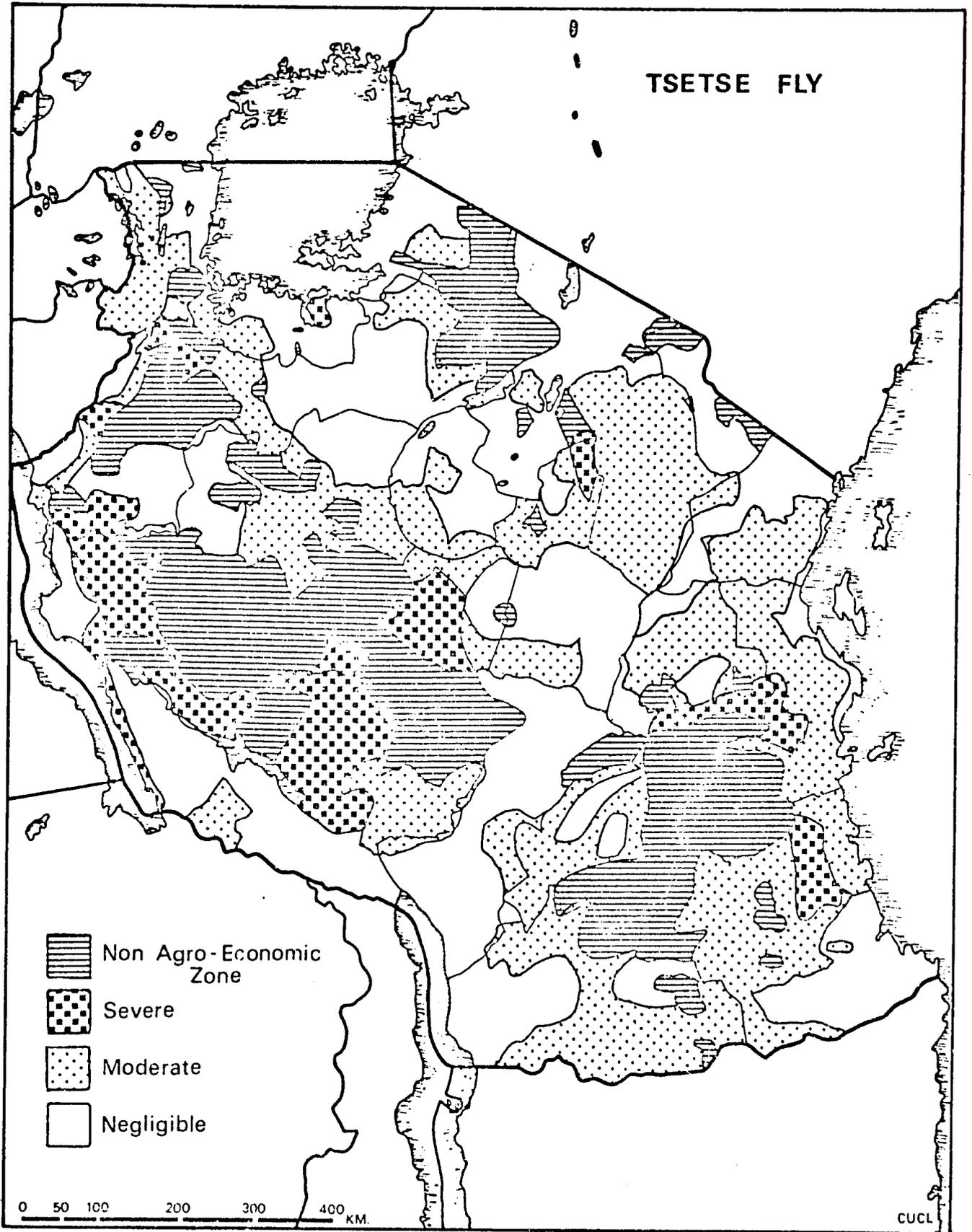
Other forms of agricultural change come as a result of the elimination of environmental problems. At present, tsetse fly, East Coast fever, and debilitating human diseases are a barrier to the use of large areas of Tanzania. Current programs to eliminate these hazards will potentially allow the expansion of agriculture into new areas (Map 3). Unfortunately, most of the tsetse areas are areas of marginal land and semi-arid climate, so that as these areas are freed, agriculture and/or ranching can only be introduced with care.

