AGRICULTURAL DEVELOPMENT IN EAST AFRICA:
A PROBLEM IN CULTURAL ECOLOGY

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ABSTRACT

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This thesis is an attempt to understand the reasons for success or failure of attempts at directed change in agriculture in East Africa.

Since agricultural development, like agriculture itself, is dependent on environmental permissibility, the environmental setting for agriculture was first examined. This examination revealed that, although there are many different subsistence environments in East Africa, most of these are fairly explicit as to the opportunities they present for cultivation, and most present severe limitations as well, particularly in the great variation in annual rainfall and in presence or absence of various scourges to crops and herds. The functional result of the various environmental limitations is, for much of East Africa, the ever-present threat of famine. To minimize this threat the subsistence strategies of many East African cultivators and herders are adaptations to minimal rather than to average environmental conditions. In addition, much of the content of East African cultures not ordinarily classified by anthropologists as subsistence practices, but apparently part of social organization,

religion, etc., functions as defensive adaptations to the threat of famine.

An examination of various instances of spontaneous development of agriculture suggests that, when properly motivated (usually by pressure on the land caused by restriction to locale), East African peoples are not only willing and able to practice an intensive agriculture, but they have often invented one. An examination of instances of devolution from intensive to shifting cultivation suggests that, in the absence of land shortage, they prefer the less demanding and perhaps higher yielding shifting cultivation. These spontaneous changes in agricultural systems suggest that the African farmer bases his decision as to whether to accept or reject change on the relative advantages of the old versus the new ways -- a cost-benefit analysis.

An examination of the colonial experiences of the East African peoples shows that many changes imposed by the foreign administration (land alienation, removal to new land, restriction of movement to the tribal areas, etc.) function as additional ecological limitations, and pressure additional adaptations, as do other ecological changes.

An examination of forty-one cases of directed agricultural change initiated in the British colonial period reveals a set of regularities pressuring for acceptance of change similar to those obtaining in the cases of spontaneous agricultural development. These regularities include: (1) the proposed technology was suited to local environmental conditions

as well as to objectives of the project; (2) the project was perceived by its prospective members as offering them a clear benefit in relation to its cost, without increasing subsistence risk.

Reinforcing the above observations drawn from analysis of the nearly 2/3 of the reported cases which were successfully instituted are observations made in analyzing those cases which failed. Causes of failure included: (1) technology was not suited to all manifestations of the local ecological conditions; (2) projects were designed to fit in with a mistaken notion of a people's culture (cooperative rather than individual family farming, etc.) with little or no resulting benefit; (3) projects had been designed not so much for the benefit of their members as for the convenience of external interests.

Evidence from both successful and failed agricultural development schemes in East Africa, therefore, suggests that where the preferred change does not increase subsistence risk, where it proves to be technically feasible for the local ecology, and where it offers to the people a benefit perceived by them to outweigh its cost, it is likely to be accepted.

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I wish to thank the people who have shared with me their experiences with agricultural development in East Africa. Their names are cited as sources for various cases of agricultural development schemes presented in chapter III. I wish also to thank Mr. Floyd of the U.S.A.I.D. who guided me through some agricultural development schemes in Africa and whose sensitive comments and questions about the people among whom he worked helped me to choose my thesis topic.

This is an opportunity to express my thanks to the many librarians who have helped me research this topic, often with an interest which seemed to match my own. In this connection, I must single out Mr. Milford of the Food Research Institute of Stanford University and Miss Mullins of the library of the American Geographical Society.

I am indebted also to Mr. Carey B. Singleton, Jr. of the Foreign Agricultural Service of the U.S. Department of Agriculture who supplied me with reports - published and unpublished - of the Department concerning East African Agriculture.

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CHAPTER I

INTRODUCTION

This thesis is a study of some attempts at directed change in agriculture in East Africa.

Many anthropologists have studied the process of directed change both as an exercise in applied anthropology and as a chance to study synchronically the larger process of cultural evolution (Arensberg, 1967: 65). Much of any culture is the result of adoption of innovations brought to its awareness through contact with foreigners. Directed change projects can be seen as attempts to speed the process of cultural evolution by deliberately arranging the contact, promoting the awareness and encouraging the adoption.

Most anthropological studies of directed change have been of two types--1. intensive case studies of single change projects, or, 2. studies of the change process based on comparisons of many such cases. These latter studies tend to isolate variables operative in the group of cases, and then, by counting incidences of each variable among the

several cases of adoption or rejection of some proffered innovation, to come to some conclusions about generalizations which may be made concerning the change process. In effect, they endow the "directed change process" with a life of its own, controlled by some constellation of relatively fool-proof rules. For example:

> Although there are at least seventeen different kinds of forces which impinge on the change process, there are six which stand out from the others. These can be regarded as the primary process variables: (1) the methods of communication used by the change agent, (2) the kind of participation he obtains from the recipients, and (3) the manner in which he utilizes and adapts his innovation to the existing cultural patterns; and as far as reaction of the recipients is concerned, the primary variables are (4) whether they have an initial felt need, (5) whether they perceive any practical benefit in adopting a change, and (6) whether their traditional leaders are brought into the planning and implementation of the process.
>
> . . . . . .
>
> Theoretically, if all six of these ingredients exist in a change project, the innovation will be adopted. (Niehoff, 1966: 40)

In such studies of the change process no consideration is given to the area of life in which change is to take place, nor of the importance in the lives of the people or the activity in which change is to be introduced. In counting instances of acceptance or rejection of change, all change is weighed equally. In other words, the substance

or substantive area of change is considered to be irrelevant to the process of change adoption. The same rules are assumed to apply whether the change will effect the family's eating habits, its God, or its income.

In examining these various sets of rules, it has occurred to me that in at least one human endeavor it is unlikely that people can be manipulated to change their behavior through any mechanical application of rules for directed change. The special critical nature of subsistence activity would seem to preclude such a likelihood. The special critical nature of subsistence refers, of course, to the fact that the subsistence cultivator may be entirely dependent on his produce for the feeding of his family. Risks in agricultural change are not of the same order of risk as those in adopting a cottage industry, for example, or in practicing improved hygiene, or in participating in a literacy class.

The importance of the especially critical nature of agricultural risk was brought most forcibly to my attention when, on a trip to Madagascar, I was shown by an agriculturalist working for U.S.A.I.D. two separated demonstration paddies he had personally cultivated in the hope of convincing some Merina farmers to replant their nursery-started

rice seedlings in straight rows in the flooded paddies rather than in the random manner that was their custom. The purpose of planting in rows is that it facilitates weeding. Weeding is important because weeds compete with crops for space and for soil derived nourishment. In one of the agriculturalist's demonstration paddies the rice crop seemed to be about twice as abundant as in the surrounding paddies of the villagers. In the other, not a blade of rice had grown. The A.I.D. man had no clue as to what accounted for the failure of the second paddy but he was fairly certain that he had lost the case for planting in rows with the villagers. He had hoped to demonstrate to them a benefit they could perceive. Instead he had offered them a gamble. It is one thing to motivate a man to take a change on double or nothing in a non-subsistence economic activity. He can keep his mind on the fifty percent chance of getting rich. The man offered a gamble, double or nothing, in subsistence, is likely to keep his mind on the fifty percent chance of starving. It is a chance he is not likely to take.

Because of the special critical nature of risk in agricultural development it seemed worthwhile to study directed change in agriculture apart from directed change in general,

not so much to attempt to elicit a group of variables but to see whether such change could be fitted into some valid theoretical framework.

Anthropological theory concerning the evolution of subsistence types suggests that cultivation practices, whether invented or adopted , are largely adaptations to the opportunities and limitations of specific environments (Steward, 1955: chapt. 2).

East Africa was chosen as the locus of this study because it presents, in an area of overall geographic, historic and cultural unity, a great diversity of local environments, most of which contain some subsistence risk. The area does not include all of the East African Culture Area, but all of it, with the exception of the extreme north of Kenya, (and all of the cultures to be considered here) are within that culture area, except for a few remnant hunting groups. Groups of the East African Culture Area have been considered to be sharers of the "East African Cattle Complex" a culture complex first identified by Herkovits (1926) as characterized by a valuation of cattle and an extension of their cultural role beyond their contribution to subsistence. Members of the Cattle Complex are, with rare exception, not herders exclusively, nor even primarily. Most East Africans depend on both cultivation and herding, but in varying proportions and by varied and often ingenious arrangements.

The format of this study is, firt, to present the cultural-ecological background of the area, by showing the interrelationship of subsistence strategies to the various

aspects of the natural environment. Instances of agricultural development, spontaneous or directed, are included, as they have been influenced by, or have influenced the environment. This corresponds fairly closely to the method of cultural ecology as proposed by Steward:

> Three fundamental procedures of cultural ecology are as follows: First, the interrelationship of exploitative or productive technology and environment must be analyzed. . . .
>
> Second, the behavior-patterns involved in the exploitation of a particular area by a particular technology must be analyzed. . . .
>
> The third procedure is to ascertain the extent to which the behavior patterns entailed in exploiting the environment affect other aspects of culture. (1955: 40, 41).

Following this cultural-ecological description of the setting into which they are to be introduced, the schemes (forty-one of them) are presented, as a series of case studies. Each scheme is described and then, briefly, factors pertinent to its success or failure are noted.

Finally, the analysis of the various schemes will be used to derive theory concerning the dynamics of directed agricultural change.

CHAPTER II

THE CULTURAL-ECOLOGICAL SETTING FOR AGRICULTURAL DEVELOPMENT IN EAST AFRICA

The geographic area considered in this study consists of a block of land and some offshore islands of approximately 683,000 square miles in east central Africa. It extends from about 4°N. to 12°S. latitude and from about 29° to 41°E. longitude and lies entirely within the section of Africa referred to as Sub-Saharan. Until recently, this areaswas known as British East Africa, Today, it consists of the three new independent nations of Kenya, which, with about 226,000 square miles, comprises the eastern two thirds of the northern portion of the area; Uganda, about 94,000 square miles in area, which makes up its northwest corner; and Tanzania, a country of nearly 364,000 square miles which constitutes its southern portion. When considered in terms of cultivated and cultivable land, the areas of the three countries are much more nearly equal. Ten thousand, or roughly 10.5% of Uganda's ninety-four thousand square miles are in cultivation while only three percent of

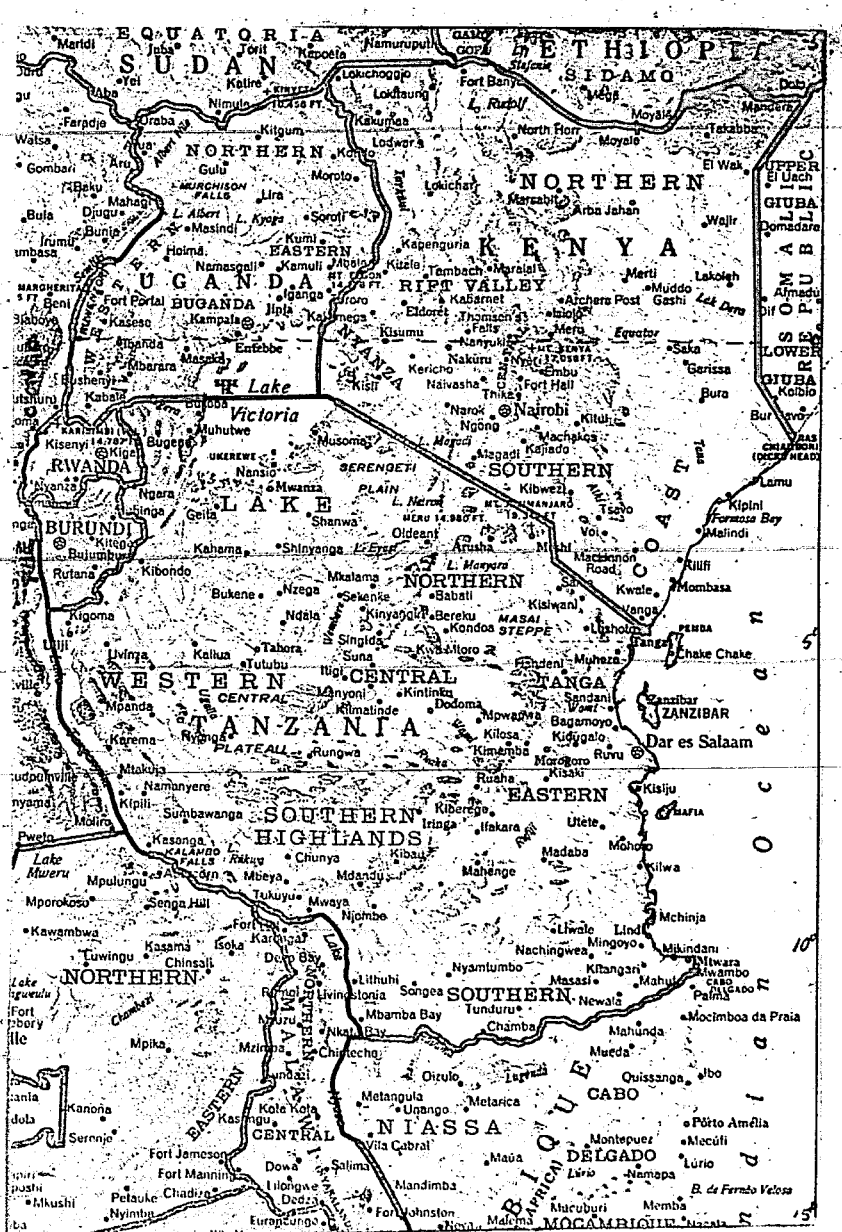

Fig.1 East Africa: Countries and regions.

that of each of the other two countries are currently cultivated. Moreover, agricultural potential is limited in each of the two larger countries, three-fifths of Kenya being too dry for cultivation and two-thirds of Tanzania being closed to cultivation by tsetse fly infestation.

To the east of this East Africa area lies the Indian Ocean which forms the entire eastern boundary of Tanzania and the southern half of that of Kenya. The remainder of Kenya's eastern boundary is its border with Somalia. To the west, Kenya is bordered on the north largely by Ethiopia, and for a short distance by the Sudan, which also forms the entire northern boundary of Uganda. Uganda's western border is at the Congo, and the western half of its southern border is with Rwanda. This last country also forms the northernmost part of the western border of Tanzania. Southward Burundi and the Congo complete Tanzania's western border, and to the east, its southern border is made up successively of Zambia, Malawi and Mozambique.

Kenya, until it gained its independence in December, 1963, consisted mainly of a British colony to which was attached a small protectorate made up of a ten-mile wide strip of land along the coast leased from the Sultan of Zanzibar. Uganda had been a British protectorate prior to October,

1962, Tanzania is formed of two former units of British East Africa: the United Nations Trust Territory of Tanganyika, which became the Republic of Tanganyika in December, 1961; and Zanzibar Protectorate, governed by the Arab Sultan of Zanzibar until its Independence Day on December 10, 1963. The two united in April, 1964, to form the United Republic of Tanganyika and Zanzibar, which, the following November, was renamed Tanzania. Within this new nation, the two components are still referred to by their old territorial names.

The current status of each of the three East African countries is that of independent republic within the British Commonwealth of Nations. With the announced intentions by their respective leaders, in 1963, of working towards a future political federation, the three new countries reinforced their inherited economic integration, directed well before independence, by the East African Common Market, which had started in 1917 as a customs union between Kenya and Uganda and ten years later incorporated Tanganyika, and by the East African Royal Commission, since December 1961 converted to the East African Common Services Organization, headed jointly by the prime ministers of the three participant countries, which, with the exception of defense,

maintains all the common services provided under British administration. These services, numbering about twenty-four, include some for transport, communications, and various research organizations to service agriculture (Nye, 1963: 467-75). (Tanzania has withdrawn from the currency union.)

Common recent colonial background (Tanganyika only came under British Mandate at the close of World War I, prior to which time it had been, for thirty-five years, a German colony), reinforces the intrinsic geographic unity of East Africa which stems not only from the contiguity of the three constituent countries but also from their sharing, as their main geographic feature, the continuous great plateau which is at once the most distinctive and distinguishing feature of the region, setting it apart from most other regions of sub-Saharan Africa, which derive their unity from sharing a river basin (Stamp, 1964: 378).

Physiography

All of inland Africa south of the Sahara is basically a great plateau, but this is divided topographically into distinct sectors and the sector which forms the East African Plateau might be considered the climax one, not only because it alone lacks a major river basin to detract from

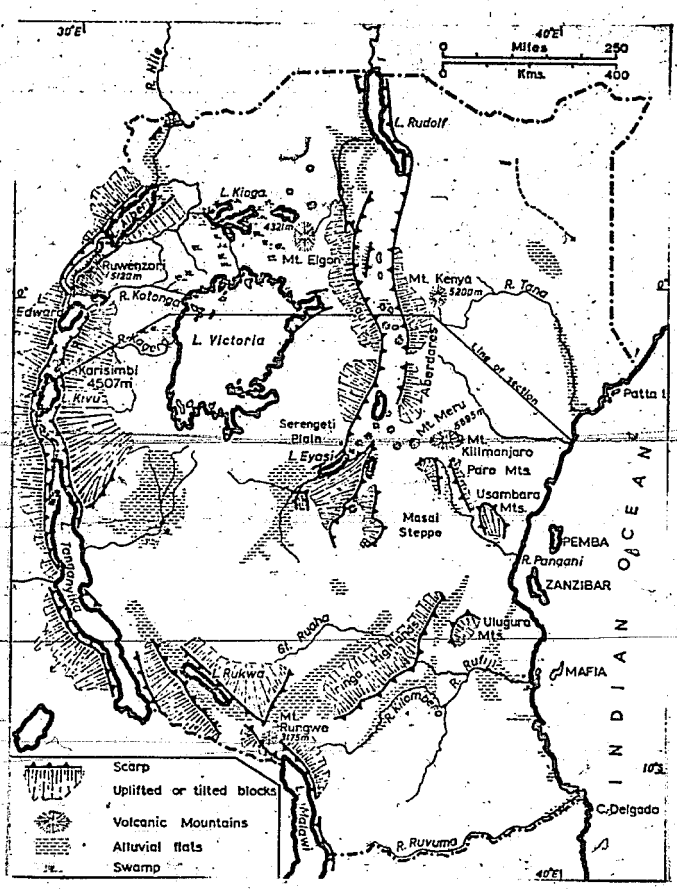

Fig. 2. Relief and Drainage of East Africa
(Warren, 1967: 167)

the plateau's geographic dominance of the area, but also because, here, in what Kimble (1960: 32) calls the "roof of Africa" it reaches its greatest height.

The distinctive role of the plateau in determining East Africa's geographic character is reflected in Miller's classifying East Africa with the Tropical Climates (1955: 125), rather than as a regional type of the equatorial climates, among which he includes both the "Congo Basin" and the "Guinea Lands" (1955: 109), which, together with East Africa, comprise the African Equatorial Belt.

While presenting, as its most distinctive aspects, those of gently rolling plain, and more rugged surface peneplain, the distinctive and unifying plateau is by no means uniform, and the great diversity of its topography, together with the frequent extreme steepness of slope which results from dramatic changes in altitude, account in large part for the great variety of agricultural zones, not only in the areasas a whole, but often within a very small section of it.

The most distinctive geographic feature to mark the East African Plateau is the Great Rift Valley which, in its southern entry into the area, carries Lake Nyassa along the southwestern border of Tanzania before dividing into east

and west forks. The east fork roughly bisects the area more or less along longitude 36°E. The west fork, at about 30°E. longitude, forms a major portion of the western boundary of the area, effectively cutting off East Africa from the Congo region. In actuality, the west rift seems not to be continuous, but rather a series of clefts in whose depths lie a string of deep lakes, starting with the largest and most southerly, Lake Tanganyika, and continuing northward with Lake Kivu, to the west of our area on the Rwanda-Congo border, and Lakes Edward and Albert on the western border of Uganda. Within the eastern rift lie two of Tanzania's lesser lakes, Manyara and Natron and, in northern Kenya, the much larger Lake Rudolph, which continues northward with the rift into Ethiopia.

The floor of the Rift Valley varies considerably in depth, dropping as much as four thousand feet in parts of Kenya, and to nearly five thousand feet at the deepest portion of Lake Tanganyika, making that lake the second deepest in the world. Adding to the depth of the cut at Lake Tanganyika is the height of the walls of its gorge which occasionally rise more than five thousand feet above the water. Elsewhere in southern Tanzania the drop of the eastern rift may be as slight as sixty feet.

The elevation of the Rift Valley floor varies not only with the depth of its cut but with the altitude of the surrounding plateau as well. Through Kenya, for example, it rises from the level of two thousand feet at its southern entry at Lake Natron to a maximum of seven thousand feet in the Highlands, dropping again to less than thirteen hundred feet in the north at Lake Rudolph.

The walls of the rifts are raised into escarpments which increase the altitude of the surrounding plateau by as much as four thousand feet, thereby adding greatly to the difficulty of providing transport facilities in the area (Hance, 1964: 395).

The floors of the rifts present an extremely irregular relief caused by the many volcanoes with which they are studded.

The width of the rifts also shows considerable variation. Usually thirty to forty miles wide, it extends to sixty miles across in some places and narrows to a few hundred feet in others.

Complementing the depressions of the Rifts, several great mountain masses tower above the plateau's surface. These include many extinct volcanoes, the tallest of which is Mt. Kilimanjaro in northern Tanzania, whose peak, rising

to 19,340 feet, is the highest point on the African continent. Other major volcanic mountains include Mt. Meru, Kilimanjaro's neighbor to the southwest, Mt. Kenya, just south of the equator in central Kenya and Mt. Elgon, on the Kenya-Uganda border. Rising with these giants from a base within the western rift in Uganda, is the great block mountain mass of Ruwenzori, once known more romantically as the Mountains of the Moon. Ruwenzori, Kilimanjaro, and Mt. Kenya, all wear permanent glacial caps.

Many other massive mountains rise above the plateau's surface, particularly in Tanganyika where their pattern has been likened to a huge figure nine, "the loop encircling the Massai Steppe in the north and the tail extending south and west in a huge arc" (Moffett and Hill, 1955:16). Here, as is typical of East Africa, it is the mountain slopes which provide most of the arable land, and many of these mountains will be mentioned further on in this study as sites of indigenous agricultural developments or of various of the specific agricultural development schemes whose analysis are its major purpose.

Cultivation on mountain slopes presents both advantages and disadvantages: it increases greatly the diversity of possible crops; but adds to the difficulty of

introducing mechanization to increase their production, while forest denudation of cultivated hillsides encourages erosion of mountain topsoil, which, with mounting demographic pressure on the land, has rapidly been increasing the danger of environmental degradation in the area. Erosion control, therefore, is among the main objectives of many mountain area development schemes. Schemes for erosion control are among the most difficult to promulgate, however, since the benefits for the required hard work are necessarily slow in being realized.

Between the proximal escarpments of the Rift Valley's two cuts lies the great East African Plateau. It's southern portion becomes the Central Plateau of Tanganyika, which lies relatively flat at an altitude of about four thousand feet, except for the frequent raising of its granitic surface into "inselberge" or "kopjes." These kopjes may form natural storage tanks for water, and in at least one case, with slight reinforcements, were used as dry season water sources for a resettlement area (Case 31). While all of Tanganyika's Central Plateau other than its extreme north is characterized by its inhospitality to agriculture, this is so pronounced in the southwest that the section just north of Lake Ruckwa is known as the "empty quarter" of Tanganyika.

The center of the plateau from northernTTanganyika northward is depressed into a huge shallow basin. Lying in the basin, at nearly four thousand feet above sea level and within the borders of all three East African countries, is the huge and shallow Lake Victoria, the second largest lake in the world. North of it, in Uganda, the smaller Lake Kyoga lies in the same basin. The White Nile rises in Lake Victoria from which it emerges through Owen Falls at the lake's northernmost point at Jinja in Uganda, to flow northward as the Victoria Nile, which drains through Lake Kyoga on its way to northern Lake Albert, whence it continues, as the Albert Nile, into the Sudan, towards its confluence with the Blue Nile near Khartoum. These three East African lakes serve as reservoirs of Nile waters, and through them, East Africanshould benefit from prospective Nile River dams. Already Kenya and Uganda receive low cost hydro-electric power from the Owen Falls dam which was completed in 1954 and which greatly increases the storage capacity of Lake Victoria as well as regulates the flow of its water into the Nile (Hailey, 1957: 999).

Adding to the region's considerable surface water are many minor lakes and the large Lake Rukwa in south central Tanganiia, and the occasional swamps which lie along

its western border and in the wetter areas near its eastern border.

Formed from mountain rains and melting snow, many rivers and their contributing streams also add to the surface water, but to a seasonally as well as annually varying amount. During the rains they may be in full flood, but by the end of the dry season, or even earlier, most will have dried up. Bridges must be constructed extra wide to take care of the wettest years, but even so, in Tanganyika, movement by road in the wet season is often interrupted by the washing away of bridges (Hickman and Dickens, 1960: 46). The same fate often overtakes minor dams constructed for crop irrigation in Tanganyika (Hatch, p.c.).

Indeed, such seasonal rivers do not always return to flow in last year's course. The tendency of the Ruvi River in northeastern Tanganyika to change its course annually defeated one irrigation scheme (case 13).

The Warufiji, who cultivate rice in the flood plain of the Rufiji River, knowing that the river's flood level varies greatly from year to year, cultivate small paddies at varying levels above the river. They resisted a scheme which called for their cultivating continuous large plots close to the river claiming, correctly, that these might be flooded out (case 12).

The few permanent rivers are divided among the three separate drainage systems of Africa's three major rivers--the Congo, the Nile and the Zambezi which flow respectively to the Atlantic, the Mediterranean and the Indian Ocean. All three systems take their rise inTTanganyika but their watersheds never meet, being separated by a depression in the Central Plateau which has no outlet to the sea (Moffett and Hill, 1955: 18).

A final major feature of the region's physiographic diversity is the ten to forty mile wide strip of coastal lowland along the shores of the Indian Ocean to which the plateau drops in a series of descending terraces, from the height of the Rift Valley's easternmost escarpment.

Off the coast, and similar to it in climate and elevation, at latitudes 6° and 5° south, are the islands of Zanzibar and Pemba, which, together with the much smaller and uninhabited rock and guano Latham Island constitute the Zanzibar area of Tanzania. At 8° south another large island, Mafia, lies off the Tanganyikan coast.

East Africa, as described above, is a region of great geographic diversity and it would be well before concluding the discussion of its topography to mention the scheme of W.H. Hance which divides the area into five major topographic regions. These regions form a pattern

of successive strips of land running more or less north to south. They include, starting at the Indian Ocean and moving inland, "(1) the coastal belt and Zanzibar, (2) the low eastern plateau, (3) the Eastern Highlands and Rift System, (4) the Lake Victoria or Central Plateau and (5) the Western Highlands and Rift System. . ." (Hance, 1964: 378).

Hickman and Dickens have put a similar scheme into the following diagram which they call a "Generalized section across East Africa" (52). I have superimposed on their diagram Hance's terms for the same regions.

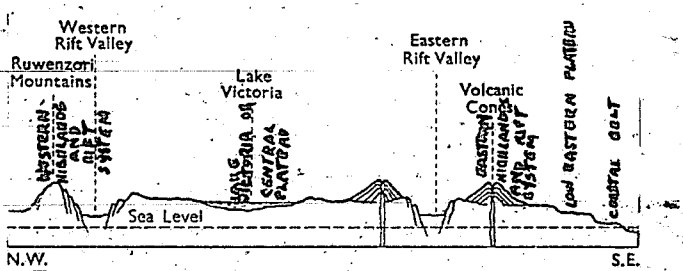

Fig. 3. Generalized section across East Africa.
N.B. The vertical scale is exaggerated.
(Hickman and Dickens, 1960: 52)

This topographic pattern of a great and irregular plateau, sharply riven by lake bearing rifts or depressed more gently in basins, topped by dramatically upthrusting

mountains and stepping gently to the sea, has its echoes in other environmental features which dondition the diverse agricultural situation of East Africa. These cinclude the climatic elements of atmospheric temperature and insolation, atmospheric moisture and precipitation and atmospheric pressure and wind, as well as soil characteristics and biotic communities.

Temperature and Insolation

Although East Africa, extending as it does, from about 4° north to about 12° south of the equator, is entirely within equatorial and tropical latitudes, the borders of which are the Tropic of Cancer at 23-1/2° north latitude, and the Tropic of Capricorn at 23-1/2° south of the equator, very little of its area has truly equatorial or tropical climates. So much does the widespread high altitude modify the expected latitudinal temperatures that most of the area, except for the coastal strip, is characterized by subtropical or even temperate temperatures. (The meridianal limits of the latitudinal subtropical zones are 23-1/2° and 35° north and south of the equator, theupper limits marking the beginnings respectively of the north and south temperate zones.) In equatorial regions, the lapse rate, or

drop in temperature for every thousand feet above sea level, is approximately 3°F. According to Porter, for two areas of central Kenya, the drop is 3.5°F.(1965: 410). Elsewhere, from a coastal sea level temperature of 80°, the drop is less, slightly under 3° per thousand feet, to 56° at 9000 feet (EAM, 1950: 8). For any given place, the greatest temperature change is that between day and night and may be as high as 50°C. There is remarkably little variation throughout the year, however; the warmest time being that immediately preceding the main rains, and the coldest month usually being July (EAM, 1950: 9).

On his map of world foodcrop climates, Bennett colors all of East Africa as either tropical or Highland (1962: facing p. 286). He defines highland climates as occurring in areas about 5000 feet in elevation, and as being "climatically heterogeneous" (288), (or, in other words, as including successions of various of the other foodcrop climates), and occurring within such short horizontal distances as to prohibit their differentiation on maps of such large scope (the world) and such small size (3 pages) as his.

Since its coastal region is at sea level, and therefore expresses the expected latitudinal temperature,

and since many of its mountains are based on the plateau below the 5000 foot minimal elevation of the highland climate zone and extend beyond the elevation of the cultivation limit (10,000 feet in Pokotland in west central Kenya, according to Porter (1965: 409), East Africa encompasses all of Bennett's foodcrop climates, which he defines according to the average temperature of their coldest months (1962: 287). Miller attests to the logic of using the coldest month isotherm to delimit climates, since cold is a deterrent to plant growth, and "the essential quality of the hot climates is that they never experience temperatures too low for plant growth (1955:97). Miller would use as the lower boundary of these "hot climates" 64°F. rather than the minimal average coldest month temperature of 68° that Bennett uses to delimit his tropical foodcrop climate. Corresponding isothermal limits for the other foodcrop climates in Bennett's scheme are, for the subtropical, 50-60° F. and, for the temperate, 50°F. at the upper end, and at the lower, temperatures too cold for crop cultivation.

The progressively thinner air of progressively higher altitudes reduces the heating effect of sunlight and accounts for the progressive dropiin highland temperatures

discussed above. The daily duration of insolation, however, is independent of altitude. All Altitudes at the equator, therefore, have equally long days and these are relatively uniform throughout the year. Increasingddistance either north or south of the equator is accompanied by ihcreaing length of days in summer and shortness of days in winter. In the latitudinal temperate zones, which extend from 35°N to the Arctic Circle, and from 35°S. to the Antarctic Circle, therefore, the duration of daily solar radiation during the summer growing season is considerably longer than it is during any season in the tropical latitudes. The increase in length of day may be sufficient to more than compensate for decreased intensity of sunrays received, a decrease which is proportional to distance from the equator, so that total insolation and, in fact, daily temperature may be higher than at the equator. Many temperate zone foodcrops require the longer growing season day of their accustomed latitudes and will not grow near the equator even at altitudes where the prevailing temperatures are those they find optimal in their native habitat. This is likely to hold true for tropical and subtropical latitudes as well, since variation in day length throughout these regions is still much less than in the higher latitudes (McPherson and Johnston, 1965: 5).

A second factor which differentiates the temperature regimes of the latitudinal and altitudinal temperate zones is that of seasonal temperature changes. The latitudinal temperate zone year is characterized by a short, well defined summer with long warm days and by winters with below freezing temperatures. The equatorial and tropical altitudinal temperate zone has a long growing season with relatively short, cool days throughout the year and occasional light night frosts. Some crops, such as apple or peach, which require winter chilling, will not grow well in tropical highlands (Ochse et al., 1961: 22).

Moisture and Precipitation

If temperature and insolation are important in defining foodcrop climates, their influence on agriculture in the tropics is increased by their effect on moisture and precipitation available to crops.

Tropical heat effects both the supply of rainfall and its effectiveness for agriculture. It increases the rate of evaporation of bodies of water, to produce vapor, which may fall as rain; it also increases the rate of evaporation from soil and plant surfaces, thereby reducing the usefulness of the rains. It increases the rate of

transpiration of plants, thereby increasing their water requirement; but in areas adjacent to large forests the mass of transpired moisture may be a significant source of precipitation. According to Wrigley, the air stream reaching East Africa from the Belgian Congo is laden with moisture transpired by the trees of the Congo forest to be precipitated over the region's western portion (1961: 49). Despite the Congo forest vapor, the long ocean coast, and the relatively large amount of surface water, however, the general rainfall picture in East Africa is characterized by its relative scarcity. According to Trewartha (1961: 121) "the most impressive climatic anomaly of all of Africa is the widespread deficiency of rainfall in tropical East Africa." Bennett, in correlating rainfall areas with his temperature foodcrop climates indicates only two "moist" areas in the region: parts of Uganda and Kenya just west and north of Lake Victoria, and a small part of southeastern Tanganyika (1962: 243). He notes that since (for the reasons mentioned above as well as others to be noted below in discussing rainfall characteristics) much less of tropical rains is available for plant growth than is rain in the temperate zones, more precipitation is required for a local climate to be classified as moist or rainy in the

tropics than in the more temperate regions. His criteria for rainfall foodcrop zones within the major temperature foodcrop climates are, in terms of average annual rainfall totals: for the tropics, droughty 10 to 40 inches; moist 40-80 inches, and wet, anything above 80 inches; for the subtropics, they are repsectively 10-30 inches, 30-60 inches, and over 60 inches; while for the cool temperate zones, the corresponding isohyets are 10-20 inches, 20-40 inches, and over 40 inches (1962: 294).

The East African rainfall picture, then, in terms of average annual totals, is that of general semi-aridity on most of the plateau, with precipitation generally ranging around 30-50 inches per year with Uganda as the wetter area and Tanganyika as the drier area. Precipitation decreases to the north to a minimum in the Northern Province of Kenya where it averages less than 20 inches and may fall to 4 or 5 inches. It increases greatly along the shores of Lake Victoria, particularly along the northwest shore where it may reach 60-100 inches a year. It increases locally with increasing elevation toaa maximum of about 8000 feet,, and from that level on decreases with increasing altitude (EAM, 7). Altitudinal increase is modified on the leeward sides of mountains and deep within

the rifts. The high windward slopes of mountains or rift escarpments force wind driven air to rise. Rising air loses heat and hence its moisture holding capacity is lowered so that chances of rain on windward slopes are increased. On leeward sides, air is decending, which reduces the chances of rain, thereby producing a "rain shadow." Since the major flow of air in East Africa is from the East, concentrated seasonally in southeast and northeast monsoons which are interspersed by prevailing tropical easterlies, most of the rainy slopes are eastern ones (EAM, 1950: 8).

The extent to which this phenomena effects precipitation levels in a given region is illustrated for the Kenya Highlands where the general annual total is 40 inches, that for the sheltered Rift Valley, 30 inches, and on the exposed slopes of Mount Kenya, over 60 inches (Hailey, 1957: 7). The pronounced effect of such rain variation on land use and land settlement is described (for Mt. Meru in Tanganyika) in an article prepared by the East African Meteorological Department: "The foot-hills on the south-east are clothed in dense vegetation and densely settled with Europeans growing coffee, sissal, and other crops. The foot-hills on the northwest are dry savannah, with a

few widely scattered ranching homesteads. Yet the transition belt is little more than half a mile wide"(1950: 8).

The general aridity increases in areas of central and southern Tanzania (the Empty Quarter mentioned earlier), in the Karamoja region of northeastern Uganda, and particularly in northern and eastern Kenya where semi-desert conditions prevail, increasing towards the true desert of Somalia. A southern extention of this North Kenya arid zone, along the plateau's eastern slopes, is known as the "Nyika" or "wilderness" area of Kenya. The aridity of eastern Kenya includes even its Indian Ocean shore where the rainfall decreases from the 40 inches prevalent at Mombassa near its southernmost point, to 20 inches at its border with Somalia. South from Mombassa, the Tanganyikan coast more closely approximates the hot wet climate typical of tropical regions.

To show, for the plateau, the relationships of certain ecological variables: elevation and its dependent variables of rainfall (varying directly) and temperature (varying inversely) as well as hospitality to vectors of livestock diseases (a variable depending on both temperature and moisture as well as, in the case of the tsetse fly, on the additional factor of shade) to subsistence

environments and the crops to which they are host, Porter has drawn the following Generalized Altitudinal Profile for East Africa.

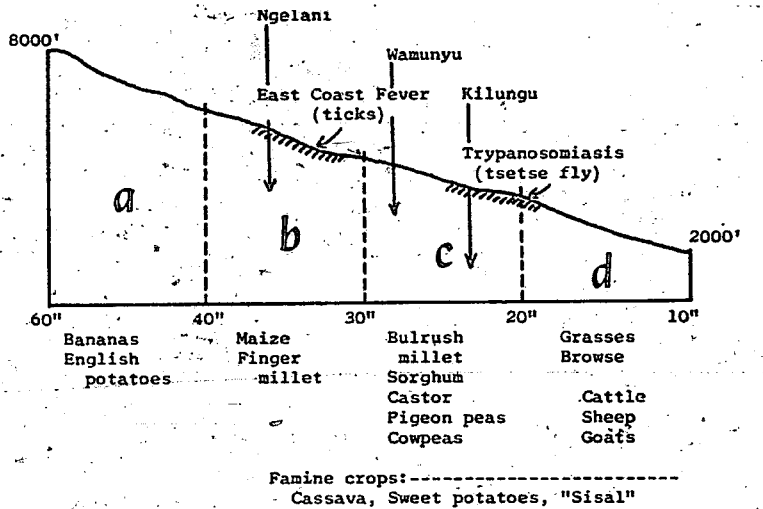

FIG. 4. Generalized altitudinal profile in East Africa showing relationships among rainfall, elevation and crops. (Porter, 1965:410)

Sectors a, b, c, and d are successive subsistence environments. The directional labels for the variables of temperature and rainfall are my additions.

It is interesting to note, that although at the lowest levels, rainfall may be insufficient for the cultivation of any human foodcrop (sector d), once the critical minimal rainfall for human food crop production is reached (sector c), as Porter points out (1965: 41), diversity of crop increases with decreasing annual rainfall.

Where this generalized profile is modified by increased steepness of slope, such steepness operates as an additional variable bringing adjacent subsistence environments closer together and offering groups living on such a slope a new type of environment which is really a composite of multiple subsistence environments. Such environmental diversity is reflected in subsistence diversity. Among the Pokot of West central Kenya, Porter's example of a group inhabiting such a steeply sloped area, this is accomplished by means of a land tenure pattern in which heads of households hold about twenty-five separate fields (of which four to six are under cultivation, and the remainder in fallow at any one time) scattered at varying elevations on the slope which ranges from 3000 to 10,000 feet. The Pokot recognize three distinct zones along this gradation: valley bottom, steep lower hill slopes, and a bench at the seven thousand foot level, and each farmer has some of his fields in each of these zones of cultivation. In addition to the farmers, the Pokot include a group of herders subsisting on the plains below the steep slope. Trade in food between the two groups, the farmers supplying grains and receiving meat and milk (Conant, 1965: 432) further increases the diversity of the food supply. The steep slope

ensures that, although living at elevations varying by several thousand feet, cultivators and herders are never more than a day's walk apart.

(Actually, according to Schneider (1959: 152) all Pokot tend both flocks and fields but those exploiting the plains can grow only a little of the hardiest crop, eleusine, while those inhabiting the slopes, where land available for farming is limited and in great demand and pastures are restricted, keep few cattle. The difference between the so-called "cattle people" and "grain people" is therefore one of subsistence emphasis rather than subsistence type; the symbiotic relationship between the two provides additional protein supplies for the latter and additional vegetable foods for the former.

Porter's model of the directing effect of the combination of various environmental parameters on East African crops is instructive but it must be borne in mind that they merely determine the subsistence possibilities and not the actual crops produced. For Porter's example tribe, the Pokot of Tamkal Valley in Kenya, Conant reports: "the inhabitants cultivate millets, sorghum and maize, at times utilizing a network of irrigation canals from points of permanent supply to less favored areas" (1965: 429),

indicating that technology may have to, or more, significant for agricultural development, may be able to, modify the local natural resources (moisture distribution, in this case) in order to increase the types and amount of crops produced. Indeed, Porter, in discussing his altitudinal profile, says that "this over-all gradient in rainfall, heat, and the presence or absence of livestock diseases, represents a continuum of profiles of environmental types wherein differing subsistence activities are possible depending on the technology and will of the people" (411).[1] This means, of course, that, given the will of the people, further technology might well make possible production of additional crops. In fact, the history of agricultural development in the area shows this to have been the case. Schneider reports that "The Pakot[2] knew only two crops before the British came, eleusine, or 'finger millet,' and sorghum, or 'millet'" (1951: 151), and that the attempts at economic reform did not begin until about 1930. Of suggested new crops, Schneider claims that "only the introduction of maize was moderately successful" (1959: 153).

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[1] Italics mine.

[2] Pakot and Pokot are alternative spellings. This tribe is also known as Suk.

Since, as Schneider reports, there have, since 1930, been constant deliberate European attempts to induce change in their agriculture, one cannot argue with his judgment that the Pakot have maintained "marked resistance to European innovations" (1959: 144). One might, however, question his explanation for this reluctance to change. Schneider feels that conservatism in the face of suggested economic development is a widely shared trait among Nilotic peoples which he judges to be in large part attributable to the "cattle complex in connection with pastoralism" (1959: 166), to which farming, he finds, "takes second place in esteem, if not always in fact" (151) while the cattle complex is "their central, all-encompassing value" (166). He adds as further factors in pastoral determined conservatism among the Nilotes, that, since they are able to accumulate large herds, these herds provide more security within their environment than do crops, inasmuch as they can be moved from areas of temporarily impoverished growing conditions to those with more favorable ones; and even more important, these herds increase by themselves with little attention from their owners. This factor of subsistence security, I believe, would in itself be enough to explain a group's reluctance to change its food-getting habits. The Pakot illustrate this in their

predominantly agricultural as well as their herding groups. Despite their cultivation of only three of the many staple foods allowed by their environment, the wide range of environmental types exploited in their cultivation provide the grain people with excellent insurance against hunger: if one of his crops or fields should yield poorly, or even fail completely in any one year, a farmer and his family has an opportunity to eat adequately from the harvest of his other crops or fields, plus the protein food traded from the herders. Such a fortunate subsistence situation is likely to dull a group's enthusiasm for change in their time-tested subsistence pattern. When on occasion, as Chaundy reports for 1940, famine does occur despite their uses of the multiple cultivable environments, wild foods seem to be available around a nearby river, completing their subsistence insurance requirements (Chaundy, 1943).

The fact that the Pokot do indeed change subsistence techniques to meet environmental demands is, of course, demonstrated by the fact that today by far the larger part of the tribe is primarily engaged in growing grain. Those that have persevered in the pastoral-herding way of subsistence economics, Schneider reports in a later paper (1964: 68), now sell cattle to Somali traders, and use the

money received to buy grain at the stores, indicating that for the Pokot, adherence to herding is at least as much due to its function of providing subsistence security in an environment suitable for cattle but not for crops as to any cultural commitment to the "cattle complex."

Whatever their feeling toward cattle, it should be noted that the Pakot, in actuality, are even more fortunate in terms of agricultural subsistence possibilities than sharpness of slope alone would guarahtee, inasmuch as their area, being located only a degree north of the equator, has as its prevailing rainfall regime, that typical of equatorial regions, which customarily have some rain throughout the year with two seasonal peaks, during the seasons of spring and fall, shortly after the two equinoxes.