There is still debate over the issue on the kinds of response of agricultural systems to population growth. The Boserup (1965) view that intensification and greater investment in land follow population growth and that environmental degradation is followed naturally by rehabilitation gains some support in the Ukara Island system in Tanzania. But the general picture in Tanzania at present suggests the more pessimistic view that in semi-arid lands, generally environmental problems are increased by population growth, at least until a major transformation in agricultural methods takes place.

#### 4.5. New Crops and New Technology

Agricultural change has also come about through the introduction of new crops and/or new technology for growing traditional crops. New crops are usually introduced with a "package" of new techniques, including seed, fertilizer, and pesticide. In this way rapid transformation of agriculture can take place. Tobacco is grown under good extension supervision in Tabora Region and here, farmers, who, a few years ago, grew subsistence maize and herded cattle, now grow good quality tobacco, using up to six applications of sprays and fertilizer a year, on both maize and tobacco. The result of the new crop is a transformation of farmers' income and production, but two environmental problems arise. The first, not yet serious, is the pollution of local water sources by chemical sprays and fertilizers. The second is the large quantity of wood needed for tobacco curing. This

MAP 3



has already used up locally available woodland and replanting has seriously lagged.

New cropping systems can be very successful but a broad range of environmental concerns must be taken into account if they are to be self-sustaining in the long run.

The most promising new technology for Tanzania's circumstances appears to be new hybrid and synthetic seeds--particularly for maize. With careful field trials, it is possible to considerably increase present low yields. It seems at present that potential production gains outweigh any of the foreseeable environmental impacts in this area. The problems may occur, though, in marketing, and in social and cultural issues.

## 5. ENVIRONMENTAL ISSUES--NATIONAL, REGIONAL AND LOCAL

This section of the report reviews the main environmental concerns in Tanzania. It outlines major issues--it cannot in the context of the current time and other constraints deal with them exhaustively. The Government of Tanzania has decentralized decision making and administration to the Regions and Districts and in keeping with the new organization of government, the issues are presented here in terms of the scale at which they need most attention. First, at national level, there is need for consideration of broad policy and environmental and developmental questions on a national scale. At Regional and District levels a series of more local concerns surface, though at this level we also see the differentiated expression of national issues; soil erosion and decline in fertility is a national issue, but in Dodoma Region, for example, it has a special dimension and particular possible remedial measures. Lastly, at the local level--the village, the small dam site of the local rural industry--other matters are important.

In all this discussion it is difficult to separate environment and development. In the agricultural sector, whether dealing with livestock or crops, the current system has evolved within clearly defined environmental constraints. As developmental programs attempt to improve standards of living and quality of life in rural areas, we still have to deal with both the natural environmental problems and the current man-land situation.

### 5.1. National Issues

A local farmer plans and grows his crop with a good idea of the constraints and opportunities of the area. If the national government and/or external agencies wish to improve the farmer's situation, they should be able to bring to bear new technology and ideas but need to be, at least, equally aware of constraints and opportunities. Given the variety of local circumstances in Tanzania, this is no easy task.

#### 5.1.1. Crop Strategies

Major environmental issues related to crop strategies include:

**5.1.1.1. Environmentally Optimum Zones for Production of Certain Crops.** According to Porter (1972) the higher altitude areas of Tanzania have substantially higher potential for maize production than low altitudes. Risk is also important. In good rainfall years, Dodoma Region can produce excellent maize crops but in most years the area is marginal. Regional specialization in crops will, of course, need a more reliable marketing system than currently exists.

**5.1.1.2. Types of Farming Systems and Rotations for Food and Cash Crops.** There is a strong trend to shorter fallow periods in the main crop producing areas as good land becomes scarce. As fertilizer becomes more generally used, new environmentally sound rotation systems need to evolve.

**5.1.1.3. Crop Wastage Problems.** These occur as a result of crop losses, both on the stem and in storage. Reduction of these losses is as vital as an increase in cropped yield per hectare.