This equatorial regime is expressed in East Africa, but with its general pattern of lower rainfall totals than in the other areas at similar latitudes in Africa, and indeed, in the equatorial world in general, both peaks and troughs of rainfall tend to exhibit lesser amounts of rain, so that, between the peaks, seasonal droughty periods inhibiting plant growth may prevail (Bennett, 1962: 196). This is probably why Porter notes that "the importance of

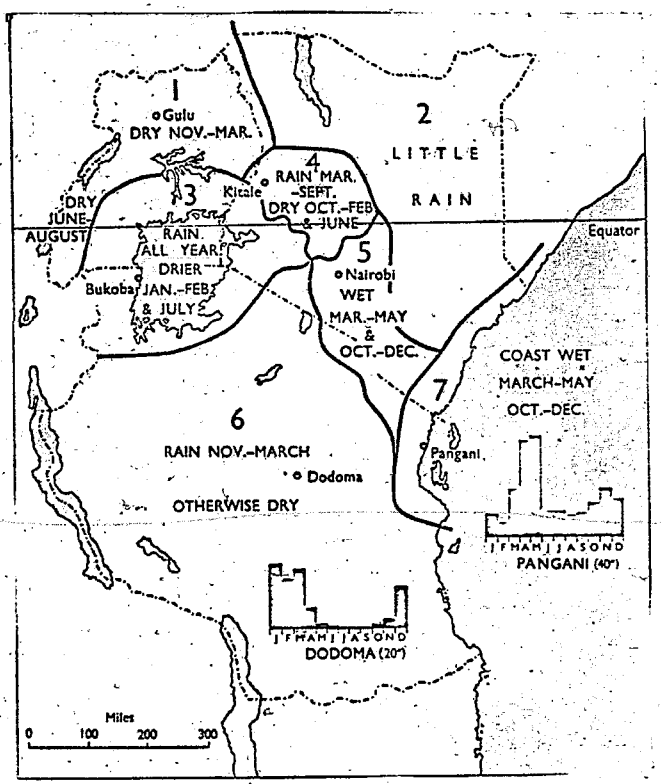

Fig.5. East Africa: Rainfall regions and patterns. (Hidman and Dickens, 1960: 8).

the bimodal rainfall regime increases with decreases in altitude" (1965: 410). Indeed, he shows that rainfall reliability as well as rainfall total decreases with decrease in altitude (415) so that whereas, in the well watered equatorial regions, two crops a year may be expected in conjunction with the bimodal rain peaks, for the Kamba, inhabiting a relatively shadowed slope at the four thousand foot level of the Kenya highlands, "the second season maize usually fails altogether" (418). Further down the slope, at 2,500 feet, these spring, or so-called "main rains" show a reliability of less than 0.1% while the autumn, or "grass rains," are far more likely to be adequate (418). According to Miller, this is opposite to the usual pattern for equatorial regions, including those of East Africa, of greater rainfall amount and reliability of the spring than of the autumn rains, although he noted the opposite may be true. (1955: 103).

No exact latitudinal limits to the equatorian rainfall regime can be given. Indeed, the borders between the equatorial and tropical climate zones are functional ones, occurring at the point of transition from the bimodal equatorial rainfall to the tropical regime of a single annual rainy season. The center of the equatorial zone is

everywhere displaced northward of the equator to distances varying from 2° to 8°, due to the fact that most of the land area of the world is in the northern hemisphere, and since in the low latitudes, where temperatures are always high, the land is almost always hotter than the sea, the northern hemisphere is hotter than the southern. For this reason, the S.E. winds are cooled by passing over seas; the hotter N.E. winds ascend sooner, and the point of meeting of the two is therefore north of the equator. For East Africa, all this means that all of Kenya and Uganda, each of which straddles the equator, but extends further north than south of it, have the equatorial rainfall regime, as described above, but that most of Tanzania, which is entirely south of the equator, has the tropical rainfall regime, the line marking the southern limit of the equatorial regime being at about 5° S. latitude inland, but extending further south in the coastal region (and including Zanzibar), to about 10° S. latitude, which is about the limit of the equatorial region in the southern hemisphere (in the northern hemisphere it may extend to 18° N.) (Miller, 1955: 105).

In the Tanganyika (or tropical) rainfall regime, it is as though the two rainy seasons, having gradually moved

closer together with increasing distance south of the equator, have merged to form one long one which occurs for varying periods during the summer season from November to May. There is often a variation in rainfall during this prolonged single rainy season resulting in what is usually a concentration of rainfall at the early part of the season, "the short rains," and again, for a greater period of time, late in the season from March through May, "the long rains." But again, because of the relative insufficiency of precipitation in East Africa, the trough between the peaks may become actually a minor dry period. The true dry season may last for as long as eight months, during which time the ground may become so dry as to be impossible to work with the hand hoes of native cultivators (Hickman and Dickens, 1960: 122). (Indeed, the hardness of the soil in the areas of the "Groundnut Scheme" proved all but intractible to tractor plowing, and one of the main obstacles to progress of the scheme was the constant wearing down or breaking of plough discs (Stamp, 1964: 410). Nor could the use of ox-drawn ploughs alleviate the situation, inasmuch as oxen are too weak to work until after the rainy season is well established, due to the poor grazing in the late dry season (DeWilde, 1967: I, 92).

The long dry season, whether due to a single or a slight and variable double rainy season, is as hard on the cattle of the herders as it is on the work oxen of the few cultivating groups who depend on them. In Tanganyika Massailand, for example, the main kraals are situated 10 miles from permanent water, so that in the dry season, "stockowners strike a balance between grazing time wasted in trekking to water and need for minimal water drinking," and the following pattern of alternation between eating and drinking periods has been established for the cattle: on day 1, animals walk to and from the water source with little time to eat along the way; on day 2, animals graze near home and drink no water; day 3 repeats day 1. As the areas close to the kraal become grazed out, the trek to water may be limited to once every four days, with no drinking in three days of four (French, 1956: 176).

Such an imposed abstinence from water is one of the two major factors in selecting Zebu cattle above European breeds for the semi-arid areas of East Africa (the other major factor is their marked resistance to local endemic diseases). In a mixed group of steers running together, 3/4 hybrids (European with Zebu) drank more than 68% more water than Zebu (French, 1956: 171). Those who suggest the introduction

of European cattle to increase milk production for East African herders must bear this in mind as well as the fact that production of minimal milk has survival value for cattle under conditions of water deprivation. Since lactating cows demand extra water (French, 1956: 172), those that produce the most milk are the first to succumb in times of acute water shortage. Heredity tends, therefore, to eliminate them and to select for the factor of low milk productivity. Indeed, as Hutchinson, quoted in Johnston, says, ". . . the whole of the selection pressure on African livestock . . . has been . . . for ability to stay alive, rather than ability to produce. It is only those with a low fertility rate and slow maturation that stay alive at all. These animals are in fact admirably suited to the conditions under which they live" (McPherson and Johnston, 1965: 48). The conditions under which they live include shortage of water for drinking, which causes failure of the thermoregulative mechanism of European cattle, and the need for long walks (for grazing as well as drinking) to which the Zebu cattle are well adapted, and the European stock far less so (French, 1956: 171-72).

Even for cattle kept by settled cultivators an ability to walk far and tolerate water deprivation is necessary.

Hickman and Dickens report that, during the dry season, some Sukuma cattle "have to walk as much as 15 miles every third day to get water" (1960: 121).

It is because of the low economic return for food and water consumed by these small, late breeding, scant milk-yielding, drought-adapted cattle that some animal science specialists advocate the harvesting of African game animals for protein food (McKelvey, 1965: 341), or even their herding for milk as well as meat. Cattle and goats, according to Lyall-Watson, are selective feeders, eating as little as 10% of available vegetation, whereas wild herbivores eat all of it. Antelope, he claims, can thrive where cattle would starve. A given grazing area turned over to game would support 10-15 times as much meat on the hoof as it does of cattle, so that, were game to be farmed rather than cattle, enough could be raised to provide every African with 1 pound of meat per week, considerably more than they are accustomed to now. Experimental eland farms in Kenya and Uganda seem to corroborate findings at a longer established one in Rhodesia that elands are superior to cattle on many counts: their dressed weight is 60% of live, while for cattle it is only 50%; their milk is 11% butter fat and 8% protein, while the corresponding values

in local cows' milk are only 5.2% and 3.8% respectively; butter made from eland milk has a higher melting point than that from cow's milk, a distinct advantage in hot areas with little refrigeration; their products could be marketed at 6ttimes the profit now realized for cattle (1965: 85-98). One can speculate on the probability of the added attraction a cuisine including exotic meats might offer for the expansion of a tourist industry which is already the second largest source of revenue in the East African countries.

According to the Gullivers, camels, integrated into a cattle herding economy, also offer advantages in the dryer areas. For the Turkana, they do not reduce the pasturage of cattle since they live on leaves and thorn; they can be milked at will, rather than according to a daily schedule, thereby serving as a hygienic milk storage; their milk is easy for babies to digest[1]; they supply more meat than an ox, and can go for more days without drinking than can cattle (1963: 60).

In any case, the typical Tanganyikan rainfall regime allows for only one planting, one growing, and one harvest season per year. In Tanganyika, every minute of the short rainy season is vital. Indeed, Bohannan points out that

since agriculture is possible only during the rainy months, the amount of rain is less important for cultivation than the number of months during which it falls (1964: 38). Preparation of the soil, and planting of seeds, however, cannot be done until the early rains have sufficiently softened the soil to allow its being worked. This not only cuts shorter the already short growing season (the Sukuma who inhabit the "cultivation" steppe to the south and east of Lake Victoria, start work on their fields only "some weeks after the rainy season hasset in") (Ruthenberg, 1964: 23), but may mean missing the optimal planting season for certain crops, and wasting the early rains, which are typically extremely heavy, and, for a relatively dry year, may provide the season's greatest amount of moisture. If a farmer grows more than one crop, the different crops must compete with each other for his earlier attention; should the optimal planting season for each occur at the same time he must decide which deserves his first attention. Should competition rise between cash and subsistence crops, the farmer's decision is likely to be in favor of subsistence, his stomach being of more vital concern to him that his pocketbook. This is true in Sukumaland, where cotton, the local cash crop, must await the planting of maize, the primary subsistence crop--thereby suffering a loss of yield

that represents a full fifty percent of the potential. So strong is the effect of missing the optimal planting period that Ruthenberg reported in 1964 that "higher yields per acre through better cultivation are not as yet noticeable" (25). And this is despite the fact that cotton has been cultivated as a cash crop since 1909 (Malcolm, 1953: 176).

Sukumaland, being near to Lake Victoria, contains some of the better watered land of Tanganyika, receiving about 30" of rain annually (Langs, 1962: 86), so that prevailing methods of providing against famine, despite the single crop year dictated by the single rainy season (these include the growing of drought resistant and ground storing cassava, a European-introduced famine crop, and the use of their herds as food in times of want (Ruthenberg, 1964: 23) seem adequate. Indeed Ruthenberg claims there is no general hunger problem in Tanganyika, although inadequate nutrition and occasional bad harvests "constitute real problems" (140). Certainly, however, in much of Tanganyika, with the long dry season, there is uncertainty about year round sufficiency of food and "a period of anxious waiting before the next harvest." (Hickman and Dickens, 1960: 11). The fact that there is little actual hunger is due to the

relative emptiness of the country so that the driest areas remain uninhabited. But the ever present possibility of famine due to insufficiency or failure of the single harvest must create constant anxiety. For the Kamba of Wamunga, in discussing the poor chance of rainfall sufficiency during the "main rains" Porter reported that "from 1943 to 1961 the district had to import maize in fifteen out of nineteen years, and in seven of these years there was severe famine" (1965: 418).

The cultures of other tribes include provisions for combatting famine due to frequent crop failure. The Ngindo of Tanzania's Southern Province expect two or three lean months every year before the harvest of the quick ripening crops, and customarily feed themselves with honey and bush fruits during the early rains when the surplus of last year's harvest has run out. But the quick ripening crops may fail; later in the season, the slower ripening staple, millet, may fail and even the manioc planted for famine reserve at European insistence may fail, so that dependence on wild foods may be necessary for longer periods. These expected food short times are known as "hunger times." When not too severe they are looked forward to by the Ngindo as a welcome break in the monotony of the yearly cultivation

and dietary cycle. The Ngindo have resisted settlement schemes which would move them from their thicket home to woodland or open country because they have come to value the local bush forage products (Crosse-Upcott, 1958).

The principal cultural adaptation imposed by a single rainy season and its single cropping period, or by a double rainfall regime, in which one of the rain periods is unreliable is that of a higher "cultivation factor," a term used to designate the amount of land it is necessary to cultivate per year in order to feed one member of the population. Allan finds that in East Africa the cultivation factor for the single crop regions approximates 0.75 acre while that of the dependable double crop regions is more nearly 0.5 acre (61). This means, of course, that for families of the same size, one and a half times as much land has to be prepared and planted per year in the single crop areas assin the double crop ones. It means also that population density is lower in single crop regions.

An inverse relationship between rainfall amount and land requirements is also imposed on herders. In Kenya, the stock carrying capacity of land with low rainfall and poor vegetation is one head of cattle to 25 acres. In the moister parts ofUUganda and Kenya it ranges between 3.5 and 7.5 acres per cattle unit. In the temperate regions,

well managed pasture is capable of carrying a cow to the acre, or better (Allan, 1965: 65, 291-94).

Another problem posed by the extremely drying effect of the long dry season is the vulnerability to fire of the tinder-dry vegetation. During the hot and dry spring months of July to November "fire blackens the countryside, sweeping through woodland, bush and grassland." (Allen, 1965: 51). These spontaneous fires are not the only ones to burn beyond control during the late dry season. The customary method of clearing a new field throughout native Sub-Saharan Africa involves some form of burning of old vegetation whether of grasses, bush or trees. Indeed, in one form of land preparation used in southern Tanganyika (and more widespread in Central Africa), citemene, tree branches cut elsewhere are piled up and burned in the newly cleared field to add to its fertility. What the African farmer knows empirically is corroborated by soil scientists: ash adds badly needed calcium and potassium to the soil as well as reducing its degree of acidity (Nye and Greenlane, 1960). 68). But in the late dry season, fires started to clear or fertilize a relatively small field may burn for many square miles beyond their intended boundaries, thereby removing protective vegetational cover from large areas of unused land, exposing it to the erosive forces of wind and

rain and to the direct rays of the sun.

Where the single rainy season is broken by an intermediate period of relative drought, this is a far less harmful time to burn new fields. Vegetation is dry enough to burn, but moisture in the soil and plants keeps the fire from spreading (Anthony, p.c.). Fires in this season or early in the long dry season burn with a flame less hot than those burning at the end of the long dry season, thereby allowing fire-hardy trees to survive which, later in times of fallow, can serve to start reforestation of the plot, whereas the hotter flame of late dry-season burning contributes to the permanent destruction of the forest, with the resultant encroachment of relatively uncultivable savanna, a phenomenon which seems to be taking place throughout Sub-Saharan Africa (Nye and Greenland, 1960: plates 15, 16). Where savanna is the prevalent landscape the late-season burn practiced by herders has an equally devastating effect, in this case speeding its trandition to desert. Allan reports that "large parts of East Africa, particularly pastoral areas such as Turkanaland and Karamoja are becoming more arid. In parts of these regions grass has disappeared and desert succulents have become conspicuous within the memory of the older inhabitants" (1965: 320). That increasing aridity may not be a reversible process is believed

by many, who feel that it is due to a lowering of the water table from the prolonged increase in evaporation from the fire denuded soil (Allan, 1965: 320). Of course, it is not only the firing of vegetation practiced by pastoralists that caused the establishment of deserts in the wake of their wanderings. Since, and this is especially true in East Africa where the high value of cattle is a dominant theme of life, "systems of management are based on the short-term objective of keeping as many animals as possible alive" (Allan, 321), overstocking tends to denude land through animal cropping, as well as to hasten its erosion, especially in the neighborhood of water holes, when the bare earth, compacted to a relatively water-impermeable hardness by the trampling of many hooves, resists absorption of precipitation, thereby allowing an increasing amount of it to be returned, by evaporation, to the air, by whose movement it may be carried away to be precipitated elsewhere. This, too, lowers the water table.

In Kenya, the provision of artificial water sources for cattle is reported to have increased the trampling-soil compaction-lowered water table effect in that the new water sources have attracted large numbers of game animals and their tramplings is added to that of the cattle (Hopcraft, p.c.).

Leaving further discussion of herd size to a later consideration of the relevance of certain culture traits to agricultural development, it must be pointed out that the practice of grass and bush burning, like the forest burning of the cultivators, has definite advantages. "The burn gets rid of useless straw, incidentally destroying disease-carrying ticks, and it allows the grass rhizomes to push out young shoots, which give a green bite for the starving beasts. It also checks woody growth that would otherwise tend to cut out the grasses" (Allan, 1965: 320). It is difficult to see how early dry season burning could accomplish the same for the herders, but for the cultivators, substitution of early dry season, or mid-wet season burn would be at least as effective as late dry season burn, and perhaps even more so, since fresh ash, lying thick on the surface, is often largely washed away or badly leached by the first torrential rains (Nye and Greenland, 1960: 69).

In view of the demonstrable benefits of land-clearing burns, one would like to suggest that governments, alarmed at the increasing loss of cultivable land to man-made fires, should substitute a program to reschedule land-clearning burns for their usual prohibition of any burns at

all, a prohibition which is regularly resisted by local farmers (Allan, 1965: 128) and so much resented that, at least in one case, burning becomes a symbol of defiance against a government land-use scheme. (Noted by the authors of a study of the society and political organization of the Waluguru of eastern Tanganyika in the title of their book: "Smoke in the Hills")(Young and Fosbrooke, 1960).

In cases where early burning has been enforced this has also met with strong resistance and Allan reports that

> nowhere can it be said with confidence that the practice had become fully accepted and integrated into local custom. The early burn disrupts normal hunting routine and its introduction is therefore resisted wherever hunting has an economic or high prestige value; while in citemene regions there is the risk of premature burning of branchwood, which usually lies spread throughout the clearing for drying at the time the burn should be made" (1965: 129).

A further characteristic of equatorial and tropical rains is that, within the annual pattern of double, or double-peaked single rainy season, there are great differences in amount of precipitation between different rains, and during a single rain. Rain tends to fall with great intensity in short periods. At a recording station near Kampala, Uganda, for example, a fifteen minute shower was recorded in which the rain was falling at the rate of 17 inches per hour (Hickman and Dickens, 1960: 15), or, supposing that was the total rainfall of the day,

better than 4 inches per day. This contrasts with an average fall of 0.1 inches per rainy day in the British Isles (Miller, 1955: 136).

This great intensity of precipitation not only reduces the agricultural value of a given rain--since rain may fall at a rate which greatly exceeds the capacity of the soil to absorb moisture--but it also contributes greatly to soil erosion due to the washing away of top soil by the resultantly large run-off. The individual drops are typically large and further erosion occurs because of the great force with which they hit the ground during the heavy rain; this force produces a splash-up of soil as well as water, and this splashed soil is then free to run off with the excess rain water; the hard-hitting heavy raindrops also tend to compact the soil, which increases its resistance to water absorption. Such of the forceful drops as do penetrate the soil carry with them the finer particles from the surface to redeposit them further down, where they tend to cement into a relatively impermeable layer, which further decreases soil absorption and increases water run-off. Should the heavy rains continue at this point the water flows undiminished along the surface of the soil, causing further sheet erosion by washing away the surface soil and

cutting small gullies, which not only further erode the land but add to the difficulty in cultivating it (Hickman and Dickens, 1960: 16). Such intense rain (or hail) showers may be limited to a local area. Should one fall during the growing season, it might level an entire field. For this reason, farmers in the Kavirondo and Kamba areas are accustomed to cultivate several widely separated plots in the hope that at least some will grow to harvest. This is one reason for the fragmentation of holdings so often cited by planners as a major deterrent to agricultural development, particularly in Kenya (Warren, 1967: 179).

Especially in central and western Tanzania does the single rainy season tend to be marked by these violent erosive rain storms (Allan, 1965: 52), particularly at the start and finish of the wet season (Miller, 1955: 124).

A final factor of rainfall important to agriculture is its reliability. This is particularly crucial in East Africa where the average totals are fairly low, and may be close to minimal requirements.

The mean annual rainfall of an area is calculated over a period of ten successive years, but the total for any single year may be twice as much or only half as much as the average. For areas whose average precipitation is

close to the lower limits of agricultural demands (Bennett's "droughty" areas), this may mean insufficient rain in five years out of ten. Indeed, Porter reports that for the Kamba of Kenya, living at an elevation of 4000 feet in Wamunyu in a zone of "medium potential" the average rainfall is nearly thirty inches (the figure usually given as permissive of maize cultivation) but that from 1948 to 1961 "the district had to import maize in 15 out of 19 years, and in 8 of these years there was severe famine" (1965: 418).

As described above, timing, duration, intensity and reliability of rainfall may be as important as the annual total in determining agricultural possibilities in the tropics. A further factor, that of evapotranspiration, (the total amount of vapor returned to the air by evaporation and transpiration) influences the effectiveness of rain. Higher temperatures increase both the rate of transpiration by plants (and therefore the need to draw in more water through their roots), and the rate of evaporation of precipitation before it ever becomes available to plants, as in evaporation from the surface of leaves and puddles on the soil. Evapotranspiration needs of plants growing in hot regions is considerably greater than those of cool regions. The loss of rainfall to evapotranspiration is

further increased in areas, such as Tanganyika, where the rainy season falls in the hot season of the year (Bennett, 1962: 197).

It has been customary in East Africa to map rainfall probability or (rainfall reliability) in terms of the probability, based on averages for several successive years, of receiving a certain absolute minimum of rainfall. In these terms East Africa is about evenly divided into areas with "very slight likelihood of receiving 20 inches in a year: a very good chance of over 20 inches a year" and "a very good chance of over thirty inches a year" (Hickman and Dickens, 1960: 14). Porter, in his mapping of rainfall probabilities in East Africa, in order to make them more functional in terms of assessing agricultural potential and subsistence risk, has considered rainfall probability not in terms of absolute amount of precipitation, but rather in terms of meeting the transpiration needs of plants. In these terms, at Wamunyu, "the probability for water supply equalling water need for four months in the grass rains is about 0.85%; in the main rains, only 0.3%" (1965: 415). The Kamba of Wamunyu, consequently, can be fairly certain of a maize crop during the first rains, but Porter reports that "the second season maize usually fails altogether" (418).

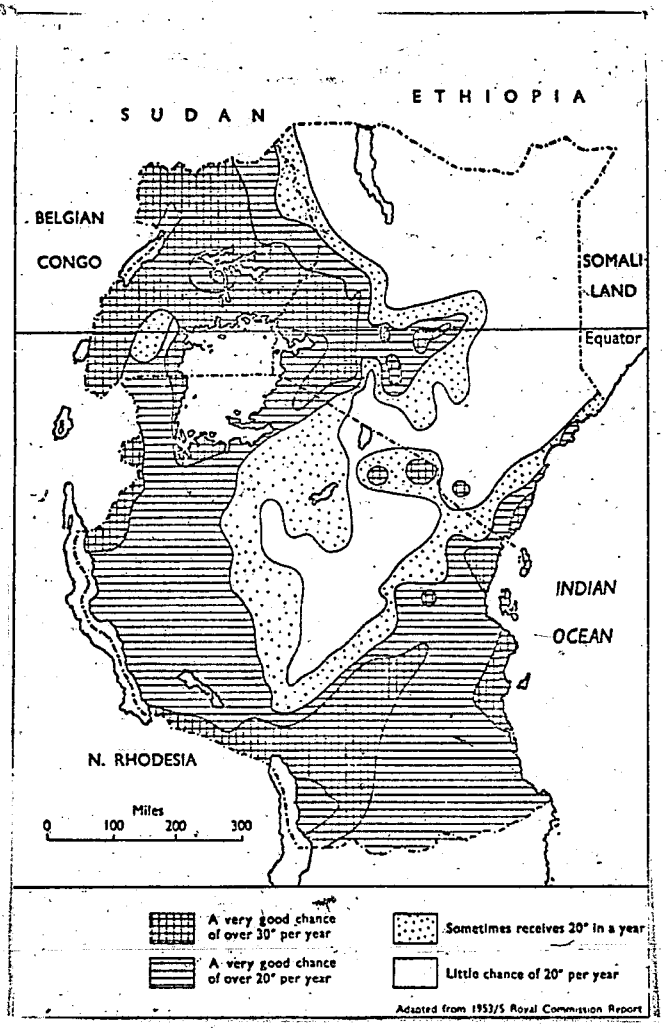

Fig. 6. East Africa: Rainfall reliability (Hickman and Dickens, 1960: 14)

Indeed, an occasional rainy season may altogether fail, or having begun, fail to continue (Thompson, 1950: 219), which is a further reason for delay in planting of seed until rain iseestablished, since the cost of seed might be entirely wasted (De Wilde, 1967: I, 92).

The prevalence of planting of drought-resistant manioc in East Africa is to a large extent due to its enforced cultivation as a famine crop, since the beginning of the century, under both German and British administrative ordinances. Although today most areas where manioc production was originally enforced voluntarily continue its cultivation (indeed, for some it is now an export crop) the initial orders to plant were often enforced by armed policemen who accompanied agricultural officers, and doubtless some resentments incurred among the farmers remain to color their attitude towards development schemes to the present day.

Air Pressure and Winds

In general, temperature is the single climatic element of greatest importance in determining agricultural potential. In the warmer regions, where temperatures, except at extreme mountain heights, are dependably permissive to agriculture, moisture is the primary limiting element. This

is particularly so in East Africa with its deficiency and unreliability of rain. Air pressure and wind are primarily important because of their influence on rainfall, but they have certain direct effects on the agricultural situation as well. In discussing the relation of air currents to the unusual situation as regards precipitation in East Africa, Trewartha emphasized that there is much that still remains a puzzle and that considerable differences of opinion exist even among local meteorologists (1961: 124, 126). For this reason, my discussion of the major effective winds will be brief and confined to material about which there seems to be general agreement.

The two main wind systems effecting the climate of East Africa are the two annual monsoons which, in turn, are associated withtthe migration of the sun. During the southern hemisphere's summer (October to March) when the sun is south of the equator, the Northeast Monsoon blows in two separate streams: a dry one that has travelled across Egypt and the Sudan, and a more humid one from the Red Sea and the Gulf of Aden which contributes to the rainy season of central and southern Tanzania. The Southeast Monsoon blows when the sun is north of the equator (April to October) and, having had a seaward passage from

the Indian Ocean, it arrives at the coast quite moist; its course is deflected eastward at the coast to run parallel to it, so that its rain is not carried inland. The coast turns just at the latitudes of Zanzibar, at about the point where Tanzania and Kenya meet; with it the winds take a sharp turn--changing southeast to southwest; in this part of their course they are termed the Southwest Monsoon.

This bending of the monsoonal air stream seems to be in response to differences in the air pressure systems of Africa and Asia. The high temperature and low pressure in interior Asia during the northern hemisphere's summer attracts these winds; during its winter, the cold and high pressure of interior Asia directs the Northeast Monsoon from there towards South Africa (Thomas, 1965: 50).

Throughout tropical Africa, the Intertropical Convergence Zone, whose migrations follow that of the sun, is responsible for the summer rains. According to Thomas (50) this is true in the case of southern Tanganyika, where it works with the summer Northeast Monsoon in establishing the area's rainy season. But even the cumulative effect of two rain-bringing air movement phenomena leaves that area with a very light rainy season.

Rain-bringing effects of the monsoons are further diminished by three factors: the meridinial course of the

two monsoons (paralleling the coast and the plateau escarpment) considerably reduces the transport of water from ocean to land, and minimizes the lifting effect of the eastward facing plateau; the overlaying of the shallow monsoonal air layer by a layer of dry and stable easterly air prevents the development and expansion of such clouds as do form in the monsoonal layer below, and further reduces the ability of the monsoonal air to surmount the higher portions of the East African Highlands; finally, Trewartha speculates that, inasmuch as the huge island of Madagascar, which lies parallel to the East African coast about 400 miles offshore in the Indian Ocean, is subject to frequent tropical storms in its windward eastern position, and since that portion receives about three times as much rain as the western region on the other side of the island's central plateau, the plateau's highlands break up winds coming from the east which diverge and subside to the lee of the island in the Mazambique Channel, thereby effectively protecting East Africa from the worst of tropical storms while appreciably decreasing its rainfall.

For as yet unexplainable reasons (according to Trewartha) the islands of Pemba and Zanzibar receive close to twice the mean annual rainfall of the nearby mainland coast,

although they share its air movement patterns. (A map of "Trade and Winds of the East African Coast" in Hickman and Dickens (1960: 62), shows the islands of Zanzibar to be right in the bend of the southern monsoon, as it turns from southeast to southwest, and it would seem likely that these islands might twice receive its rain).

In the equatorial regions, rainfall peaks do not occur during the times of the weakened monsoons, but during the equinoctial seasons of transition between them, when winds are fickle though more easterly.

Sporadically, rain bringing westerlies from the Congo invade the East African Plateau though usually no further than its western half. (Trewartha, 1961: 137).

In East Africa, many of the water-bringing winds arrive exhausted, and some water-taking winds arrive as well. During the period March-September when the sun is in the northern hemisphere, much of Tanganyika is covered by air which has blown overland from the south and its dryness helps to account for the long period of drought in the southern and central parts of the country. But the same stream of air contributes to the high rainfall of the northern and western shores of Lake Victoria where it deposits moisture picked up in its passage along the lake (Hickman and Dickens, 1960: 9).

Local wind storms in the dry season lift the soil and whirl it into "dust devils" (Hickman and Dickens, 1960: 121). In the semi-deserts such wind storms are accompanied by sand storms which increase erosion.

Although the monsoons bring little rain to East Africa, they have been important in its history. Today, as for perhaps as long as a thousand years (Hance: 1964: 379) the Northeast Monsoon brings Arab and Persian dhows from the Arabian Sea from December to March which return with the Southwest Monsoon from April on. Dhows have brought the ancestors of the large Arab and Indian populations to Zanzibar and the mainland coastal towns; and they freshen these groups with newcomers. They had earlier brought (between the tenth and fourteenth centuries) Shirazis from Persia who, along with the Arabs later, intermarried with the Africans of Zanzibar to produce its current Swahili population whose language has become the lingua franca of East Africa. They brought from Asia many of the present East African crops and they brought the Islamic religion with its taboo against pig eating and hence against pig keeping (Moffett and Hill, 1955: 572), to large numbers of East Africans. The Islamic practice of day long fasting and nightly feasting for the month of Ramadan also effects

the food and agricultural practices in the area. The holy month does not fall at the same season every year. If it should fall at times of low food, people may go into debt to feast. If at time of heavy work, it may impede the work (Wilson, 1950; 260).

Today Shirazi names survive as the names for the three indiginous African tribes of Zanzibar: the Hadimu, Tumbatu and Pemba, whose elders, during the season of the Persian New Year, observe the weather portents and advise upon the future program for crop preparations and plantings. The whole of the agricultural systems of these tribes are based on the age-old Persian calendar with its forty day periods subdivided into ten day units (Wilson, 1950: 251).

Soils

As described above, the climatic factors of temperature and insolation, moisture and precipitation, and wind and air currents have profound direct effect on agricultural potential in the tropics. They have additional agricultural significance through their effect on tropical soils. Tropical soils, as soils everywhere, are partially reflective of the geological source from which they derive. The general impoverishment of tropical soils, however, is due

primarily to the effect of tropical climate in modifying what geology has provided.

The effect of tropical climate on tropical soils is twofold. In the first place, the combined effect of wind and water erosion (and where there are rivers, river deposit), is to transport and resettle soils, so that, in large part, they are not derived from the local geologic base. Secondly, tropical climate tends to modify soils, often reducing, and/or changing their chemical content, so that soils of varying derivation evolve into similar types.

The process by which climatic and other environmental factors, notably biotic, cause the disintegration and decomposition of rock to soil is known as weathering. Weathering may be either physical (the breaking of rock due primarily to expansion causing forces) or chemical (changes in composition). In tropical regions, chemical weathering is the more important and is primarily responsible for the special properties of tropical soils.

Heat and water combine to cause much of the chemical weathering of tropical soils. In general, heat speeds up chemical reactions; warm water can carry more chemicals in solution than can cold water; heat encourages the growth and activity of the soil bacteria which are largely responsible

for the decomposition of the dead organic matter, first to humus, and eventually to the soluble salts which replenish soil fertility.

In the temperate zones, the decomposition process is slow and humus lasts through the winter to produce the salts that will nourish the next season's growth of plants. In the tropics, no cold season slows the decomposition process, so that the humus content of tropical soils never builds up beyond a maximum of 1.8%. This contrasts with the 10-12% humus content of the soils of New York state and 16% in the richest Iowa farmland (Bohannan, 1964: 39). Indeed, the 1.8% is far above the average for African soils which is only .2-.5% (De Wilde, 1967: I, 16).

Tropical heat speeds the decomposition of applied manure as it does that of natural animal droppings, so that its fertilizing effect lasts for months rather than for the years that it serves temperate soils. Fertilizer is even less effective in dry savanna areas than in tropical forest since it works well only with a certain minimum of water. (Fordham, 1965: 27). In Sukumaland, manure requirements are 3-5 tons per acre/year; cattle produce 1 ton per year apiece and require 2 acres of grazing, plus crop residue (Rounce, 1942:7). It is no wonder, therefore, that the cost

of fertilizer as well as the labor required for its application--transport is by hand carriage--is often considered prohibitive by African farmers.

Since, as mentioned earlier, native practice is usually, of necessity, to plant after the start of the wet season, a time usually marked by the greatest concentration of drenching rains, planting takes place when the soil has been freshly washed of nutritive salts.

According to Phillips, artificial irrigation in the sub-desert regions may result in similar disastrous leaching of nutrients (1959: 69).

In general, leaching results in soils which are: 1. deficient in important plant nutrients, notably nitrogen, phosphates and potash; 2. acid, due to the loss of alkalies; 3. deprived of silica; and 4. characterized by concentrations of iron and aluminum compounds. These iron and/or aluminum loaded soils are referred to as laterites; they comprise most of the common red soils of the tropics. The name is a derivative of the Latin "later," meaning "brick." In its purer form, laterite is "a rock rather than a soil. Roads can be made of it, as well as buildings, and it stands up to weathering rather better than some rocks" (Fordham, 1965: 27).

During the dry season, water, rising through the soil by capillary action, carries with it the iron and aluminum compounds which are deposited on the surface as a crust, or hardpan, which not only offers little nourishment to plants, but also prevents the growth of plant roots down to reach any nourishment that may lie below. It also slows the absorption of surface water, thereby increasing the loss of water to evaporation.

It is largely the process of leaching, by reducing soil nutrition, that makes old soils in the tropics poorer than new soils. In addition, there are parallel changes in soil structure which further lower the agricultural potential of tropical soils with age. A soil of good structure is one in which individual soil particles clump into "crumbs" which are held together by colloids provided by humus. These crumbs, being less susceptible to compaction than are finer particles, form a mass which allows easier water penetration. At the same time their heaviness makes them more resistant to the forces of erosion than are finer particles. As mentioned earlier, leaching removes soluble materials, leaving a residue consisting of sand or clay particles. These tiny particles compact readily, whether due to pressure from pounding rains or animal hoofs or heavy agricultural machinery.

The use of heavy agricultural machinery is likely to start a vicious cycle when used for dry season ploughing. The heavy equipment increases compaction of the tiny soil parficles, which results in their being highly abrasive; this in turn increases the wear on cutting equipment. Phillips reports, for example:

> In the dry season of 1948, the ploughing of recently thicket cleared upland-red soils in Central Tanganyika, . . . involved the loss of six inches in the diameter of the 30-36 inch discs of heavy ploughs per 80 to 100 acres of ground . . . with four to five discs per plough, the financial implications is obvious. (1959: 68).

Phillips feels that another danger of mechanized cultivation is that it will speed up the loss of depth in the naturally shallow tropical soils that has been a consequence of hand cultivation (1959: 6). The shallowness of the soil was one of the many factors contributing to the failure of the Uluguru Land Usage Scheme (case 24) which, among other reforms, called for the construction of bench terraces on the mountain slopes and cultivation on the contour of the terrace surface, in order to decrease erosion. Terrace construction required removal of some top-soil so that cultivation was sometimes on exposed clayey under-soil which yielded a reduced crop for greatly increased work.

In East Africa, as elsewhere in the tropics, relatively new soil is the best for agriculture. Relatively new soil is found principally in the igneous slopes of volcanic mountains and the walls of the Rift Valley. Soil that is too young is infertile because it has not had time to store even a minimum of humus-derived nutrients.

Alluvial soils, constantly replenished by water borne nutrients leached from soils along a river's course, are of high agricultural value. In East Africa, alluvial soils are limited, as are the rivers that produce them. Other, more localized types of fertile soil include: that within old craters; termitaria, in which, according to Allan, are "collected and imprisoned most of the local fertility" (1965: 211); and recently abandoned houses and kraal sites, where the household rubbish or cattle manure temporarily enrich the soil. These last two sites are deliberately chosen for kitchen gardens by many African farmers who are well aware of the connection between compost and/or manure and soil fertility. That they do not transport and apply these to distant plots isuusually due to the difficulty of head carriage, the traditional means of portage.

The opportunity for enriched cultivation offered by

termitaria is also appreciated and exploited. The Sandawe, for example, who have only recently been converted from a purely hunting and gathering subsistence to one including crop cultivation, for a long time resisted pressure from agriculturalists to adopt the mass cultivation of maize as their main staple. They did, however, cultivate some maize on the sides of worn down termitaria (after removing the tops for house building material (Newman, 1970: 98).

Where old craters are present their fertility is also recognized and exploited. The Nyakyusa, whose traditional land tenure custom called for the redistribution of village land by the new chief each time another village age grade succeeded to power, provided for permanent use and inheritance within the patrilineage of crater land, as of fruit trees or bamboo (Wilson, 1963:384). This treating of crater land like permanent tree crops presumably signifies that crater land supports permanent cultivation.

In addition to the generally poor and few good soils discussed so far, one other type of soil prevalent in East Africa must be mentioned.

This is the bog, of half-bog soil or the swampy areas. These are commonly too waterlogged for much agricultural use. Schemes to drain papyrus swamps in Uganda, in order to

prepare their nitrogen-rich soils for cultivation, have proved impractical. Swamp drainage threatened the fishing industry in Lake Victoria--the swamps were the spawning grounds for the tilapia which are found in the lake. Drainage increased the number of malarial mosquitoes--and therefore the incidence of human malaria--by increasing the habitat of the mosquitoes which was along the margins, not in the body of the swamp. Finally, drainage killed the papyrus, the source of the bog soils' fertility (Warren, 1967: 173).

In the Singida Depression of northern central Tanzania there are numerous small shallow swamps with only a little surface water. But since that water is permanent so is the swamps' vegetation. The Turu, who inhabit the area, have developed a true mixed farming system based on this permanent swamp vegetation which enables them to live in permanent settlements of high population density. Schneider describes the Turu as settled herders, although they keep cattle mainly for manure. The cattle can be permanently grazed near home, feeding on the swamp vegetation and watered from the swamps. The manure is used to support permanent cultivation of millet, maize, and several subsidiary crops (Schneider, 1966).

A final point to note about East African soils is

their great diversity in a small area. Five different types may be found within a few yards. (Hickman and Dickens, 1960: 23), each suitable for a different group of cultivates. Along a mountain slope, different types of soils regularly succeed each other in a repeatable sequence called a catena; each layer of the catena supports its own typical vegetation. It is for this reason that mountain dwelling farmers try to have plots which include every soil type in the catena, a land holding pattern which contributes to the fragmentation so much deplored by agricultural development personnel. When Kikuyu in Fort Hall, Kenya, accepted land consolidation, they refused to accept in exchange for their scattered holdings square blocks of land covering a relatively uniform altitude; they insisted instead that their consolidated plots be rectangular strips running down the mountain to include the entire catena (case 2). To the administrators this diminished the usefulness of land consolidation since machine cultivation must follow the contour. To the Kikuyu this diminished the loss of the security which their traditionally scattered holdings had been designed to provide.

This tendency for multiple soil types in a small area often makes it imperative that farmers recognize the

various local types and their agricultural potential. As will be discussed in the following section, East African farmers often make use of natural plant associations as indicators of agricultural potential, but in Sukumaland, where the prevalent cultivation steppe has been in such constant agricultural use that the natural plant associations do not have time to emerge, farmers depend on soil types as indicators. Malcolm reports that in the Sukuma village of Nyushimbu, a self constituted agricultural committee prepared a guide of the best soil types, in order of preference, for each of the twelve locally cultivated crops. Their guide distinguished eleven different soil types (1953: 190).

This diversity of soils within a small area, whether randomly mixed on the contuum, or in an orderly catena along a slope, is reflective of the extent of microecological differences in East Africa, a situation which probably accounts for the fact that schemes designed for large areas commonly fail, while those that are designed for small areas have a far better record of success (Miracle, 1967).

Biota

While it is true, as indicated in the above discussion of soil variety, that specific soils will only support

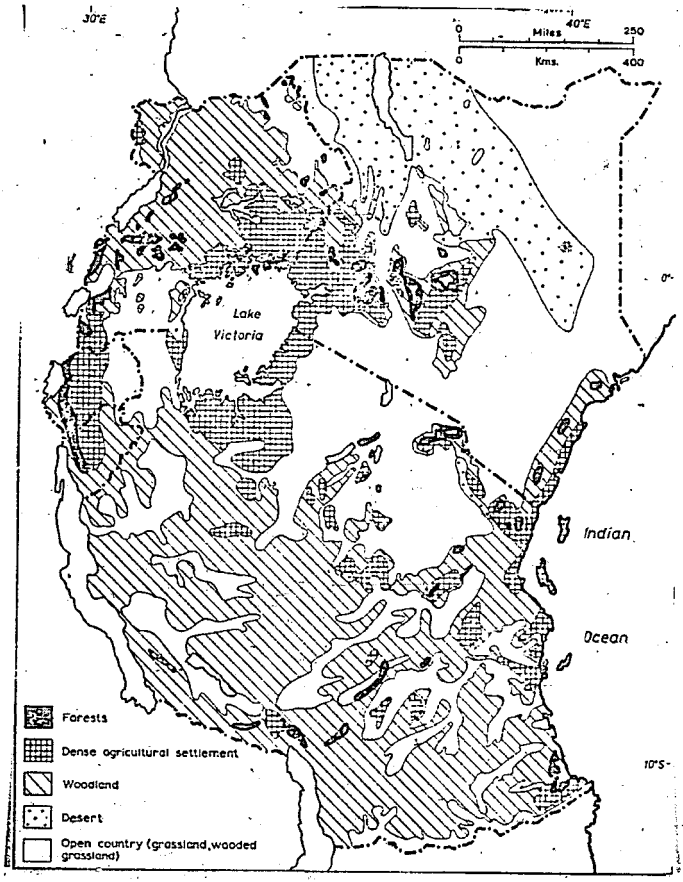

Fig. 7. East Africa: Vegetation Cover
(Warren, 1967: 170)

specific plant life, soil is not the only determinant of agricultural potential. It is the integration of soil with the various climatic factors which determines, for any locality, its natural vegetation. This natural vegetation, therefore, can be taken (as indeed it is by African cultivators) as an indicator of the cultivates which the land will support. The Wagogo of Central Tanzania, for example, knew by natural plant associations where groundnuts would grow; they planted the nuts only in the scattered spots where the appropriate indicator plants had been growing. In the ill-fated Groundnut Scheme the nuts were planted by machine throughout the scheme area; despite the enormous expenditure of money and modern equipment, the scheme's first year harvest exactly equalled that which the Gogo customarily had realized with their soil scratching techniques on their few scattered plots (Culwick, 1963: 33).

Where cultivated land had been left to recuperate through fallow, it will be invaded by a regular succession of vegetation assemblages until the natural climax is reached. This may take as long as thirty years in East Africa (Warren, 1967: 173). African cultivators are acquainted with the various sequences of natural plant associations

in their area. The reappearance of natural climax[1] has been the traditional indicator that a block of land was fully recovered and ready for reopening. Similarly the usual sign that a field has been under cultivation long enough and should be left to fallow is the encroachment of certain weeds as well as diminishing crops (Hodder, 1968: 99). Where land has been in sufficient supply to allow for this timing of cultivation and fallow with the natural succession of wild flora, his traditional system of land use has served the African cultivator well. However, where increased population and increased cash crop cultivation has increased demand for land, fallow time has often been reduced drastically and this, indeed, is the major cause of the current crisis of soil deterioration which, in turn, is one of the principal reasons for the great increased in the number of agricultural development schemes since the end of World War II.

A good example of the specificity of natural plant associations as indicators is furnished by the lush growth of natural tropical forest in Africa. This has often mistakenly been taken as an indicator of generally fertile

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[1]Actually, because climatic conditions tend to vary, the "natural climax" is unlikely to repeat itself exactly.

soil, and Europeans have often been surprised that, when the forest was cut, the land did not prove particularly rich for agriculture. The answer to thesseeming paradox of luxuriant vegetation on poor soil is that the tropical forest lives in equilibrium with itself and takes very little nourishment from the soil. The humus formed by fallen leaves and branches of trees is used immediately for nourishment by the same trees. Once the trees are cut, however, the conditinn of the soil is quite different. Deep below a protective roof of trees, the soil had been shaded from the drying effect ofddirect sunlight; it had remained cool enough to slow down bacterial action; it had received rain whose force wasddissipated on the canopy above; it had been anchored against the wind. With its trees removed, the forest floor is exposed to more direct effects of the elements and ground temperatures are considerably higher.