## **5.1.2. Livestock Strategies**

The livestock sector is best considered in two parts: the range management agro-economy with animal rearing the mainstay of the system, and mixed crop and livestock agro-economic systems. In all parts of the sector, except government ranches, the livestock economy is complicated by the social role of cattle in the cultures concerned. Exclusively grazing economies are limited to the Masai area and the grassland zones of the country. Problems here are familiar ones in Africa:

**5.1.2.1. Range Management and Grazing.** As animal numbers have increased and as the area available for pastoral groups has contracted, problems of overgrazing have grown more serious, palatable grasses are selectively eaten out and areas around water points are heavily eroded. Although statistics are notoriously unreliable, estimates of

cattle numbers in Tanzania were: 1,650,000 in 1913; 6 million in 1950; 8 million in 1960; 10 million in 1965; and 14 million in 1972. However, the agricultural census--also in 1972--provides a preliminary figure of 9.4 million, of which 2.4 million were estimated to be in Arusha Region. Whatever the numbers, the pattern of growth is clear. Increase in absolute numbers does not appear to have been accompanied by a commensurate growth in offtake. The resulting land and grazing problems are complex, demanding changes in aspects of land tenure, economic attitudes, marketing, and prices. Investment in range management is a necessary basis of dealing with this sector. This investment needs to be based on a clear understanding of the natural capacity of the different areas in Masailand and a long term program towards a new pattern of land management. The USAID range management program needs to be seen as part of this long term context.

5.1.2.2. Water and Range Management. Water is often thought of as the main problem in semi-arid areas. In many areas it may come second to that of good grazing. Provision of water for livestock is a delicate task and this is one area where considerable harm may occur. Small dams and boreholes which are intruded into the traditional patterns of watering and grazing may give rise to ownership and tenure problems, to overuse and to rapid depletion of local grazing resources (Murray-Rust, 1972; Berry and Kates, 1973). Water must be provided as part of an integrated land use program for the area and may be used as a catalyst for such a program. This need fits into the program for the growth of Ranching Associations in Tanzania. If new water supplies are provided, careful following of the use pattern is essential to monitor both the positive and negative impacts.

5.1.2.3. Mixed Sector. Three-quarters of the cattle in Tanzania are owned under a mixed farming system, many of them in the cotton growing areas south of Lake Victoria. Cattle occupy a somewhat different place in each system. In Sukumaland, the traditional grazing lands were the mbuga lands, the clayey lowlands which were left in grass. Now, many of these mbuga flats are used for rice cultivation but cattle remain an essential part of the social and economic system. Many solutions are sought to the increasing land problem. In some areas cattle are grazed far away from the home village, in some areas cattle numbers have decreased, and in many areas grazing is concentrated on smaller land areas with consequent problems.

Apart from the mountain slopes of Kilimanjaro and Meru where dairy cattle are still fed, the mixed farming sector has shown no better record than the pastoral sector in adapting to new situations of relationships between people, land and animal-crop systems. Once again, the future must be seen in terms of new patterns of land use and steadily evolving roles for cattle in both society and economy. The alternative, as the 1972 TANU paper states, is to destroy "the heritage our children can expect from us--which is the land itself".

### 5.1.3. Land Use Planning

Tanzania has plenty of land in relation to population numbers, yet a national land use policy is essential. At present there are clear guidelines for demarcation of areas for forestry, for catchment protection, and for game parks; yet each of these functions is viewed separately from each other. A national land use policy could serve as a framework for the following:

5.1.3.1. Mountain Area Catchment Protection. Agreed reservation of mountain areas for catchment protection is probably the most important land use consideration for the future as a high proportion of the total water yield of the country comes from a relatively small area.

5.1.3.2. Areas for Forest Protection and Forest Use. Demarcation of areas for forest protection and forest use is already well in hand, but needs, in some areas, to be reconciled with other land use needs. The need of charcoal for Dar es Salaam and other centers and the need of the tobacco industry for wood supplies are examples of these.

5.1.3.3. National Parks and Game Reserves. Tanzania has a good record in the area of maintenance and/or modification of national parks and game reserves in the light of the needs of the local population, the tourist industry, and long range preservation of wildlife.

5.1.3.4. Coastal Environments. Preservation and enhancement of coastal and offshore environments are important; vulnerable in Tanzania, as elsewhere, tend to fall between different administrative hierarchies.