Because of its general aridity it is unlikely that much of East Africa, at least since neolithic times, had ever been covered with dense forests, but it is in the few formerly forested areas--the slopes of Mt. Kilimanjaro, Embu, Meru, and Kenya, for example, and the hilly area of Buganda, with its extra Congo derived moisture, that people

have depended on tree crops (bananas) for food and where tree crops (principally coffee, and now tea) have been successfully introduced as cash crops. The banana-coffee combination typical of these areas forms a happy ecological analogy to the tropical forest with its levels of canopy, the higher banana trees providing a canopy for the shade demanding coffee trees below.

It is because of the scarcity of natural forests that L.H. Brown recommends the use of grasses as indicator crops for selection of cultivates in Kenya (Brown, 1959: 9). Phillips prefers to use, not single species, but plant communities (or edaphic communities where soil conditions prevent the development of plant communities to their usual climaxes), as indicators of what he calls "bioclimatic regions" of Africa. In this way, he finds that East Africa consists largely of variants of savanna bioclimatic regions which fairly well coincide with the rainfall regions in a continuum from subhumid wooded savanna in the coastal and western regions to arid wooded savanna in northeastern Kenya. Forest regions are limited to two types: in the highlands there are either humid or subhumid montane forests; highly humid forests are found in Uganda in the area between Lake Victoria and Lake Albert (the

Buganda area). The freshwater swamps of the West are examples of edaphic communities. (Phillips, 1960: Books 2 & 3).

Although extremely varied, most of East Africa is savanna, which consists of varying proportions of mixed stands of grasses and fire resistant shrubs, and trees up to 50 feet tall (Nye and Greenland, 1960: 17).

To the prevailing natural savanna scenery of East Africa must be added the Sukumaland Cultivation Steppe in the area south of Lake Victoria in Tanzania. Sukumaland presents a nearly completely treeless landscape, a phenomenon known to have resulted from prolonged continuous cultivation by the local Sukuma people. This suggests the possibility that much of the East African savanna is the result of human cultivation. Indeed, Nye and Greenland find that the density of wooded growth varies greatly according to the intensity of cultivation, the method of clearing, and the severity of the annual burn (1960: 71).

Sukumaland is representative of only one of the three East African savanna types--Grass Savanna--in which trees and shrubs are very isolated or absent. The two other types include: Tree Savanna, where the appearance is that of parkland; and Savanna Woodlands, where trees are more numerous.

The Grass Savannas are made up of three types, depending on the amount of rainfall. Where rainfall is between 20 and 35 inches, short bunch grasses (1 foot tall at flowering) predominate; where rainfall is between 35 and 45 inches, tall bunch grasses (3 feet tall at flowering) predominate; and where rainfall exceeds 45 inches, high grass predominates, principally elephant grass, which may reach 15 feet at flowering (Nye and Greenland, 1960: 18). The Short and Tall Bunch Grass Savannas are used for herding. The High Grass Savanna provides fodder grass rather than pasture since it is too tall to permit the passage of cattle. It is more abundant than good pasture grass and it is used by tribes which are accustomed to stall-feed rather than herd cattle. The Chagga of Mount Kilimanjaro, for example, keep their cattle for their entire lives within the family home; they are brought as calves into the home where they grow till they are too large for the doorway. The cattle are fed on various crop residues and on veldt grass (Clayton, 1964: 6) gathered laboriously by the women, and carried on their backs, often for several miles, from the steppe below.

The Wakara, pressed for space on their small Ukara Island in Lake Victoria, cultivate elephant grass as a

fodder crop in pits especially dug along the rim of the lake where the water provides natural irrigation (Rounce and Thornton, 1956).

As indicated in the foregoing, natural vegetation suggests to East African peoples various opportunities and limitations for exploiting their home areas for the provision of food. Other biotic elements increase the opportunities somewhat, and the limitations greatly. Some of these biotic elements present challenges which are common to cultivators everywhere; some are unique to East Africa, or especially exaggerated there.

The enormous population of game animals touches the lives of African cultivators in many ways. Game can, of course, be used as the principal source of food by hunters--a few representative remnants of which still exist in East Africa--and as supplementary food by cultivators. One agricultural resettlement project in Uganda (case 36) made a virtue of the necessity to clear game from the resettlement area before the appearance of the first season's crop by using the hunted game as a food supply for the first settlers awaiting their first harvest.

The Bakiga successfully eliminated the game from the Kigezi resettlement area, but the people of Shinyanga in

Tanganyika were forced to abandon another resettlement area when, among other hardships, they were unable to drive off a tropp of baboons. A tropp of baboons can, and often does, harvest a farmer's entire year's grain crop much more quickly than can the farmer and his family. Other animals, notably elephants, have occasionally destroyed an entire field of crops as well as the fence that surrounded it, merely by moving through an area. Anton Nelson, a recent missionary among the Meru people on Mount Meru, reports that elephants repeatedly tore up a wooden trough he had taught the tribesmen to build for the purpose of channeling spring water to their cultivated plots. The troughs impinged on the elephants' bathing pool (1967: 166).

Statistics concerning the loss of stored grain to vermin (at least 20%, or 20,000 tons, is lost every year in this way in the Southern Province of Tanganyika, for example) (Tang. Govt. 1964: 26) become more believable when it is remembered that vermin in East Africa include elephants and hippopatomi as well as mice and rats.

Another interesting instance of the special problem presented to agriculture (and development in general) by the special African fauna was experienced as still one more difficulty of the difficulty-ridden Groundnut Scheme--

the tendency of giraffes to become engangled in the telephone wires! (Hance; 1958: 92).

Game present hazards to the livelihood of herders as well as of cultivators. Many of the game animals are, like cattle, grazing animals and therefore compete with the cattle for pasture and water. In recent years, population of both cattle and game have increased as cattle and their owners have been protected from disease and game have been protected from hunters. This has resulted in an increasing competition for lebensraum between herders and game which, in the case of some Tanganyikan Masai, was recently decided in their favor by President Nyerere of Tanzania. Despite protests of other national leaders that East Africa had the responsibility of preserving for the world one of its great treasures, the president agreed to a Masai request to kill off some of the great herds of wild beasts in the Ngorongoro Crater (New York Times, October 31, 1969: 38). In another instance of game-cattle competition, the game were the victors; a Samburu grazing scheme had to be closed when, during a prolonged drought, game entered the scheme area and destroyed the essential rotation schedule by grazing the resting pastures (case 27).

Where wells are built to augment natural water supplies for herders' cattle, they attract game animals as well,

often in such great numbers that they severely trample the soil, thereby increasing erosion and, eventually, reducing the natural water supplies (Hopcraft, 1966).

Predatory game more directly attack demesticated animals, particularly calves, small stock and chickens. Newman reports that Sandawe chickens are prey primarily to mongoose, but to eight other wild animals as well (1970: 105). In Uganda, the Teso rejected a scheme for night paddocking their cattle on their resting fields which was designed to increase nourishment of beasts and fields alike, until provision was made for protecting the cattle from lions (case 8).

A further hazard posed by the East African wildlife to East African agriculture is that they serve as a reservoir for the organisms that cause trypanosomiasis, or sleeping sickness (nagana) in cattle, without themselves succumbing to the disease. The tsetse fly ingests the causative agent from the wild animal and injects it into a domestic one. The tsetse fly requires warmth and shade. The first is present throughout the plateau; the brush provides the second. The accepted method of combating sleeping sickness is to destroy brush and keep the cleared area free of bush regeneration by cultivation. There is no

possibility of keeping a bush area free of the disease by removing all the causative agents a single time, because the game will always introduce a new supply and tsetse flies will always invade bush.

Attempts to eradicate sleeping sickness by killing game in an infested area have proved disappointing, partly because the tsetse's favorite prey is the warthog, and the warthog can easily escape the hunter by hiding in holes. But even when warthogs have been eliminated the disease has persisted; snakes, lizards and birds have proved to be hosts, as well as game (Huxley, 1964: 211).

Many of the agricultural development schemes to be discussed later incorporate tsetse clearance as an objective. The usual method employed is to clear bush, and to maintain and extend the cleared area by continuous cultivation. The area that must be kept cleared in order to keep out fly is one which is, in every dimension, beyond the flight capacity of the tsetse--a capacity calculated to be two miles (see case 39).

Many of the schemes have succeeded but many have failed, usually because the land allotted to each farmer has been more than he is able to keep clear (see cases 31, 37). In the nature of things in East Africa, however,

other things besides inadequate cultivation have destroyed the delicate balance necessary to keep out tsetse. The rinderpest epidemics introduced from Europe in the late nineteenth century, for example, killed millions of cattle, and through starvation, millions of the herders who depended on them for subsistence. The herding areas which had been kept clear by the grazing of cattle, and by their herders' annual burning of dry grass became invaded by woody growth which, in turn, attracted tsetse. Game was there to supply the disease agent, this time the form which infects man. In Uganda, from 1900 to 1906, approximately 10% of the Baganda died.

Eventually bush clearance and game eradication lowered the menace of sleeping sickness. At the same time, the cleared land was subject to increased erosion which led to an increase of the standing water which is the habitat of the malarial mosquito. This led to an increasedin the incidence of malaria (Warren, 1967: 17).

In any case, despite constant and wide-scale attempts at tsetse eradication for more than half a century, the pwoportion of Tanganyika under fly remains at 2/3, that of Uganda, 1/4 and of Kenya, 1/5 (Hailey, 1957: 879). As fast as the fly is eradicated from one area, it reappears in

another. In fact, going back a little beyond the half century, the area under fly seems to have increased considerably. Fosbrooke reported in 1951 that all of Kondoa District, Tanganyika, now largely under fly, had been entirely fly-free within living memory, so that "In the old days, the cattle could range throughout vast areas of woodland, and so collect and concentrate the fertility in the form of manure which the natives used on their plots before the advent of the European" (1951: 169). Now the cattle are restricted to the hilltop where their manure is wasted.

Deshler describes another instance of an ecological chain caused by tsetse invasion moving cattle out. He reports that in the mid 1920's tsetse invaded western Dodoś in northeastern Uganda. The Dodos in the infested area moved with their cattle to join their fellow tribesmen in eastern Dodos where they remained for thirty years until fly clearance made it safe to return to their homeland. In that thirty years eastern Dodos had become a wasteland from overgrazing. Western Dodos, on the other hand, in effect under fallow for thirty years, was renewed. The first cultivators to return obtained crop yields five times as great as did

their relatives in the eastern region (Deshler, 1960).[1]

A similar situation affected a ranching scheme in Buganda which was opened in 1956 after the area (one that had been invaded by tsetse in the wake of the rinderpest epidemic) had been cleared of fly and had stayed fly free for two years. Four years later its eastern half was re-invaded by fly and the cattle had to be concentrated in the western region. Here an epidemic of East Coast Fever relieved the pressure on grazing.

The presence or absence of tsetse has prompted many of the frequent moves of herders, and in this way has influenced East African history and culture. Commonly, cultivators have gradually cleared forest land in extending or shifting their fields. Eventually, where a cleared area has provided a continuous corridor through a forest from one grassland to another, herders have moved their cattle through the corridor to reach the further pasture. (Ford, 1960). Historically, this has been the means by which many first contacts between herders and cultivators took place in East Africa. Often each group, to some extent, took on the subsistence technique of the other; each practided the

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[1]Many agriculturalists consider that the protection afforded the soils by tsetse against overgrazing and/or overcultivation has more than outweighed its disadvantages.

adopted technique as a separate, supplementary means of obtaining food. It is largelyddue to this manner of cultural borrowing that, although most East Africans in modern times have been, to varying extents, both cultivators and herders, they have kept the two cultivating systems separate, practicing cultivation and herding in parallel, rather than mixed farming.

An additional effect of the prevalence of tsetse has been to keep the horse from East Africa, as from all Sub-Saharan Africa, the horse being even more vulnerable to sleeping sickness than are cattle (Phillips, 1959: 36).

Cattle in East Africa are subject to many endemic diseases besides trypanosomiasis. Indeed, serious cattle diseases occur in East Africa more than in any other place in the world One disease, East Coast Fever, possibly the most widespread in causing cattle deaths, is so named because it occurs only in East Africa. East Coast Fever is carried by ticks which inhabit both brush and grassland. It and other tick-borne diseases can be wiped out by trapping and killing the ticks. The method used is, essentially, to use the cattle themselves as tick traps, and then to walk the cattle periodically through chemical dips which kill the insects. The success of this

method is evidenced in case 25. Today the tick-killing chemicals are often applied in sprays. For other diseases, vaccines are effective, for example bovine pleuropneumonia and foot-and-mouth disease. The first must be taken in three doses and is therefore difficult to use with nomads. Despite recent advances in fighting infectious cattle diseases, epidemics are still so frequent that East African cattle are banned from the international cattle markets of Western Europe, which is a principal reason for the failure of cattle destocking schemes since local demand is often insufficient to ensure sales of the required offtake (F.A.O., 1967: 13). On the other hand, improved veterinary services have lead to such an enormous increase in cattle numbers as to cause the overgrazing problems which the many grazing and cattle marketing schemes instituted in East Africa have been designed to counteract.

As with cattle, game compete with sheep for grazing. As with cattle, this increases the incidence of disease. The game spread the tick which is the major cause of sheep death, and they are heavily infested with the same internal parasites that sheep are prone to (Lipscomb, 1950: 142).

As the animals of herders are plagued by diseases, so are the crops of cultivators. Most plant diseases are

species specific, and one reason that African cultivators prefer to plant several small scattered plots of each crop is tollimit the spread of a disease. Combining fields for mechanized cultivation spreads the unbroken area of a crop and, should it be present, of a crop disease as well. Since diseases may remain dormant in the soil from one cultivation season to the next, cultivators alsoppefer to switch fields often. For the same reason they often burn any crop trash in which a disease may survive. (Burning the trash also heats the soil to a degree that would kill disease agents)) Trash burning, incidentally, also adds some fertilizing ash to a field. In the Uluguru Land Usage Scheme, farmers were forbidden to burn maize (or any) trash. Instead they were forcedtto use all trash in the construction of bunds. The trash bunds proved to be breeding grounds for maize borers which seriously damaged the next season's crop (case 24).

Crops in East Africa are subject to insect and bird predators as they are to disease and vermin. East Africa is in the path of all three types of locusts, and of the Sudan dioch or quelea bird; swarms of any of these can harvest great numbers of fields of grain in a day. Traditionally, boys have acted as scarecrows. Now

that so many boys attend school the quelea presents an even greater nuisance.

Fuggles-Couchman describes how rice growers in Kilosa District, Tanganyika, handle the problem:

> For some two months of the year it is a full time occupation for any rice growing native to guard his crop against these marauding flocks, so that, in a rice area, the air is filled with a constant shouting and screaming as a flock approaches a series of shambas, to be scared to another area, there to give rise to further frenzied screams or whip cracking. (1936: 54)

It is largely because of its ability to store underground, and therefore tb escape bird depradation that manioc has been pressed on East Africans as a famine insurance crop (see case 15). Manioc, however, is not immune to animal destruction. Newman reports that the Sandawe have tried manioc, but rejected it, since they found that it was rooted up by bush-pigs and porcupines (1970: 62).

Discussion of the biotic aspect of the ecology of agriculture and its development in East Africa must not omit the spread of human disease with agricultural development. The increase of malaria with swamp drainage has been mentioned. Malaria also spreads with irrigation. Perhaps more serious, bilharzia (schistosomiasis) also goes along with irrigation. This is particularly true in irrigated rice schemes, since entry of the schistosome is through

the moistened skin, and cultivators spending hours barefoot in the flooded paddy present the ideal target. Bilharzia is also a problem in fish ponds (Tanganyika Report on Development, 1955: 25).

Famine

The preceding discussion of East African ecology has attempted to show the types of environmental opportunities and limitations faced by various East African peoples, as well as some of the kinds of subsistence adaptations various tribes have made to specific environmental opportunities and limitations. Whereas subsistence opportunity in varying degree must exist in order for an area to carry a human population, it would seem that for East Africa as a whole, limitations have been the more influential in shaping subsistence adaptations. Although it is true that different areas of East Africa may present to human populations different conglomerations of subsistence limitations, a common denominator can be found in the common functional result of the various limiting factors. This common functional result which, in effect, assumes the role of an environmental factor is the ever present threat of famine, or, as it is more commonly called "subsistence risk."

There must be very few East African peoples who do not share the memory of severe famine. Two recent studies of famine in central Tanzania present famine calendars. Starting after World War I, (to eliminate famine from other than natural causes--before that time local wars caused many famines) although the two calendars differ somewhat (each is recorded from the memories of informants), each makes it clear that, over a forty year period, famines occurred at about three year intervals. To illustrate this, as well as the multiplicity of famine causes, I have abstracted from Brooke's famine calendar those famines reported by Gogo informants for that forty year period:

1925-26	Severe drought; many deaths
1929-30	Poorly distributed rain; severe famine
1932	Locusts; moderate famine
1934-35	Main rains failed; severe famine
1937	Drought, rinderpest; moderate famine
1942	Drought, Dioch

In 1942 Government ordered construction and use of silos for grain storage, and the planting of sweet potatoes as a famine crop, but neither measure proved adequate in times of severe famine.

1943-45	Drought continued.
1946-47	Drought; more than 100,0000cattle died in Dodoma District
1949-56	Long drought which began in 1948; harvest 1/3 normal; in 1949 cattle were taken to the bush when their usual grazing area became a desert; some contracted sleeping sickness; many died from rinderpest as well as from drought. Cattle owners sold some animals for cash with which to buy food; where there were few cattle to be sold, famine relief was required earlier.
1953-55	Loss of grain from dioch - 3000 acres on the Overseas Food Corporation Farm.[1] Then, in 1953-54, drought and army worms reduced the grain harvest by 75%. Livestock mortality was 60%.
1961-63	Drought began in 1960-61. Then, in 1961-62, heavy rains destroyed the first planting. Replanting failed (Brooke thinks this was due to leaching resulting from the early heavy rains). (Brooke, 1967)

[1]This is the Kongwa farming settlement scheme of case 41.

The second calendar reports the same famines as reported to Ten Raa (1968) by the neighboring Sendawe. The Sendawe are a tribe which still practice different degrees of hunting and gathering along with their newly acquired cultivation and herding. In those areas where more hunting and less cultivation was practiced famine was least severe. In the more highly cultivating area, the extensive clearings cut down on the available game and bush produce.

Although initial stimulus for the adoption of cultivation by the Sandawe came from severe famine in the late 19th century--as well as from increasing population and game laws (Newman, 1970: 56)--it would seem that agricultural development has increased their subsistence risk by increasing the severity of famines. For famine subsistence the Sandawe primarily depend on hunting and gathering (as well as fishing in the early dry season when the wet season streams are no longer in flood, but have not yet dried out). But in the long 1948-50 famine, they sold children to Nyamwezi traders for grain and cash. (Newman, 1964: 79). More recently (1961-62) they have been issued American corn for famine relief.

Another case of famine following on the adoption of

cultivation is that of the Ik, neighbors of the Dodos in N.E. Uganda. The Ik had traditionally been hunters, pursuing game throughout Kidepu Park which straddled the borders of Uganda, Kenya and Somaliland. Now settled to cultivation, and no longer permitted to cross national boundaries, the Ik have had to adapt to severe famine. Turnbull reports that their anti-famine devices include refusal to share scarce food (even with elderly parents or young children), and instigation of raids between the Turkana and the Dodos, for whom they made spears and acted as spies; the cattle received in payment were used for food. (Turnbull, 1966).

The case of the Ngindo, whose annual recourse to bush cropping during the preharvest "hunger time" has acquired a value as a welcome break in the monotony of regular cultivation and ordinary diet, has been cited earlier.

In addition to the annual "hunger time," the Ngindo have also experienced occasional more severe famines, known to them as times of "the hunger that kills." These severe famines were associated not with crop failure but with more unusual catastrophes, usually war; in pre-colonial times these took the form of Ngoni raids; within recent memory, of the

three major famines, two were associated with war with Europeans--the Majimaji revolt against the Germans in 1905, and World War I. The last occurred as a sequel to an Evacuation Scheme.

For the months of the "hunger that kills" the Ngindo resort to bush foods in addition to the honey and fruit that they look forward to eating in the annual hunger months. They rate the wild foods into a hierarchy of desirability, and start collecting the most preferred ones first. In a period of really severe famine they will eat termite earth, using it to swell the honey which is always a delicacy and, since it gives more sustaining power per mouthful than fruits, is so highly valued during famines that the Ngindo will fell a large tree to get at the honey. Other than honey, fruit, and finally the earth, the Ngindo subsist in long famines on a wide variety of plants, seeds, nuts, grasses, roots and tubers (some of which are poisonous and require detoxification, for which the Ngindo have developed techniques), leaves, sap, bark and wood (the Ngindo make salt from the stems of a local tree), and ground and tree fungi. Their use of meat resources is limited by the game laws, and by their adherence to Moslem taboos, but they do eat some small mammals and birds which they

catch with snares. They also eat insects, and the excreta of one insect is considered a delicacy.

All Ngindo, due to familiarity with the bush gained in the course of their regular bush craft of beekeeping, know how to find these famine foods (Crosse-Upcotte, 1958).

The case of manioc forced on Tanganyikans as a famine crop being used as a source of cash for purchasing food has also been cited.

Cash is also used to obtain famine food by the Safwa of the Southern Highlands of Tanzania, but since only 25% of Safwa men have a regular source of cash from wages, a form of institutionalized hospitality is adapted as a device for sharing the cash of the few wage earners throughout the community. Harwood reports that during his residency in 1962 when crops were washed away by extra heavy rains, causing severe famine, one or another of the village housewives would, about once a week, borrow enough money to purchase maize to make beer. All her neighbors were then invited to a beer party. The few men who worked in town for wages would order rounds of beer for the entire company and pay for them with cash. Thus the beer drink, ordinarily an occasion of pure hospitality, was commercialized, providing a device for sharing the means for famine

survival--cash for food purchase (Harwood, 1964).

Among the Kikuyu of Kenya, hospitality also, though in a quite different manner, serves to share food in times of famine. During famines, the Kikuyu "lend" their children. The sister of a woman living in a famine free area will ask to borrow children from her sister in a famine stricken one. The borrowed children will be sent home on visits from time to time, bearing gifts of food baskets (Kinyanjui, p.c.).

In the case of the Ik and the Ngindo, the authors provide a graphic description of the physical effects of severe famine on the people. Crosse-Upcotte discusses also the deterioration of culture among the Ngindo: work parties, social visits and ceremonies cease; what food there is is eaten in private; divorces increase; farmers plant their next season's crops early to protect the seed from robbers; lacking the energy to clear new land, they cultivate the fallow instead. The dead are buried in animal burrows.

The strong influence of the threat of famine on cultural evolution is even more clearly suggested in a poignant letter received by the anthropologist, Robert Gray, from one of his Mbugwe informants, a part of which is quoted here:

In November and Deeember 1961 there were good rains, and the people cultivated their shambas as best they could, considering their weakness from hunger. In December many people planted a little maize, but mostly short sorghum which should only take four months to mature and bring relief from the famine. In January everyone planted the regular tall sorghum, and also some more maize. When the early sorghum was a foot high an alarming sign appeared--it began to turn red. The tall sorghum planted in January was in the seedling stage and remained healthy.

In the month of February the rains stopped for two weeks, and the short sorghum became infested with insects called nsongo. These crops looked very bad. Every shamba was affected; the plants dried up and withered. If you looked at a shamba from a little distance away it appeared to be just dry grass. During February the mood of the people changed from hope to despair.

After that it rained and rained until all the streams and valleys were flooded. The withered sorghum began to sprout new shoots from the roots. The weeds also grew very rapidly, for now they were not restrained by the usual shade from the growing crops. Again there was a faint spark of hope, and the Mbugwe used all their strength to hoe the weeds. But in March the insects came again and penetrated the secondary growth of sorghum. The people were again seized with despair; but ah this second invasion of insects was less destructive than the first the people continued to hoe weeds. During April there was plenty of rain, the pests disappeared, and the crops regained their health. The short sorghum began to put out leaves and ears. The people became hopeful that the danger of famine was over. Then, just as the short sorghum was forming kernels of grain, a new kind of pest attacked.

There were actually three different kinds of pests that came in turn. The first pest, which was the worst of all, is known as mpifi. It is a small bug, sometimes black incolour and sometimes dotted. It gives off a strong smell when crushed. This bug dries up the grains and gives them the appearance

of beeswax. The second pest, called unsene, destroyed the grains of sorghum, leaving empty husks. It would appear as if the grain had been eaten by birds. At first the people were astonished to find the crops destroyed in this way. All day they stayed in their fields guarding their crops against birds. Then the next morning they came and found the grain eaten as if by birds. For a long time they did not understand what was eating the grain. For these bugs were very clever; they did not appear until after dark, and before morning they left the crops and hid among the weeds. Finally it dawned upon us that the grain was being destroyed by small bugs which could not be guarded against like birds. The third pest was a tiny thread-like worm which attacked the sorghum both day and night.

These three pests continued through April and May to destroy the heads of sorghum as soon as they ripened. At the end of May all these pests went away and it was hoped that there would be some harvest from the late sorghum. But now the birds appeared in such extraordinary numbers that it was impossible to prevent them from eating the crops. Therefore, the people began to push their sorghum stalks to the ground at an earlier stage than usual, and as the grain was still immature it did not ripen properly. 1962 was truly a year of disaster in Mbugwe! With the sorghum on the ground, the people drew a breath of relief, thinking that at least this small portion of the crop was safe. But at this point the shambas were invaded by swarms of rats. These rats set up their camps right in the fields, and all night they ate sorghum. They stored large quantities of the grain in their holes in the ground.

When the people realized what was happening they began to harvest the grain as fast as possible without waiting for official permission from the msungati and field elders. However, it was wasted effort, for the grain was still wet and immature. The harvest was almost a total loss. Those who had planted early lost their crops to the bugs and worms, while those who escaped these pests through planting late were ruined by the birds and rats. Every person in Mbugwe was faced with hunger. The people could think of nothing but how to avoid starvation. (Mbee, 1955: 201, 202)

Culture

"The people could think of nothing but how to avoid starvation." In these words Mbee has aptly summed up what seems to me to have been the major stimulus for cultural evolution in an area where subsistence is at best hazardous and where uncomfortable famine conditions are common and disastrous famines frequent.

Subsistence arrangements are, on the one hand, adaptations to the universal human need for nutrition, and, on the other, adaptations to the opportunities and limitations of a given ecology. Where the limitations pose a constant threat to adequate nutrition, subsistence arrangements must be defensive adaptations to the threat of famine; they must be adapted not to average climatic, etc., conditions but to the known--perhaps even the imagined--minimal conditions.

Philip Porter, a geographer who has participated with anthropologists in a study of variation and adaptability of culture in East Africa concludes that the risks to agriculture and herding in the area are so varied and so severe, that:

> It is . . . inaa geography of subsistence risks that a meaningful link can be forged between subsistence economies and environmental potentials.

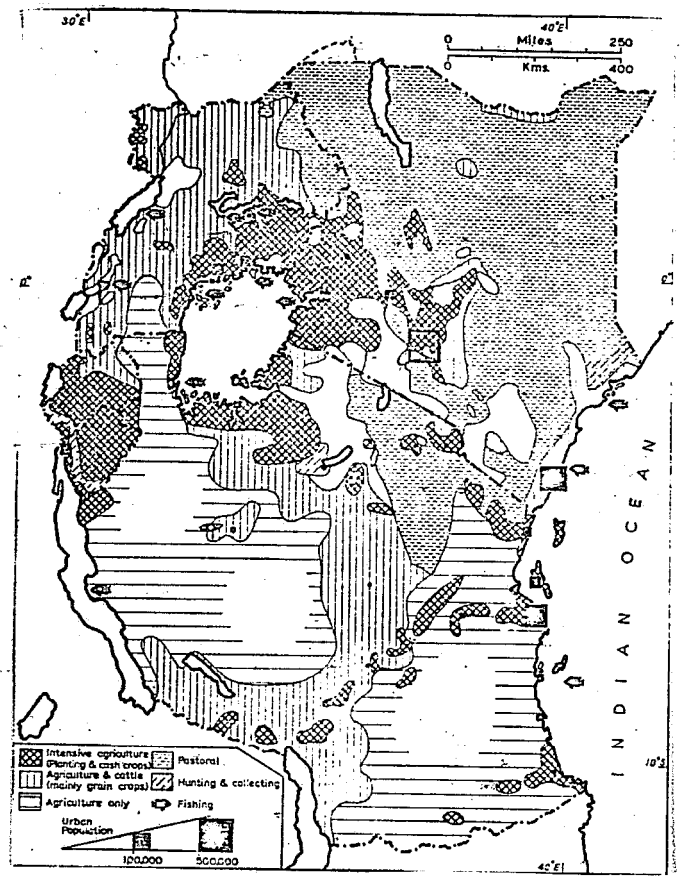

Fig. 8. East Africa: Subsistence types.
(After Warren, 1967:175)

> . . . A community has institutional and technical means of coping with risk. It can tighten its belt, develop surpluses, or raid neighboring territory. Danger to the individual can be decreased by sharing out risks, through dispersal of fields, timing of harvests, cattle deals, and the like. We may assume that in the degree to which the situation is tenuous, adjustment to risk is the essential element in the articulation of subsistence with environment. (1965: 412)

Anthropologists too have been struck by the strong influence of ecology on subsistence type in East Africa. They have been wont to classify East African cultures by subsistence type as well as by "race."

Herskovits, for example, while describing the region culturally as the "East African Cattle Area," actually divided East Africa into two functional areas, based on the possibility of raising cattle.

> The existence or non-existence of cattle is determined rigidly by the line of 60 inch rainfall which allows the vegetation among which cattle cannot live, and which permits the deadly tsetse to flourish. (1926: 52).

Inclusion or exclusion of cattle, then, according to Herskovits, depends on the ecology, but valuation of cattle is characteristic of peoples throughout the East African Culture Area. Schneider has summarized Herskovits' model of the Cattle Complex as including: an affection

for cattle; identification with cattle; dislike of killing cattle except for rituals; the use of cattle in birth, death and marriage ceremonies; the concept of cattle as the chief form of wealth; the concept of cattle as being the basis of prestige and power; the use of cattle for food for feasts and ceremonies; taboos against women handling cattle; and taboos against the use of milk (Schneider, 1959: 278).

Following Herskovits, various anthropologists who studied tribes within the East African Cattle Complex have sought in the cultural role of cattle in these tribes, the basis for the extraordinary valuation of cattle in East Africa. Examples include Evans-Prichard who says that, among the Nuer, cattle were valued primarily for their ritual functions (1960); Colson who says that the most important function of cattle among the Plateau Tonga was the creation of social bonds through cattle exchanges (1955) and Gravel who says that cattle are valued, not as the means of social transactions, but as the means of documenting those transactions (1969). Walter Goldschmidt declares that herders are universally more resistant to change and less involved in the modern world than are cultivators (1965: 406) an opinion he based in part on

findings by Kennedy in a study comparing the cultural personality of herding and cultivating segments of four East African tribes (Kennedy, 1965), and which he subsequently defended (1967: 223) against the contention of McGlaughlin that, as regards resistance to change, the opposite was, in fact, the case (McLaughlin, 1965).

That resistance or non-resistance to change may not be intrinsic to the condition of being herder or cultivator, but may be due to the cultural ecological situation in which these groups usually exist is evidenced by a case study of directed change among the Aba-Ha of western Tanganyika, in which Griffiths found that for this group, among whom cultivators lived isolated in the bush out of contact with outsiders, whereas herders wandered in the open plains in contact with passing traders, herders were more involved in the modern world than were cultivators (Griffiths, 1936). The case of the Aba-Ha is, of course, a direct reversal of the usual situation for cultivators and herders, where the former are much more likely to be in contact with outsiders than are the remotely wandering herders.

Whatever may be the comparative propensity to change of herders and cultivators in East Africa, there is

considerable evidence that both have undergone many changes, both throughout history, and in modern times. Indeed it is contemporary change which is the subject of the present study of agricultural development schemes.

Murdock (1959) divides the East African peoples into "races," but traces archeologically and inferentially, how different groups of these people have come to have similar subsistence types. In settling in certain environments they have retained their own or borrowed techniques from earlier settlers, as best suited these new environments.

Briefly, Murdock says that the current major populations of East Africa--the Bantu (of five regional groups) and the Nilotes, both negroids--entered East Africa somewhat over a thousand years ago, the Bantu arriving from the tropical forests to the west (sometimes by way of the south) slightly ahead of the Nilotes who came from the northwest. Both immigrant groups met with small populations of Bushmanoid people, hunters living throughout the region, and with various Cushitic groups living in separate areas.

Upper Paleolithic Southern Cushites of North African derivation inhabited the northern Rift Valley.

Neolithic Cushites were of two groups: 1) Megalithic Cushites of the highlands of Kenya and northern Tanganyika, who had come from southern Ethiopia perhaps 3000 years B.P., and 2) Western Cushites who had entered central Uganda from southwestern Ethiopia at an undated but probably similar time. These Neolithic Cushites practiced intensive agriculture including the keeping of cattle and small stock. The Negalithic Cushites practiced terracing, irrigation and fertilization on their highland farms.

The Bantu entered East Africa as pure horticulturalists; the Nilotes as herders who knew cultivation, but, having developed a milking complex, were able to live entirely off their animals while migrating.

In general, where the newcomers encountered Bushmanoid hunters, they eliminated them. Where they settled in areas inhabited by Cushites, they merged with the earlier settlers through intermarriage, and adopted their subsistence techniques. These had been invented in the Ethiopian homeland, but, by the time of the arrival of the negroids, they had been well adapted to their East African environments.

Today only two Nilotic tribes, the Masai and the Samburu, are pure herders. Most are primarily herders

who practice cultivation as an auxiliary means of subsistence, although the Teso, the Arusha, and the members of the Luo and Nandi clusters are now more dependent on cultivation than on herding.

All but the Luo Cluster of Nilotes have been Cushitized and practice various Cushitic customs such as the drinking of blood drawn by piercing the neck vein of a living cow with a blocked arrow. Among the Cushitized Nilotes, women milk the cows. Among both Cushitized and non-Cushitized groups, women do most of the work of cultivation, which emphasizes cereal grains, sorghums and millets, primarily.

Nilotes referred to in this study include: the Lango and Luo of the Luo Cluster who inhabit northern Uganda; the Jie, Karamojong, Teso and Turkana of the Karomojong Cluster who live in Northwestern Kenya and adjacent Uganda; the Kipsigi, Nandi, Barabaig and Pakot of the Nandi Cluster in the mountains of western Kenya; the Arusha, Masai and Samburu of the Masai Cluster who live East of the Karomojong and Nandi Clusters in Kenya and in northern Tanganyika; and the Hima who live among various Uganda Bantu whom they serve as professional herders. (Chapter 43).

Of the Bantu, some arriving via the south, went north along the coast. They are referred to as Northeast Coastal Bantu. Those who stayed in Tanzania and settled the immediate hinterland have retained their original culture and are principally cultivators. These are the members of the Zigula Cluster of whom only the Luguru are mentioned in this study.

Some Northeast Coastal Bantu migrated further north where they were subjugated by the coastal Azanians (largely Megalithic Cushites). From these people they learned herding, and when they later escaped to move south and live free in the immediate Kenya hinterland they retained herding as an important auxiliary to cultivation. Fishing is also important for some. In this study we are concerned with the Digo and Giryama of this Nika Cluster.

On the immediate coast and the off-shore islands, detribalized, Arabized Bantu form the Swahili cluster of whom we are concerned only with the Rufiji. The tribes of the Swahili Cluster do considerable herding along with cultivation.

All the Northeast Coastal Bantu grow millets and sorghum. Some grow rice, some maize or manioc as staples (chapt. 39).

Someoof the Bantu arriving in East Africa did

not continue to the coast but went north into the eastern highlands where they remain as the Kenya Highland Bantu. Those who settled on the higher slopes of mountains found Megalithic Cushites practicing irrigation and cattle keeping which they adopted and practice still. Many also adopted fertilization with animal manure which enables them to cultivate their fields permanently. Crops are mainly cereals--millets, sorghum or maize being the staples. Cattle are kept for manure and for dietary supplement--providing milk, butter, and blood. Men clear land, take care of irrigation and animals. Women usually do the cultivating, and often the milking. Among the Chaga, however, men cultivate and care for the irrigation system, while women stall feed the cattle. The Kenya Highland Bantu referred to in this study are the Chaga, Kamba, Kikuyu, and Teita (Chapt. 44).

Still others of the inmigrating Bantu settled in the region of East Africa's great lakes. Here they were joined, about a thousand years ago, by Nilotic groups of the Luo Cluster from whom they learned the herding and milking of cattle. For most of the Bantu peoples in this area, cattle approach cultivation in economic importance. Most depend on sorghums and millets as staples, but in Uganda,

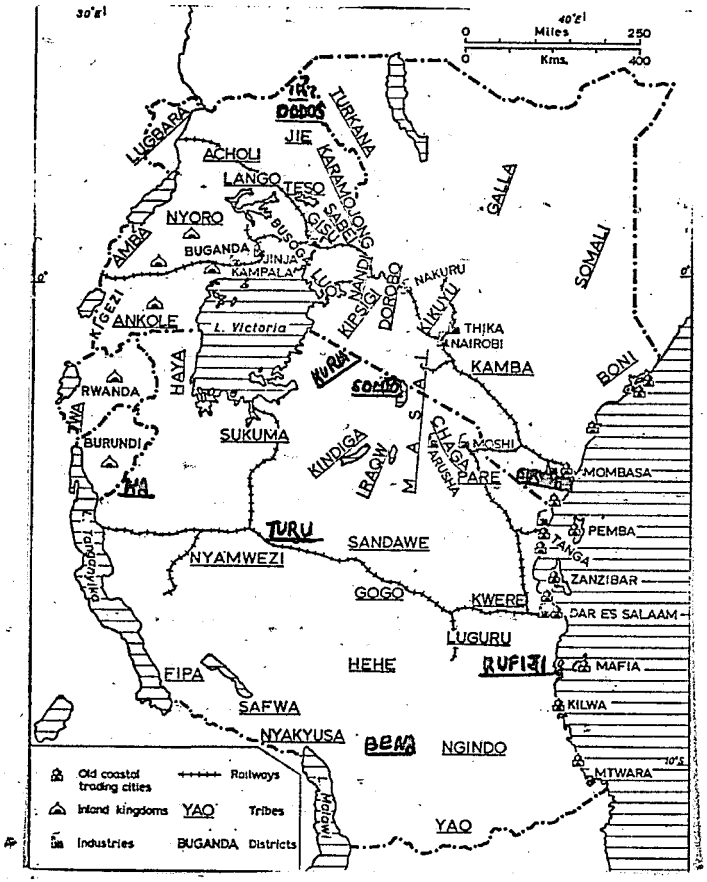

Fig. 9. East Africa: Tribal groups
(After Warren, 1967: 177)

these are displaced by bananas. Fishing is often a major occupation. In the west of the area, particularly in Uganda, despotic states prevail which, according to Murdock, the Bantu immigrants have copied from earlier western Cushitic inhabitants. Their own states once developed, the Bantu used their power to subdue their Cushitic neighbors. This Cushitic contact did not include the adoption of herding. In fact, Murdock specifically denies the assumption of earlier writers that the Intralucustrine Bantu derived their cattle complex from the Cushites of Ethiopia and the Horn. Intralacustrine Bantu dealt with here include: the Ha and Nkole of the Ruanda Cluster who live on the Western border of Tanganyika; the Ganda and Nyoro of Southern Uganda, of the Uganda Cluster; and the Gusii, Kara and Sonjo of the East Nyanza Cluster (chapt. 45).

Another Bantu migration settled interior Tanganyika. Here, the newcomers encountered only Bushmanoid hunters and gatherers. One of these, the Sandawe, is discussed earlier in this study. The Sandawe have recently adopted agriculture and their subsistence type is much like that of the surrounding Bantu, though they continue some hunting and collecting. Cereals provide the staples--millets, sorghum and maize. Except where there is tsetse,

cattle are kept; all tribes keep small stock. In general men care for the animals and women for the cultivation. Many of the Tanganyika Bantu tribes are organized into states. The Nyakysa are unique in having a village settlement pattern and land tenure system based on age grade membership. Tanganyika Bantu discussed in this study include: the Gogo, Mbugwe, and Turu of the Rift Cluster who inhabit the area in northeast Tanganyika adjacent to the Masai, from whom they have picked up many traits, including the drinking of blood drawn from the necks of their cattle; the Nyamwezi and Sukuma of the Nyemwezi Cluster of the northwest; the Safwa of the Rukwa CCluster of the southwest; the Bena Hehe and Kaguru of the Rufiji Cluster of eastern Tanganyika; and the Nyakyusa of the Nyasa Cluster, of the extreme south around the northern end of Lake Nyasa (chapt. 46).

A final Bantu tribe considered in this study, the Ngindo of the Yao cluster who live mainly in Mozambique, but extend into the southernmost section of eastern Tanganyika, belong to another one of Murdock's major Bantu groupings, the Central Bantu. They are swidden cultivators growing manioc, maize, millets and sorghums as stables (p. 295).

An isolated tribe of "remnant" Southern Cushites, the Iraqw of northern Tanzania, is the subject of one of the case studies (case 28). These remnant Southern Cushites practice cereal cultivation and animal husbandry about equally and make use of manure in their agriculture (195).

One Central Sudanic tribe, the Lugbara of the Madi cluster (p. 226) is mentioned in this study. They live in extreme northwestern Uganda. Others of the tribe live in adjacent areas of the Sudan and the Congo.

A last tribe involved in one of the development schemes to be discussed in the next chapter (case 29), the Dorobo, is classified by Murdock with the East African Hunters. They live in the mountainous sections of Masai and Nandi country in Kenya (p. 59).

The Ottenbergs discuss culture types of all of Africa as directly related to climate, and climate as related to distance from the equator. For East Africa, the Equatorial Zone is highland, with a moderate rainfall where, except for occasional pockets of forest, the prevailing grassland is used for the cultivation of grain crops and the herding of cattle.

North and South of the Equatorial Zone are the

Sudanic Zones. In East Africa, very little of the northern Sudanic Zone occurs, and where it does (Northeast Uganda, and Kenya) it goes quickly into desert, but a good part of the area is in the osouthern one. For all of Africa the Sudanic Zones are grasslands where cattle herding and cultivation of grain crops are the subsistence types.

> In some cases the choice of productive activity has clearly been determined by geography, while in other cases it has been made in terms of the past interests and experience of a particular group (1960: 10).

As "geography" becomes more limiting it is more deterministic of "productive" activity. If choice of productive activity "has been made in terms of the past interests and experience of a particular group" geography must have been sufficiently permissive as to have allowed the choice. In East Africa "geography" permits few choices. One group which, according to Sanders (1968: 150), a relatively benign "geography" has permitted to make its choice of pure pastoralism in terms of its past interests are the pastoral Masai[1] who inhabit the central part of the East Rift Valley of Kenya and Tanzania. Here, according to Jacobs, wet season rainfall, which averages 30" and which

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[1]Other Masai speaking people, like the Arusha, practice some agriculture and are called agricultural, or semi-pastoral Masai.

carries to the Rift Valley floor nutrients leached from the bordering escarpments (1961: 11) is sufficient to support good graze year round. Consequently, families are able to stay together in their transhumant moves from wet to dry season camps, and all can be fed from the products of their herds. Water and graze, however, are both much scarcer in the dry than in the wet season, so that milk production is reduced and 10 to 15 cows (up to 20 in drought) are required to feed one adult rather than the two to three that suffice in the wet season. Since allowance must be made for animals lost to predators, disease and drought[1] as well as some to trade for spears, etc., the near pure pastoral diet of the Masai requires large numbers of animals. On an average, thirteen head of cattle plus an equal number of sheep and goats per individual are owned by the simple or compound family which makes up an economic unit.[2]

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[1] In the 1961 drought one third of the cattle, approximately 400,000 head, of Kenya Masai died.

[2] This is far less than some individuals in agricultural tribes may own. Malcolm reports that in southern Sukumaland some Sukuma who are full time herders own herds of up to a thousand (1953: 70).