In Tanzania, as elsewhere, it is the increment of many small decisions and actions which presents the greatest danger to particular parts of the environment. The current situation in land use planning is unclear, and some overview of the situation would assist the Government of Tanzania in assessing trends and developing policy.

#### 5.1.4. Pest Control

While major efforts are devoted to increasing production, it remains important to continue the battle against pests and food losses. I did not have the opportunity to make an up-to-date assessment of this problem.

#### 5.1.5. Major Water Resource Development

Tanzania's rivers are relatively few and relatively large. Water development schemes tend to involve transformation of these major rivers in multi-purpose developments of hydro-electric power, irrigation, and flood control. There is a clear need for careful assessment of the environ-

mental impacts of such developments. This is not a concern of currently planned USAID projects.

#### 5.1.6. Policies for Ujamaa

The increased emphasis on settlement in villages over the past two years has brought about a major transformation in part of rural Tanzania. These changes have major potential impacts on a number of environmental issues. Important concerns include:

- (i) The spacing and linking of villages to form an integrated pattern.
- (ii) The organization of the various land resources around villages to provide a sustained support for the rural economy for both current and future populations. This involves problems of crops and crop rotation, wood plots for fuel, and adequate grazing land.

#### 5.1.7. Ministerial Organization

At present, environmental concerns are part of the responsibility of several ministries and of the Regional administrations. This is, of course, natural, as in a rural-based economy such as Tanzania's, most parts of government have a concern with rural areas and environmental problems. The World Bank Report (Annex 3) defines a need for:

- "(a) Improving the knowledge about the identified agro-economic zones, particularly with respect to soil conditions, present yields and farming systems, erosion and fertility problems;
- "(b) Establishing possibilities for expansion of cultivated area and grazing land and required investments in roads, water, social facilities, tsetse control, and soil conservation measures; and
- "(c) Determining optimal farming systems (crops, practices, rotations, farm size).

"Such planning will require a joint effort by the Ministry of Agriculture (research, National Soil Service), BRALUP, Regional and District Administration, and Comworks; but the Ministry should assume full responsibility for the program and coordinate all efforts."

This recommendation implies a redefinition of responsibilities within Kilimo, but could, if implemented, provide a good basis for the vital coordination of several pressing development issues.

## 5.2. Regional Issues

At Regional level there is a good opportunity for integrating national policies towards localized specified problems. Among the concerns which are important for Regional level action are:

### 5.2.1. Specific Land Use Planning

This is necessary in regard to the mix of resources and opportunities in a particular Region. The need for fuel and timber can be met locally in most areas with careful planning. Part of the concern of the RDP and the DDD is to guide the national and optimum use of the Regional and District natural resources.

### 5.2.2. Soil Fertility and Soil Erosion

This is a national problem but susceptible to Regional and local solutions as these need to be clearly linked with the agricultural development of the area. While national policies are important, the Regional concern is paramount.

### 5.2.3. Local Water Pollution

Industrial or agricultural water pollution is not a widespread problem in Tanzania, though many local water sources are sources of water-borne diseases. The sisal agro-industry has a heavy water demand for washing fibers and rivers in sisal growing areas become locally polluted

with sisal waste and fiber. Both this and local industrial pollution are regional and national issues.

#### 5.2.4. Implication of New Infrastructural Development

An important part of the development of new crops and agricultural growth is the provision of road networks to improve marketing and provision of agricultural inputs. The location and routing of feeder roads is important. Feeder roads attract settlement and the layout and design of such roads should encourage development of lands with the best local potential and with the least danger or rapid degradation.

## .6. CURRENT GOVERNMENT OF TANZANIA ACTIONS AND AWARENESS

The "Siasa Ni Kilimo" statement of 1972 appeared to mark a new level of awareness of some environmental problems by the Government of Tanzania. It has not been possible to gain a comprehensive picture of Government of Tanzania stance but there is some evidence that the follow-through to that policy statement is as yet incomplete.

During the period 1961-1972 the main concern for land and erosion problems centered in the Ministry of Agriculture, although this involved job descriptions only in a small section of the Ministry. At present, responsibility for rural development is shared between the Ministry of Agriculture and the Prime Minister's Office and to some extent in the Regional Offices. It is clear from Miss Conyers' interviews of Regional and District authorities that there is widespread recognition of a range of environmental problems at the technical level. Now there is also awareness at the Party level. The present time, when the drought has brought a renewed concern with problems of production, is opportune to consider new initiatives within the ministries and in the Regions. There is some evidence that this is indeed beginning, but the trend needs every encouragement and material and technical assistance.