How one group of pastoral Masai makes use of the opportunities of the environment is described by Page-Jones in a study of their grazing system. In the dry season, grazing is organized around a central water source by means of a series of cattle bomas placed in a circle of five mile radius. Herding alternates daily between the route to and from the water hole and within the wider arc from the boma to a distance five miles further out from water. In other words, cattle are herded ten miles daily and are watered only once in two days; on the days on which no time is taken for watering, they graze a larger area. When the area served by each boma is grazed out the cattle are moved to the next boma around the ring. This pattern allows for thorough grazing of all the land within a ten mile radius of a water source. With the breaking of the first rains, the Masai leave the area of permanent water sources to allow maximum time for reseeding and resting while the cattle graze the wet season areas in which the temporary flooding provides water sources. Page-Jones offers the opinion that "these people have . . . achieved a balance with nature in which they put their land to as good use as present conditions allow" (1948: 52). How precarious this balance is is pointed up by his finding

that some of the water holes are effectively kept from normal use by the presente of the tsetse fly so that "In a drought season, cattle must be driven into fly bush to take the choice between possible death from tsetse and certain death from starvation." (p. 53).

Jacobs claims that extreme drought causes tsetse to recede and that the areas they had protected from grazing then become valuable reserve pasture. Altogether, Jacobs presents a much greener picture of Masai pastoral conditions than does Page-Jones, or, more recently, Gulliver. In attempting to analyze why the Masai, more than other East African peoples, have resisted change, Gulliver concludes:

> The crucial factor seems to lie in the fact that the Masai of Tanzania, like many other East African pastoralists, live in fairly or very poor country. Although rainfall (the vital consideration in such country) is on the whole rather higher in most of Masailand than in the pastoral regions of, say, northern Kenya, the reliability is very low. Rainfall is adequate over the whole country no more than once in six or seven years. Pastures are fair, but agriculture is scarcely possible except in scattered areas of favoured land. The pastures are interspersed with infertile stretches and tsetse-ridden thicket, whilst water supplies are scattered. The Masai have been able to make a fairly successful pastoral livelihood, though always under the threat of devastating drought about once a generation or less (1969: 238).

Whether or not agriculture might be possible on the Masai

Plains, it is clear that the Masai have opted to stick with herding as their sole subsistence type; on the slopes of the Rift Valley escarpment to the west, and of the various mountains which serve as an eastern scarp, the Masai encounter many cultivating people whose subsistence they could emulate should they so desire.[1] For example, the Arusha, a tribe of agricultural Masai formed from mixed groups of Masai speaking peoples who, about 1830, while refugees from Masai wars, joined in settling the south-western slopes of Mt. Meru in Kenya, where they remain as prosperous and expanding cultivators, are well known to the Masai, among whom they have kin and with whom they share age grades (Gulliver, 1969). It might be added, "and to whom they feel superior," for the Masai are reported to have only contempt for cultivation and vegetable foods and to feel superior not only to those who partake of these but to all people who are not Masai. This tribal

[1] In fact, Masai frequently take wives from cultivating groups such as Chagga and Kikuyu, and these women are experienced cultivators. Among at least one former purely pastoral group, the Barabaig, importing of foreign wives from a cultivating people (Iraqw) has been the means of their adoption of an auxiliary cultivation (Klima, 1969: 20).

pride was undoubtedly part of the reason for the success of the Purko-Masai Sheep Ranch (case 21). Many an African group, shown the success of neighboring European farmers as an incentive to participating in development schemes, has failed to identify with that success. Rather their feeling is that "that is something white men can do, not something I can do" (Silverman, p.c.). The young Masai recruits to the sheep ranch, on the other hand, were "confident that they could emulate the success of the European sheep farmers. . . ." (Aldev, 1962: 82).

The history of the sheep ranch also illustrates the Masai scorn for cultivation. Anxious to prosper, the ranchers nevertheless refused to practice the small amount of cultivation recommended to protect the ranch area from erosion. They agreed, instead, to accept neighboring European farmers as share croppers on their land.

Whether it is the inhospitality of their environment to agriculture as Gulliver claims, or its generosity to herding as Jacobs and Sanders claim that prompts the pastoral Masai to subsist by herding alone, it is true that they are fairly unique in this. According to Sanders, other than in Masailand:

> . . . the ecology of those parts of Uganda and Kenya which are home to the pastoralist tribes, makes it impossible to survive by pastoralism alone. That means that as much agriculture needs to be practiced as possible, given climate and soil conditions. During the dry season the cattle are gaunt and not very productive, therefore milk is scarce and people hesitate to bleed theccows too often considering the poor physical condition of the animals. In order to survive some other source of food is necessary. To this end most tribes cultivate gardens which supply them with grain and vegetables. These provide the necessary subsistence until wet season brings green pastures and plentiful water for the herds and, in turn, an adequate supply of milk. The soil is not fertile enough, given the horticultural techniques familiar in the area, to feed the tribe throughout the year. Thus arises the need for a mixed economy (1968: 3).

In general, Sanders is correct in asserting that most of the pastoral areas of East Africa are not good enough for either cattle or food crops for people to survive on either alone; most non-Masai herders do depend on food sources other than cattle and small stock, although not necessarily on agriculture. The Samburu, for example, ex-nomads who live in Kenya's extremely arid north, which allows no cultivation, are often classified with the pastoral Masai as being purely pastoral;[1] actually they supplement their pastoral diet with gathered roots and bark and with grain bought with the proceeds of cattle sales (Spencer, 1965: 2).

That nomadism may be the best adjustment to

[1]Murdock so classifies them.

current Samburu ecology is suggested by the failure of a Samburu ranching scheme (case 27). The ranch, which at first seemed completely successful in maintaining soil fertility and abundant graze through use of rotated grazing blocks and provision of artificial permanent water sources, was abandoned after game animals, drawn to the ranch by their need for graze and water during the severe drought of 1961, upset the rotation schedule, and grazed out the ranch.

The Turkana, living in the Rift Valley in the northwest of Kenya where the annual rainfall averages only 14 inches, persist in the cultivation they had practiced in their former home on the higher plains of northeastern Uganda with only infrequent slight success. Their subsistence comes almost entirely from their animals, but in order to more fully exploit their environment they divide their herds between browsing and grazing stock. Aside from the sheep and goats (which are both browsers and grazers), they keep camels (browsers) as well as cattle (grazers). The cattle spend a good part of each year--the nine month dry season, and longer if the rainy season is not sufficient to provide enough graze on the plains for them as well as for the small stock--in the mountains in the

care of boys and young men. Since browse is ubiquitous and since the Turkana prefer the plains, camels are kept on the plains. Comparing subsistence practices of the Turkana with those of the Jie, with whom they were once one tribe, provides an opportunity for a synchronic study of change in subsistence with change of ecology. The Jie have remained on the plains of northeastern Uganda above the Rift Valley which had been their common home with the Turkana before the latter descended to the more arid Rift Valley floor. On the higher plains (4,000 feet) with an average annual rainfall of 25 inches, the Jie continue to subsist on the millet cultivated by the women equally with the products of the herds of the men (Gulliver, 1955: chapt. 2).

The Karamojong in northeast Uganda exploit multiple environments with a mixture of subsistence types to provide continuous and secure supplies of food. Being almost on the equator, their area has occasional dry season rains. The central part has several rivers and therefore several stretches of rich alluvial soil. Here they make their permanent settlements and their garden plots in which the women cultivate their sorghum. In the rainy season cattle are herded here and the sheeps and goats remain

all year. The eastern and western borders of the area are highland and usually have at least some permanent water sources. A third ecological zone is provided by western plains. Here too, there is always some water, since clay pans hold water for three weeks after a dry season rain.

Each zone clearly presents opportunities for subsistence. Each presents limitations as well. In the central zone there is permanent water, but no graze at all during the dry season; the clay soils of the western plains are so sticky as to be dangerous for cattle and herders, and the tall grass of this zone shelters dangerous predatory animals. In the eastern highlands East Coast Fever is enzootic; on the north live the Pokot who raid the Karamojong to increase their own herds and kill the herders in the process. It is because their cattle are so vulnerable that the Karamojong, in addition to keeping their herds as large as possible, till the soil and, when they are available, gather wild foods. On the other hand, as Dyson-Hudson (1969) points out, herds are movable as as plots are not, and therefore they can survive a drought that occasionally kills the year's crops.

> The main effort of Karamojong husbandry is directed not so much to manipulation of the environment or of the animals within the herds as to manipulation of the herd within the environment (p. 88).

The Pokot, as mentioned earlier, also exploit multiple environments to achieve a balanced diet of animal and vegetable products, Their method is to divide the environment between herding and cultivating segments of the tribe who trade their different products with each other. Since one way of exchanging food is through affinal relations:

> A wealthy pastoralist i . . is said to have chosen wisely if two of his wives are from widely separated korok in the mountains--one wife from a region in which crops are harvested early and the other from an area where they are harvested late, thereby assuring the exchange of pastoral produce--meat, milk, skins--for farm products (especially grain, tobacco and gourds) over more than one harvest period (Conant, 1965: 432).

A group of Bahima herders were also able to obtain a mixed diet by means of their cattle. These herders arrived in Uhaya in Tanzania from Bunyoro in the north in the late seventeenth century, bringing with them their long-horned Ankole cattle. Settling among the indigenous Bahaya cultivators, the newcomers farmed out their cattle to their neighbors. This resulted in a rewarding symbiosis between cultivators and herders in that droppings of manure so increased the fertility of their soil that the cultivators were able to devote more of their land to

the cultivation of bananas. Banana trees are perennials which yield continuously in rich soil. The continuous supply of staple food from a small area enabled the cultivators to shift from a shifting to a sedentary mode of life. Bananas became the new staple of both groups, the cultivators supplying the cattle owners with the surplus of their crop in return for the use of the stock (Korit-Schoner and Hartnell, 1942).

Another herding group, the Iteso, finding themselves in a well watered and fertile land in the course of migrating south from Karamoja in northern Uganda, adopted a sedentary agricultural life. Concerned for the safety of their crops, they tended to keep their cattle far from their cultivated plots, usually in the care of a hired Hima herdsman. A porridge of finger millet flour became their principal food. In some ways their tradition of cattle keeping has helped their agricultural development. The Iteso were the first cultivators in Uganda to adopt ox-ploughing. They accepted with the plough a set of rigid rules specifying its use in cultivating a hillside. Today, when asked about their method of ploughing, young men claim "It is an old Teso custom" (Parsons, 1960: 15).

Some Iteso cattle keeping customs have worked against successful agricultural development. Parsons reports that a livestock improvement scheme was abandoned as a failure after many years because the "custom of persistent and perpetual drafting in and out of a herd of bride-price cattle . . . made it impossible to assess the effect of any breeding bull" (1960: 22). Additionally, the custom of castrating cattle late, after full development of neck and shoulder muscles desirable for working oxen, interferes with breeding programs. Also, regular destocking for sale proved unfeasible because the ownership of cattle was by groups, so that no one person could make the decision to sell an animal.

Elsewhere, another destocking scheme successfully got around the problem of selling group owned cattle by having members agree that any holder could dispose of an animal providing that he would return to its owners any money received for it (Jordan, 1957).

Some Iteso now have progressed to true mixed farming by accepting a scheme to graze their cattle on their resting fields (case 8).

In the discussion of the Karamojong, reference was made, as one hazard to herding, to the presence to their north of Pokot herders who frequently raid Karamojong herds in order to increase their own. So do the

herds. According to Dyson-Hudson, they consider this to be "a valid means of enhancing their livelihood, not a crime" (1969: 87).

The Karamojong attitude towards cattle raiding is typical of East African herders. Indeed, in the language of the Kipsigis, the same word is used for "going to work" and "going to war," the object in both cases being to increase one's herd (Westermann, 1949: 23).

Thompson reports that the year during which she lived with the Dodoth,[1] a long peace between them and the Turkana (and the Turkana's allies, the Jie), was broken, leading to a series of 125 raids in eleven months. According to police records 150 people were killed and 25,000 cattle changed hands, with the Dodoth losing 6,500 more than they captured (1965: 115-125).

The following recent report from Nairobi shows that cattle raiding is still a common practice among East African pastoral tribes.

> A gang of Suk tribesmen, armed with spears and bows and arrows, crossed the Uganda border into Kenya last November and raided a cattle corral of the Turkana people.
> After a bloody battle, the rustlers took 73

[1]Dodoth and Dodos are alternative spellings.

> cattle and drove them back across the border. For almost every head stolen, a human life was lost. The bodies of 59 Turkana men, women and children were left at the scene. So were nine slain rustlers. (Los Angeles Times, May 4, 1970)

The report adds that in Kenya, where the annual value of livestock production is one hundred million dollars, the annual loss from stock theft is between 1-1/2 million to five million dollars. The problem is considered to be so severe that the Kenya government which, immediately after independence, abolished the British practice of communal (i.e., tribal) punishment for stock theft as degrading, had recently been handed a parliamentary resolution asking for revival of the colonial practice,

Walter Goldschmidt feels that cattle raids are such a severe threat to herding tribes that it is to counteract the danger of raids that the many social exchanges of cattle characteristic of these people have evolved. He therefore links the economic exchange of cattle for herd building-- his example Sebei, Kambuyu, was seen to have more often in the course of a year exchanged a male animal for a female (thirty six times) than vice-versa (six times), and the social exchange of cattle as two means of furthering the welfare and increasing the strength of the corporate group of clan or lineage which is "the strongest

mutual protective unit in an environment where raiding and warfare are endemic" (1967: 9).

Although as evidenced several times above there are more threats to herds in East Africa than intertribal raids, Goldschmidt is right in pointing out the subsistence insurance function of the social exchange of cattle. Dyson-Hudson says for the Karamojong:

> The giving of livestock is the only way a man can extend his supporters beyond those relatives he was born with. He can marry a woman with many relatives and give each some livestock at the marriage ceremony. He can also contribute to the bridewealth of another man and thus acquire a formal friend who will support him as a relative would (1969: 88).

Cattle giving and cattle lending among East African herders are proverbial . While it has been customary for anthropologists to assign first cause to social reasons (see for example Colson, 1955 and Gravel, 1969), a cross cultural study of cattle giving and lending indicates that the primary motivations for both are economic--protection against subsistence risk. There are social rewards to the lender and social obligations to the borrower as there are everywhere, and certainly the man rich in cattle places his cattle where these rewards will be greatest. Primarily, however, dispersing his herd is insurance to the owner that all of it will not succumb to

a local epizootic, or be lost in a single animal or human raid. (During the year of raids in Dodoth discussed above, some men lost all of their herd, some lost none. [Thompson, 1968: 125]). It spreads the pressure on grazing and water supplies. It hides extravagant wealth, not only from jealous neighbors, but, as Hamilton suggests, from the tax collector as well (1969). For some herders, the primary motive for lending is to obtain the services of the borrower in taking care of cattle when the owner lacks sufficient help at home (Malcolm, 1953: 72). Among the Iraqw who kraal their animals in the family homestead so that no man can keep more animals than he can take into his house, primary motivation for cattle lending is shelter for excess animals. Among the Samburu, giving of cattle to "stock friends" makes one a "worthy man," a basis for prestige. It also guarantees that when "the worthy man" needs food, or stock or help with his herds, he can always expect these" (Spencer, 1965: 28).

The borrower of cattle clearly gets, along with obligation to the lender, defense against subsistence risk. He gets the use of milk, and where they are used, of blood and manure as well. Usually he is allowed to keep some of the calves produced by the borrowed cows, as payment for

his care of them. In this way a herdless man can build a herd of his own.

The Kongwa Ranching Scheme (case 41) provided for the building of herds of improved cattle by the members in just this way, with scheme management being the "lenders" of cattle. On the other hand cattle-destocking schemes have failed because animal holders were often not animal owners and could not sell their excess beasts. When this problem arose on the Iraqw scheme (case 28), where cattle were even more likely to be on loan than among other tribes, since, as mentioned earlier, Iraqw do not keep at home more animals than can be kraalled in the house, it was decided that loaned animals would be sold according to destocking quotas, but proceeds of the sales would go to the owners.

Another cattle exchange custom, that of lobola, or "bride price," while clearly serving the social functions of reinforcing the marriage tie by binding together the kin groups of husband and wife as well as providing some insurance against mistreatment by the husband of his wife, or desertion of the husband by the wife, is commonly recognized by anthropologists to have an economic base. Bride price compensates the bride's family for loss of her

services in cultivation as well as for the loss of her progeny and of their future services.

The common East African practice of slaughtering cattle for food only for ceremonial feasts (animals that have died a natural death are eaten routinely) can be interpreted as part of the food sharing custom. In an area of dispersed settlement, such as East Africa where means of meat storage are lacking, a large animal would largely be wasted by spoilage if it were slaughtered for family dining.[1] Only on ceremonial occasions where large numbers of people are fed at one time can cattle economically serve as meat. During the rest of the time, cattle are much more efficient suppliers of food if only their replaceable products, milk and blood, are used for food, and the animals themselves are used as both producers of food and means for its safe storage. The economic basis of the taboo against killing cattle for ordinary meals becomes clear when one examines studies of ceremonial occasions for cattle slaughter for food.

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[1] Dyson-Hudson says that the Karamojong can dry and store meat for long periods. The reason a man does not kill an animal for ordinary dining is that relatives, neighbors and friends would beg for a share and he would not be able to refuse them since reciprocal begging for meat is their method of insurance (1969: 80).

Schneider lists several ceremonial occasions for which the Pokot butcher cattle. One of these, kerket, is a feast held because one wants to eat meat. Kerket has a prescribed ritual (1959: 293). Dyson-Hudson points out that the Karamojong usually hold their religious ceremonies in times of poor rainfall or after a crop failure. He says:

> this is a way to reduce the herds slightly and to distribute meat to the human population when other foods are in short supply (1969:82).

An additional indication that not only are cattle eaten when the occasion demands, but that the occasion may be demanded when one wants to eat cattle, is that among the Dodos, who also customarily kill cattle only for ceremonial feasts, cattle, like humans, can be witches. A cow that is accused of being a witch is always killed, and a cow that is dead, is always eaten. (Thompson 1965: 176).

For the Pokot, Schneider found that, for whatever reason (birth, marriage, death, etc. or kerket) a man was considered to have done his duty to his neighbors if he gave one feast per year. Since there were forty to fifty families in a neighborhood, distribution of beef by communal feasting occurred about once a week (Schneider, 1957: 292). If this is added to the beef that is eaten when cattle die

a natural death, and to the sheep and goats that are eaten in routine family consumption, it is seen that herders, though they may keep cattle mainly for their store of milk and blood, nevertheless have considerable meat in their diet."

In a later study of the Turu of north central Tanzania, Schneider found that these people sell their cattle to butchers from whom they also buy meat, making it very clear that the function of the taboo against killing cattle except for ceremonial feasting is to avoid wastage of food. The Turu express this feeling against food waste in their attitude toward eating eggs. Why eat an egg, they say, when it could grow to be a chicken (1964: 69).

It is quite possible that in pre-colonial times (and therefore pre-national boundary) times, freer than they have been since to exploit larger territories to graze their cattle, most East African herders were able to subsist quite well on their herds alone, particularly since, in those times, before the great rinderpest epidemics of the 1890's, much less land was closed to herding by the presence of tsetse.

Klima, writing of the Barabaig in 1969, reported that:

> The independent government of Tanzania has decided the cultural fate of the Barabaig. It has banned the wearing of traditional clothing and is seeking to force the Barabaig to settle down in a permanent location, to give up cattle-herding, and to practice garden cultivation (p. 112).

But the Barabaig had been, on their own, cultivating more and more under the influence of Iraqw wives and brothers-in-law, and because they were beginning to find that migration, the traditional solution to grazing, was no longer serviceable, since "there were few places left where they could bring their cattle without inciting some hostile opposition" (Klima, 1969: 20).

Actually, political (including tribal) boundaries and tsetse infestation are only part of the cause of the restriction on movement that has made herding in recent years more and more hazardous as a way of life in East Africa. Increase in human and animal population as well as greatly increased cultivation due to the introduction of cash crops and alienation of land to European estates cut down increasingly on grazing areas. When the government's scheme to fully settle the Barabaig has succeeded, as it finally must, it will have served the function, not of creating settled cultivation as a new way of life for a formerly nomadic people, but as a force for

speeding up the progress of evolutionary processes already well advanced.

The case of the Teso, already cited, provides one example of how the interplay of spontaneous and induced change resulted in the evolution of a purely pastoral system to one of true mixed farming.

Another example is that of the Kipsigis whose lack of traditional cultivators' land tenure has proved to be a factor in speeding up their modernization of their agriculture so that they are now one of the most agriculturally advanced of Kenya tribes. Kipsigis mythology tells how a group of women discovered some millet growing in a piece of elephant dung. Tasting it they found it sweet and decided to cultivate it; thus beginning the tribe's adoption of cultivation. In 1907, a local District Commissioner, anxious that a supply of foodstuff be available for the increasing number of non-food producing personnel settling in Kericho district to manage colonial affairs, pressured the Kipsigis to grow maize which would provide a heavier yield of grain than their millet and sorghum. After World War I the market for Kipsigis maize began a steady increase with the flourishing of the local European tea estates on which large numbers of Africans (Luo and Gusii,

primarily), were employed. In 1921 the first Kipsigis farmer had bought a plough and the first Kipsigis water mill for the grinding of maize flour had been acquired. By 1930 there were 400 ploughs in the Kericho district.

Five years later the first Kipsigis had enclosed some of the land he had originally expropriated from the common grazing area for maize cultivation to make a paddock. Thus began a spontaneous movement of land enclosure that has snowballed in Kericho until "today there is virtually not a square foot of unclaimed land" (Manners, 1965: 232). The Aldev Board describes the Kericho area since 1952 as being one of neatly hedged farms with managed pastures resembling Dorset from the air" (1962: 183). The Kipsigis, lacking a long tradition against individual permanent ownership of cultivated land, as well as the fragmentation of holdings characteristic of the traditionally cultivating tribes, proceeded with land enclosure (and thus permanent tenure), considered as being a necessary preliminary to improved farming in East Africa[1] with much greater speed than did any of the long-time cultivating tribes.

A good example of the interrelationship of directed and spontaneous change in the transformation of East African herders to mixed farmers is that of the Nandi, close cousins

[1]Farmers, it is felt, are loathe to invest much labor or money in land they may have to give up.

to the Kipsigis. Aldev reports that agricultural development schemes, among the Nandi prior to 1956 had concentrated on bush clearance, communal stock reduction and rotational grazing. "It became clear, however, that the money used would be better spent on promoting and guiding private enclosure on the lines followed in Kipsigis" (1962: 159). In Kipsigis, as mentioned above, enclosure was a spontaneous reaction to an increasingly valuable cash crop, maize, which in turn was developed by adoption of the plough. In other words, a Kipsigis invention in land tenure provided the British with a model to follow in directing change among the Nandi.