## .7. RECOMMENDED USAID ACTION AND STANCE

1. USAID is providing substantial support to the agricultural sector in Tanzania. Insofar as that support plays a part in the evolution of agriculture towards higher production levels, it should play a role in improving man-environment conditions in the country.
2. Special care is, however, needed in range management and in certain areas of crop production. It appears that consideration has been given to siltation and erosion problems in the USAID range management project, but the environmental impact should remain an important part of the project review process.
3. While recognizing that serious problems exist in Tanzania and that the Government of Tanzania is aware of these problems, all parties should appreciate that most solutions are long term and need to be worked out carefully in relation to the short and long run perspectives of Tanzanian farmers, Regional officials, and Central Government officials. However, a number of actions can be taken now as a beginning.
4. We need to ensure that specific projects such as USAID Masai Range Management Project take full account of the East African experience of range management. Local farmer expertise and knowledge should not be ignored but meshed with scientific know-how, including modern techniques of resource assessment.
5. In programs involving manpower training and upgrading, we need to encourage a significant component of environmental management and agricultural engineering. Our skills in these fields need to be related to local environmental conditions, as too often in the past attempts were made to transfer North American and European technology. However, until Tanzania has increased awareness at all levels and better trained manpower for these tasks, progress will be slow.

6. While university training is important, there will be greater short term results with manpower training at lower levels.
7. We should encourage Government of Tanzania interest in Land Use Planning at National, Regional, and Project scales--as a tool to effectively allocate and preserve natural resources.
8. Tanzania is fortunate in having a considerable data base on environmental concerns and having institutions committed to working further on these problems. Efforts should continue to incorporate this expertise into the planning and implementation process.
9. However, more work has been done in recent years on soil degradation problems. Less attention has been given to broad-scale land resource issues and to ecological considerations, and these need increasing emphasis. Current USAID work on the tsetse fly is a beginning.
10. In areas where there are special problems, United States expertise and technology; remote sensing, for example, may very usefully work with Tanzanian personnel (Government of Tanzania and BRALUP) in resource assessment programs. These activities should, however, be linked specifically with development activities of the Government of Tanzania.
11. These comments are drafted after a short visit and without recent field investigation. They are lines of thought for further investigation, rather than firm guidelines for the future. In my view, we need to intensify our efforts to help the Tanzanian rural sector. Part of our help will be geared to the short term needs of increased production and improvement in the quality of rural life. Nothing should stand in the way of that vital goal. But a significant and growing part of assistance should be geared to longer run issues of improvement of rural life. If production is to be sustained over a longer period, the critical

problems of maintaining land, water, and vegetation resources must be tackled. We should be ready to help the Government of Tanzania in a broad range of activities ranging from research and training to immediately applicable field experiments and programs toward this end.

APPENDIX

"SIASA NI KILIMO"

TANU PARTY GUIDELINES  
ON MODERN AGRICULTURE

## Siasa Ni Kilimo

As translated by

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Dar es Salaam

### AGRICULTURAL POLICY

the  
"For many years to come, the majority of citizens will continue to live in villages and earn their livelihood through agriculture. The land is the greatest basis for the development of our people and our country. We have no other basis. If this be so, then it is obvious that if the life in our villages is not socialist then our country would not be socialist either even if industries, commercial ventures and politics were based on socialism. Now, the pinnacle of Tanzanian socialism must be villages and farmers in villages."

(Agriculture in Rural Areas)

(National Executive Committee, Iringa, May 1972)

#### Part I

#### The Importance of Agriculture

Our agriculture including animal husbandry must fulfil the following needs:

- 1) First, it must provide food for farmers. If in a particular area it has not been possible to get food in a particular year we must either (a) send food from another area instead of selling it for foreign exchange or (b) to expend our foreign reserves to buy food from abroad. Either way we shall weaken our chances of getting or preserving our foreign reserves to buy equipment like machines for setting up new industries, tractors, drilling apparatus, lorries, steel etc.
- 2) Second, it must provide food for the following categories:
  - (a) more than 44% of our people who are 14 years or under
  - (b) a large number of 9% of our people who are of 50 or above (In the year 1967 these two categories totalled 6,600,000 out of a total of 12,300,000).
  - (c) adults numbering more than 450,000 and their wives who do not farm but work in offices, in the civil

service, in schools or in industries or are in business or in the army etc.

(d) 5,300,000 children will have been born between 1967 and 1980 if the birth rate continues at 2.79 as is at present.

3) Third, it must improve the quality of our food. The average span of life for Tanzanians is 40 compared to the English who reach 70. This low expectancy results from poor diet i.e. our food lacks in proteins, vitamins and such other essential elements. Improving the quality of food does not mean getting food enough to fill one's stomach but we must get the type of food that is required by the human body. These are proteins which are found in beans, fish, groundnuts, milk and eggs. Secondly, we must get food that would maintain health and provide resistance to diseases. These are vegetables, and fruits of different kinds. Thirdly, we must get food that is burnt up so as to provide energy for the body to be able to work, like a machine burning up coal or oil to enable it to work. Such foods are maize, wheat, potatoes, millet, cassava etc. It is necessary for our agriculture to produce these three types of food in sufficient quantity and quality.

4) Through agriculture we must produce for the outside world so as to acquire the foreign reserves we need. If we don't do this we will not be in a position to buy anything from abroad either for our defence or development or even for our economic advancement. As it is, between 85 and 90% of our exports are agricultural products, either semi processed or in raw form. And even if we wanted to earn the same value for our exports we must increase production since the prices of our products are falling in the external markets and the prices of things we need is continually rising. For instance, in 1965 we could have acquired one tractor by selling 5.3 tons of our cotton or 17.3 of our sisal; today the same type of tractor costs us 8 tons of our cotton or 42 tons of our sisal.

5) Fifth, our agriculture must produce crops like cotton, kenaf, copra etc. which we need for our industries.

6) Therefore (a) the farmers must be explained the importance of their work; they must feel both pride and responsibility and must realize that but for their efforts our nation would collapse; and (b) our efficiency in agriculture must increase.

## Part II

### Our Agricultural Efficiency has Slackened Since Independence

Since the main aim of development is to get more food and more money to enable us to acquire our other neces-

sities, this means that our effort to increase production is real effort and is the only effort, in fact, that will bring development i.e. more food and more money for every citizen.

(Arusha Declaration)

- 7) Our total output of crops has increased considerably. For example, cotton has increased from 167,500 bales in 1961 to 421,322 bales in 1971, wheat from 17,250 tons in 1962 to 45,000 tons in 1970, maize from 58,000 tons in 1961 to 215,000 tons in 1970.
- 8) This increased output arises out of:
- (a) an extended amount of land under cultivation--from 29 million acres in 1960 to 39 million acres in 1970. Increased use of tractors and ox-ploughs is one contributing factor for this increase.
  - (b) the number of farmers has increased since the population has increased.
  - (c) new and improved seeds, especially in cotton, wheat etc.
- 9) Our methods of farming have not improved so the output is much less than the input of effort:
- (a) the basic rules of good husbandry are not applied, especially in the crops we are used to. The rules of early planting, proper spacing and clearing the land after harvesting are hardly applied now and were not applied in 1961 either. In some sections there has been a slackening since independence and that even the rules of better husbandry that were being applied before independence are not applied now;
  - (b) the amount of fertilizers sold - the country is less than 43,000 tons and manure as fertilizer, is used even less.
  - (c) crop rotation is not applied anywhere.
- 10) The effects of this failure to change husbandry methods are serious.
- (a) There is a widespread fall in the production per acre. For instance, when Ismani was still a virgin land 20 or 25 years ago, the maize production per acre stood at 20 or more bags of maize per acre. Today, Ismani produces an average of only 7 bags of maize per acre. Also, despite the fact that there are better cotton seeds today, than in the past, the production in the areas where cotton is usually planted has decreased. Even for new crops like tobacco in many areas already the production per acre has begun to fall.
  - (b) Soil erosion has spoiled and continues to spoil the land in many areas.

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11) By using slipshod agricultural methods we are reducing our capacity to increase wealth. Worse still, we are despoiling the heritage our children expect us to preserve for them; this heritage is land. The use of better health services means that the population will expand year after year. But if our agricultural techniques remain the same we shall not be in a position to maintain our present position, let alone improve it. Moreover, our policy of Socialism will have failed if in the years to come we are unable to produce sufficient food, or if we fail to acquire foreign reserves from our exports, there will be a halt in our development projects.

### Part III

#### What Should We Do Now?

"... the basis of development is the people and their efforts especially in agriculture"

It is the responsibility of the Government and Cooperative Societies to ensure that the people get equipment, training and guidance necessary for modern agriculture and animal husbandry.

(Arusha Declaration)

12) For revolution in agriculture there are two important things necessary: The first is a sound policy on land ownership and its exploitation. The second is to increase skill in farming. The first condition was fulfilled immediately after independence by nationalizing all land and supporting this by the Arusha Declaration. The second condition, i.e. skill in agriculture, depends on the one hand on the response, knowledge and efforts of the people and their leaders and on the other hand the services and projects of the Government in implementing this revolution.

#### Call to the People

13) Increased production and skill in agriculture depends upon the efforts of the people especially. In order to stride towards development we must abandon old-fashioned farming techniques. All farmers must acquaint themselves with the new techniques and implement them. Modern farming includes using all types of fertilizers, better seeds, better planting and better weeding. These alone do not suffice; real success will depend upon the efforts of every farmer. In order to implement modern farming techniques we must have large farms of cooperative nature. Hence, the way to revolution in agriculture is to hasten towards and establish Ujamaa Villages. Farms in Ujamaa Villages must be farms where modern techniques are applied.

14) We must:

- (a) educate ourselves in using modern techniques in the production of crops, in animal husbandry and in fishing.
- (b) learn modern techniques from books, from the magazine UKULIMA WA KISASA (Modern Farming), from documentary

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films on agriculture and development in villages and from Radio Tanzania,

- (c) employ rules of better farming i.e. use better seeds, clear the land early, plant early, space the planting as required, weed properly, to make an effort at harvesting and to clear the land after harvesting,
- (d) improve the quantity and quality of production by using fertilizers. Fertilizers can be in the form of salts, manure, rubbish thrown out of homes and leaves;
- (e) use insecticides to kill crop destroying pests;
- (f) employ better techniques in animal husbandry by availing the herds of adequate and better fodder and food, clean and adequate water, and to immunize them against diseases.
- (g) cooperate in fishing and use modern vessels and fishing nets.

15) Small farmsteads and hand implements cannot be expected to bring about modern development. It is difficult for individual farmers who don't exploit their fellow-men farmers to get rid of their small farmstead and hand implements. Therefore it is our responsibility to hasten to join in Ujamaa Villages so as to be able to till bigger farms and use modern farming techniques.

16) In accordance with the expansion of activities of economic situation in the villages, it is necessary to employ better agricultural methods and implements. Tractors are essential only if the farms are large and that work is carried out systematically and if there is possibility of supervision and maintenance of tractors working without hindrances. Without this, a tractor can be a burden to a farmer and spoil the land. If a village is not yet able to use a tractor it must continue using ox-ploughs or those drawn by donkeys. Also, fertilizers, crops and other requirements of the farmers must be carried in push-carts.

17) By cooperating with TANU leaders and experts we must prepare and implement economic plans and rules to increase skill in agriculture, animal husbandry and fishing in villages.

18) We must preserve our land and its fertility, so we must:

- (a) observe the rules of preventing soil erosion by planting ridges and ensuring that the land is covered by vegetation;
- (b) to stop clearing hill-tops of trees that protect the water-springs and to stop farming near the river banks.
- (c) to stop burning forests and bushes
- (d) plant trees on open lands.

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19) Besides observing skills and rules of better modern farming we must set targets and prepare projects, divide work properly and to strive to fulfil these.

20) At present much of our country where there are lakes or rivers lack in harvests for want of rain. Thus it is necessary to carry out cheap, simple irrigation where possible. We can start digging ditches by using the little knowledge we have without waiting for expensive projects.

21) If we wish to succeed, we must abandon practices and customs which if continued will hamper advancement of skill and effort in agriculture. Herders must be in the forefront to remove such practices and customs and must beware of problems and hindrance facing the people which would retard progress.

22) Revolution in agriculture demands that people have good health. Thus it is essential to insist on producing better food. Our aim should be to grow more vegetables, more fruits and to raise goats, sheep and poultry.

23) Development of agriculture also depends upon better transport. Hence making and maintaining proper roads in villages must be emphasized.

24) It is not necessary that money should be spent in order to achieve better skills and better crop production. What is really needed is working intelligently.

#### The Responsibility of the Government

It is essential that the people be provided with certain services that would encourage them to make greater efforts. Hence:

25) The Government must initiate and establish various kinds of research necessary to increase skill and experience in making better farm implements, for good animal husbandry and for modern methods of fishing. Also research must be intensified in producing better seeds and especially of crops and food. To ensure better use of fertilizers, there is need to emphasize research into soils especially in ujamaa villages.

26) There must be a programme to make a better use of the experts so as to spread agricultural skill and to train the villagers so that they can rely upon themselves for skill and experience.

27) Political Education, education on rural environment and economic ways of agriculture can stimulate revolutionary spirit in rural agriculture which must be the integral parts of training imparted by agricultural experts.

28) Government farms, Prison farms, Schools and Colleges must help train leaders and farmers in villages.

29) Plans must be made to help farmers use fertilizers, better seeds and insecticide for important crops and herds, especially in

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ujamaa villages. The Government, Parastatal organizations and Cooperative Societies must ensure that the essential of better farming viz. fertilizers, insecticides, better seeds and equipment are made available in the villages in good time. We must rely on chemical fertilizers only. There should be research into the possibility of making fertilizers from dirty water in towns.

30) Arrangements must be made to choose important crops that need to be emphasized. In such arrangement, land for the (grazing of) herds must not be forgotten.

31) When pricing the produce, consideration must be given to the question of implementing better and modern agriculture and to choose important crops that would be produced in different areas.

32) The Government must establish and increase better use of the necessary organs to advance loans and the necessary organs and to buy their products. Alongside loans for fertilizers and equipment there must be arrangements for loans in ujamaa villages for villagers to get loans in cash for their day to day living before harvesting and selling their crops.

33) This revolution will increase production in the country. The organs concerned with selling our crops at home and abroad must be strengthened so as to enable them to cope up with this increase in production.

34) The Government must be ready to help the people everywhere they start small and cheap arrangements for watering the farms and to ensure that such ditches are owned for the common food.

#### Part IV

#### The Responsibility of TANU

"The leaders must set examples for the people by their ways of living and actions."

(Arusha Declaration)

35) Although the Government employs many Agricultural Officers to advise farmers and give training to them, the TANU leaders must also participate in the task of spreading better agriculture for the following services:

- (a) Better agriculture is important for the success of our socialist policy.
- (b) Agricultural officers will only be useful if farmers agree to learn from them.
- (c) It is not possible for the officials of the Ministry of Agriculture to be available at all times, but better farming skills must be developed everywhere now.

36) To say this means that all cadres of TANU leaders have four responsibilities:

- (a) They must first learn the essential principles of

better farming for their crops and their land.

- (b) They must explain to the farmers why old methods must be abandoned and to stimulate in them an interest in learning new ways of farming.
- (c) They must arrange for Agricultural Officers to go to village farms at appropriate times. If these arrangements are not possible, they must be ready to teach the new skills themselves.
- (d) By cooperating with organs responsible for distributing goods such as State Trading Corporation and Cooperative Societies, the leaders must ensure that fertilizers and other necessary aids are available in their areas whenever need arises.

37) TANU meetings must discuss agriculture and must give progress reports so as to assess results, realize problems and to take action.

#### Conclusion

38) Political education is expertise in agriculture and agricultural expertise is a part of political education. So the important part of TANU is to ensure that a large section of the people working in the villages realize the need for expertise in agriculture and that they cooperate together in using this expertise. It is necessary to explain to everybody:

- (a) that our production per acre is dwindling
- (b) that by slipshod agriculture as practiced today we spoil the land;
- (c) it is necessary to act to ensure that production is increased and to preserve our land. But better agriculture practice is not taught by addressing political rallies; it is taught through person to person conversation and through cooperating. What is needed is action: better farming; not speeches from the platform.

August, 1975

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