Traditionally, herders had considered all the tribal land to be held in common for the communal grazing of members' stock. Indeed, it is quite possible, that before the Europeans entered the scene, there were no "tribal lands." There is now much evidence that tribal boundaries (and indeed tribal identities) were imposed on African groups for purposes of administrative convenience by their colonial rulers.

> It is common knowledge that the definition of 'tribal' units; the formation of 'tribal' councils; the use of 'tribal' names in censuses and on official forms--all helped (especially in the British territories) to promote a tribal consciousness which had not

> previously existed. So, too, did the personal attachment of some European missionaries, administrators, and anthropologists to 'their' tribes. (Argyle, 1969: 51; italics mine)

It is therefore even likely that in precolonial East Africa there was no concept whatsoever among herders of the land ownership of any sort, and that various herding groups grazed their animals wherever conditions attracted them, all sharing the land equally as the Masai are said to do today with the herds of various wild grazers.[1] Indeed such a situation prevailed in Dodoth just prior to the year of raiding mentioned earlier. The Turkana had moved into Dodoth to escape a severe drought at home. The two tribes shared grazing and intermarried--maintaining a long peace (Thompson, 1965: 115).

Imposition of tribal boundaries by the Europeans colonial officials had the effect of stopping time as they found it. If the indigenous population did have the concept of tribal land and tribal boundaries, these could not have had fixed areas over time. The herders were not so much moving in as through a territory; they were likely to be in an

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[1]The Masai have been less gentle with human neighbors. Indeed Masailand boundaries were drawn to protect other tribes from Masai raids. (Oldaker, 1957).

area that represented a stage of migration. Cultivators, too, exploited an area by moving through it, though over a much longer span of time. Traditional East African farming was shifting cultivation with old areas gradually abandoned as new areas were gradually opened, resulting in gradual movement of the group.

When the colonial powers drew (and therefore fixed) tribal boundaries, group movement was considerably restricted. It must be remembered that colonialism in East Africa started when many groups were considerably shrunken as the result of the rinderpest and trypanosomiasis epidemics of the late nineteenth and early twentieth centuries.[1] Many groups, recouping their numbers and their stock, found themselves fixed in an area much smaller than they had been used to exploit. This would seem to be the basis for the misunderstandings of the British concerning the status of the White Highlands. The early British settlers, obviously firm believers in an African type of land tenure--right by usufruct, claimed that they took no one's land. The land being at the time unused, they claimed

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[1]There were, during the same period, severe epidemics of small pox.

it was theirs for the taking. The Kikuyu claimed they had only temporarily abandoned their mountains, and, according to their custom, had planned to return.

In any case both land alienation[1] and immutable boundaries had the effect of increasing pressure on the land, and in this way the effect of European occupation was to increase already existing pressures for spontaneous agricultural evolution, or development. Given environmental permissibility it would seem that the major cause of agricultural development is land shortage; more intense cultivation must substitute for expansion of the cultivated area. There are several examples of East African groups which have developed (or, as Murdock claims, in some cases, adopted from earlier Cushitic inhabitants), rather extraordinary means of increasing cultivation from small amounts of land. The Chagga, for example, crowded on the slopes of Mt. Kilimanjaro for fear of Masai on the plains below, have been mentioned earlier for their stall feeding of cattle. Their land cultivation is as intense and as productive. The farms of Chagga living on the middle slopes

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[1] The British assert that they took only 2% of Kenya's land. Since, however, only 10 % of the land is arable, 20% of the arable land was alienated.

of the cultivated area are in two parts. A homestead is situated on the kihamba, where the major crops of subsistence and cash--bananas and coffee--are grown, so that these can get the farmer's major attention. Kihamba are only one to four acres in size and are sufficiently productive to house and largely feed entire families and their stock, as well as supply some of the highest incomes in East Africa. Beans are grown closest to the ground protected by the crop bearing trees. Of these, arabica coffee trees grow in the shade of the banana trees. Goats feed on the hedges that fence the kihamba. Cattle are sheltered in the house. Their manure is applied to all crops on the kihamba. Cattle are fed with leaves and stalks of the bananas as well as on grass and hay carried from the lower slopes on the heads of the women. Banana skins provide mulch for the coffee trees. It is not only manure that keeps the kihamba so productive. The Chagga maintain an intricate system of irrigation leading from the higher forest zone of the mountain. Water, derived from melting snow from the mountain peak, is available year round.

Each family has also a shamba on the lower slopes where it grows maize and eleusine for subsistence and some cotton for cash.

The Chagga have different types of land tenure for their two types of plots. The shamba tenure is by usufruct, while that of the kihamba is by permanent freehold tenure (Brewin, 1964).

Even more intensive farming is practiced by the Kara of Ukara Island in Lake Victoria. The cause of high pressure on the land here, is, of course, the island location, a home its people seem loathe to leave. Each family (average 4.5 persons) has only a little over 2 acres to cultivate. The Kara agricultural calendar comprises a three year cycle in which two separate crop rotations as well as a manure rotation are practiced. Three crops of millet followed by a final one of sorghum are grown. The first millet crop of the cycle is planted by the farmer, the second and third are self-germinated. Interplanted with the millet crops, crotalaria striata and bambara or ground nuts are planted in alternation. The former supplies a green manure which is dug in as a fertilizer in alternation with cattle manure. The latter is prepared from cattle urine and dung which has been mixed with grass bedding and carefully rotted. Rainfall, roughly averaging 60 inches a year, is sufficient for these crops. In separate areas they grow rice with irrigation from brooks. Rice is grown first

in seed beds and then transplanted. The Kara grow elephant grass as a fodder crop in pits dug below the water level at the lake shore. Cattle are also fed on crop refuse, weeds, and the leaves of trees. In addition to this stall feeding they are occasionally grazed on grassland on areas of the island unsuitable for agriculture.

The Wakara practice erosion control of various sorts, including the building of stone-walled terraces near the lake shore.

Although the Wakara work very hard and have been enormously ingenious about getting as much from their little land area as possible, there is no doubt that their population could not be supported from the crops and cattle alone. The Wakara supplement their diet by fishing in the lake.

The Wakara own their plots and their trees outright and sales of land and trees are common.[1]

Another group of people practicing permanent cultivation on limited areas are the Haya of Bukuba District in the northwestern corner of Tanganyika on the shores of Lake Victoria. These Haya live and cultivate (bananas and robusta coffee, primarily) on fertile "islands" scattered amid infertile grasslands (where they

[1]Sources for the material on the Wakara include: Rounce and Thornton (1956), Lunan and Brewin (1956), and Patterson (1956).

graze their cattle). Whatever the geologic reason for this rare land pattern it has resulted in Haya villages and cultivation plots being remarkably permanent. In 1953, Reining remapped a Bukoba subchiefdom that had been mapped in 1911. All the villages in the earlier map were still extant in 1953, as were all the named banana gardens in the single village which Reining studied in detail (Reining, 1965).

Cultivation in Bukoba is on the kibanja on which the homestead is located. It revolves around bitoke (banana) which is the dietary staple, though numerous other food crops, and robusta coffee are also grown.

> The Haya see the maintenance of the kibanja to be accomplished through the return of all parts of the plant--stem, leaves, root mass, peelings -- to the immediate environs in which it grew (insofar as the human occupants eat the bitoke and also use the kibanja for latrine purposes, there is a further indirect contribution from this source) (Reining, 1965: 225).

The few Haya cattle graze the less fertile grassland. Their manure is used on the kibanja. Certain grasses are collected for mulching on the kibanja, another grass is used as household carpet; when soiled with household waste it is used as additional mulching. All these (as are comparable practices of the Chagga and Kara already mentioned) are devices for transferring nourishment from

the grassland to the more important kibanja.

Reining only discusses land tenure of kibanja holdings. The kibanja must not be divided. Each is transmitted directly from a man to one of his sons who remains at home with his father while his brothers must settle elsewhere.[1] Kibanja are bought, sold, and leased. As in the earlier cited areas of intensely cultivated land, on which permanent sedentary residence is based, tenure is not by the usual African method of usufruct, but by outright ownership. This, together with evidence we have cited previously, would seem to indicate that where land supports permanent use, land tenure evolves to ownership. Reining points out a related possible regularity of social organization where a restriction to locale exists. She refers to Marshall Sahlins' suggestion concerning the Tiv, that lineality is a product of long term, repetitive use of restricted resources (Sahlins, 1961: 342). The Haya, she finds, share with the Tiv restricted resources, with the added factor that locale is restricted as well as overall productivity (as it is not among the Tiv who consider

[1]This is the stem family, an adaptation to the same need to preserve the family farm intact as it is among Irish peasants (Arensberg and Kimball, 1948: 109).

their land, not as having a specific locale, but rather as being a guaranteed share of the land of their lineage (Bohannen, 1963, 225).

Reining compares the case of the Haya not only with that of the Tiv, but also with that of the Nuer. The herds of the Nuer represent restrictive resources. But the Nuer, like the Tiv, do not share the restriction of locale characteristic of the Haya. Reining theorizes that when restriction of productive resources is combined with flexibility of locale (as for the Tiv and Nuer) segmentary lineages, as Sahlins claims, are likely, but when "there is restriction to locale as well, a system of territorial groupings is likely to result" (1965: 236).

Looking at another tribe which, like the Haya, have both restricted productive resources (land and water) and locale, the Sonjo or Tanganyika, it seems unlikely that Reining has made a valid generalization. The Sonjo form an isolated enclave deep in Masailand, so restricted as to locale by the historic necessity of protection from Masai aggression that they have lived nucleated and fortified in the same six villages for two hundred years. The Sonjo are able to practice intensive cultivation because they exploit a river valley bottom and its flanking slopes where the

alluvial soil responds well to the irrigation brought to it from the river and from valley springs by an ingenious system of dams. The Sonjo live in villages, as do the Haya, but each village is divided into patrilineal clan wards. Perhaps Reining needs to add one more factor to the conditions leading to territorial rather than lineage organization, and that is the inheritance system. The Haya, as mentioned above, restrict inheritance of a man's land (which combines residence and subsistence plot) to a single son, the other sons departing from the area. This separation of brothers would, of course, work against the evolution of lineages. The Sonjo clans allocate residential plots in their wards to all clansmen. Cultivation plots are individually owned, and inherited by all sons. It would seem that when the agnatic group is kept together as corresidents in the restricted locale, formation of localized lineages, and even of localized clans is not ruled out.

Another case in point is that of the Turu who live in permanent villages near the swamps which provide year round food and water for the cattle which, in turn, provide the manure which enables the Turu to cultivate their fields permanently. The units of Turu society are

the localized lineages which act as corporations for the ownership of the livestock which are the vital capital goods supporting their subsistence system (Schneider, 1964: 73).

Whatever the effects on social organization of restriction of locale, evidence is clear that such restriction is a force towards intensification of agriculture. There is also evidence, from East Africa as elsewhere, that whereas cultivators are able to respond to the challenge of restriction of locale by intensifying agriculture, such response is looked upon more as a necessary adaptation than a preferred one. Where restriction to locale has been lifted, people have often given up their clustered settlement pattern and their intensive cultivation. The Gishu of Mt. Elgon in Uganda, for example, had been driven to the higher slopes of the mountain by raids of numerous herding tribes. There they lived by increasingly intensive production of bananas as their numbers increased. When the British administration put a stop to the raiding the Gishu colonized the lower slopes. With plenty of good land available, they abandoned their intensive cultivation practices for those of shifting agriculture (Allan, 1965: 168). Similar instances of agricultural devolution following on the imposition of a Pax Britanica are reported for

other East Africans as well as for groups elsewhere. The Wambulu, held in highland Kainam by Masai and Mangati raids, at the time of European contact were practicing several methods of preventing soil erosion. These included storm trenches around the upper ends of fields, and pumpkins planted to hold shifting soil at their lower ends; contour planting; ridging; and even terracing of the mountain slope. Since the Pax, free to spread out from their former clustered settlements, they have been gradually abandoning these practices (Sturdy, 1938). Elsewhere in Africa, Robert Netting has reported a like phenomenon among the Kofyar of northern Nigeria (Netting: 1966), And, of course, Leach has described the classic case of agricultural devolution following on the Pax Brittanica among the Kachin of Highland Burma (1965: 27). The reasons for reversion to less intensive cultivation seems to have been the same in all cases--with no limitation on land, the same amount of crop can be produced for considerably less effort. In fact, in the Kofyar case, Netting claims "Shifting cultivation obviously gave the highest return per unit labor in a situation where land was not a scarce commodity" (1966: 35).

The Hehe of the Southern Highlands of Tanganyika,

having responded in a different manner to raids and warfare than did the aforementioned groups, underwent an opposite subsistence change with European imposed peace--this time from the Germans. The Hehe did not retreat up the nearby mountain. They remained on the plains below to become warriors themselves. Close settlement is efficient for calling up an army quickly and for the care of large herds which, in turn, are well adapted for serving a constantly moving army with food. The Hehe were warrior-herders. With the coming of peace, the Hehe spread up the mountain. Those inhabiting the highlands now practice shifting cultivation of the chitemene type. (Winans, 1965).

Today, for most of East Africa, land is becoming an increasingly scarce commodity, and there is not always land to be allotted to young men. Young men often leave their tribal areas for wage work on other Africans' farms, on European plantations, in the towns, and even in the copper mines of Zambia. Among the Lugbara of northwest Uganda, migration to southern Uganda to work as farm laborers, or to grow cotton for themselves has become a form of temporary tenancy which provides land away from home for the young men until such time as land becomes available for them at home. This has become such a general pattern among

the Lugbara as to have become part of a new economic life cycle for the men of the tribe (Middleton, 1966: 12).

In order to make the point that indigenous subsistence arrangements in East Africa have evolved largely as adaptations to the local ecology and history, several examples of specialized subsistence systems have been cited. It is necessary also to describe some generalized characteristics of East African Agriculture. In the Ottenbergs' terms, most East African Agriculture would be characterized not as true shifting cultivation but rather as "bush fallowing" which they describe as:

> the practice of leaving a section of previously cultivated land fallow for a number of years in order to restore its fertility. This is accompanied by true sedentary residence, with permanent settlement in one location" (1960: 24).

In East Africa today, pure subsistence cultivators are limited to a few tribes in southern Tanzania. Ecological conditions, particularly the widespread prevalence of tsetse, combined with underpopulation resulting from the slave raids, wars against the Germans and severe famines of the last century, have isolated these tribes from development. Elsewhere all tribes are involved more or less in the cash and market economy, even if only to sell surplus subsistence crops, and even if only enough to pay

their taxes. The addition of cash crops, however, has not necessarily changed agricultural techniques, or tools, though it usually has, to some extent, altered the traditional division of labor between the sexes. In most East African societies, crop cultivation has always been the sphere of women. Today this remains true for the subsistence crops, but often cultivation of cash crops has been taken over by the men (Johnston, 1965).

The agricultural year may consist of a single cycle or it may encompass two separate cycles, depending on whether there is a single or double rainy season. As the most generalized system, the double cropping one will be described.[1] At the end of the long dry season, fields are prepared by the men who cut bush, gather the felled material into piles with the aid of the women, and burn it in the field. (Some tribes in southern Tanzania add to this branches pollarded from trees growing in an extensive area surrounding the field to be opened in a system known as chitemene (Makings, 1966: 201). After the first rain has softened the soil the ash is turned in to the soil by the women as they break the soil (twice, according to Thompson)

[1]This description largely follows that of Thompson, 1950.

with their short-handled iron hoes, preparatory to planting. When the rains are established, staple grains are planted by the women. For maize or sorghum they open a hole with the short-handled, iron bladed hoe, drop in the seeds and allow the earth to fall back to cover them. Finger millet is broadcast on the prepared surface and hoed lightly into the earth. Where the rainy season is sufficiently long maize will be planted a second time to provide a second harvest. (Maize may take as little as three months to mature, whereas millet and sorghum require six months.)

Beans are interplanted with the early sown grains, and later, groundnuts. Weeding is done several times during the growing season by the women and older men. Towards the end of the rainy season, fresh ground is broken for the planting of sweet potatoes. Then the grains are harvested, the best being saved to provide the next season's seed. At the end of this second dry season, plots are prepared for the short rain crops, usually beans, cowpeas, gram, simsim and maize. These are weeded and then harvested by the women at the time the men are busy preparing fields for the next long rains.

Although Thompson's account of a typical Kenyan

subsistence cultivation system mentions only the single agricultural tool of the short handled iron hoe, other accounts of agricultural practices among various tribes often mention a machete like knife (panga) used to cut bush and grass, and a digging stick with a fire hardened point, used for planting. Schneider describes the planting tool of the Turu as a wodden paddle used to turn the sand under which seeds are planted, and then to turn the sand back over them (1966:26).

Other frequent cultivation practices indlude the joint efforts of cooperative work-groups, of both men and women, for the larger and more laborious tasks of the cultivation cycle. Such groups are organized among kin or neighborhood groups, and, although membership carries obligation to show up for scheduled services, workers are usually compensated by an after-work beer drink provided by the man receiving the services. The special and occasional functions of these groups did not always allow for their adaptation to demands of agricultural development. One scheme dependent on the extension of services of such groups, failed (case 4). Another succeeded (case 23).

A further usual division of labor is that where a man has more than one wife, each wife has her own fields

to cultivate, the husband being responsible for land preparation for the fields of all his wives. According to Tanner when a group moves into an area of bush requiring more of a man's work in clearance, the number of wives per man declines. (Tanner, 1958).

As generalizations can be made for land use in traditional East African societies, so can they for land tenure, Again, many instances of special land tenure arrangements have been mentioned, but these would seem to represent evolutionary steps above the basic traditional type of land tenure which is, for herders, ownership of all land by the tribe with all herding land a commonage to be freely used by any member; and for cultivators, ownership by the group (or in the case of the Uganda kingdoms, by the ruler) with rights of usufruct protected for members. These usufructuary rights are obtained by allocation of specific plots to specific persons.

Often the specific plots allocated include separate ones for each of the ecological types which make up the group's land. Where land is allocated in single blocks, cultivators often "lend" portions of their allocated plots in exchange for loans of portions of plots from farmers whose plots represent different agricultural potential (Malcolm, 1953: 52; Hamilton, 1969: 9).

Oldaker reports that for the job of allocation, most East African tribes had a special land authority, either an individual or a group. Although in all groups allotted land has definite, known boundaries, only among the Hehe of Tanganyika were allotted plots of a standard size. For other tribes, the notion of standard sized plots was introduced only with the order from colonial authorities that each farmer must plant an acre to famine root crops. (An acre was defined as a plot of seventy paces, square) Allocation of plots was usually permanent, and mainly unconditional. Where conditions were imposed they usually concerned continued use and/or good behavior. Requests for land and notices of abandonment of land were to be made to the land authorities. If a man were to simply take occupancy of land without its being allocated to him, where there was no pressure on the land this misbehavior would usually be forgiven after the giving of an apology and a beer party; should there be pressure on the land the plot would be taken from him (Oldaker, 1957).

Usually land allocation was a free right to community members. The Wambulu, however, were reported in 1938 to be required to pay the hereditary elders in oxen for use of a piece of land. These oxen were kept in a trust

account to provide relief supplies for widows and the sick (Sturdy, 1938).

Obol-Ochola (1969) has identified four evolutionary stages of land tenure, formerly and/or current in East Africa: 1. ownership of land by the entire community or tribe, to ensure the group's existence, or for defense; 2. with the establishment of law and order, and the resulting population increase, ownership of land passed to the clan, and 3. later to the family and 4. eventually to the individual. He adds:

> because of commercialization of agriculture, permanent cultivation, improvement in structure and durability of buildings and perhaps the individualism of the colonial masters there is a set trend of individual ownership of land throughout Africa" (37).[1]

Oldaker would add to these causes of the trend toward individual tenure, Muslim inheritance laws and the planting of trees (1957: 120). According to tradition, although the land on which they had been planted was the property of the group, trees were owned by the man who planted

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[1]Outside influence in establishing individual tenure was even clearer for Buganda, where, by the Uganda Agreement of 1900, British granted Mailo lands to the chiefs in holdings of from 20-60 square miles (hence mailo). Peasants remained on the holdings as tenants (Richards, 1963: 267).

them, or by his heirs.

Oldaker further related communal ownership to shifting cultivation. He finds that planting of trees, population pressure and soil fertility all work against shifting cultivation, and hence, toward individual tenure (1953:20)

One final aspect of East African Agriculture, and changes therein, remains to be examined, and that is the crops themselves. A consideration of the origin of the common subsistence crops shows that a goodly number have been introduced. Most can be classified according to their origins, in one of three groups: 1. native cereals include the millets (sorghum, pennisetum and eleusine); 2. of Asian derivation--the banana was introduced perhaps a thousand to fifteen hundred years ago; and 3. from the Americas, maize, manioc and sweet potatoes were introduced during the 16th and 17th centuries (Seddon, 1968: 494).

According to Miracle, who made a study of the spread of maize in Africa, this now popular staple was almost unknown in East Africa as recently as a hundred years ago. Early in this century, it was introduced by government as well as by white farmers who fed it to laborers. In Tanganyika, the German government encouraged the production of maize as food for their troops in World War I. After the

war, the British colonial administration issued maize meal as famine relief. African farmers took to planting maize themselves in anticipation of poor harvests, since its time to maturation (four to five months) was shorter than that of the millets and sorghum (six months). In Kenya, it was found that maize survived a locust invasion better than other grains. Some Africans were encouraged early to increase their maize plantings for selling as food for laborers. During World War II, this commercial production was greatly increased as government encouraged maize growing as part of the war effort. Government's policy of guaranteed high prices for corn was continued until 1954. Local consumption of maize increased along with its production, so that, by 1958, when the Tanganyika government carried out a study of diet changes with increase of disposable income in twenty districts, it was found that in ten maize was already the staple; in six it was replacing millets, sorghum and manioc as the staple. Interestingly, in some districts people of high income were already replacing maize with wheat or rice (Miracle, 1962: 122-136).

Adoption of new food crops is still going on. Newman recounts how the Sandawe adopted maize as their staple food only after the severe 1961-62 famine which they

survived through gifts of U.S. surplus maize. At the next planting season, maize seeds were the only grain seeds available; therefore the Sandawe planted maize. Now the Sandawe like their maize. They find it more resistant to bird depradation than the bullrush millet and sorghum that had been their staples from the beginning of their cultivating history. It is also more marketable when there is a surplus (Newman, 1970: 6).

On the Mwea-Tabere Irrigation scheme (case 14) farmers were issued dry plots for subsistence cultivation in addition to their paddies. Rice was intended to provide a high value cash crop. But farmers have come to like rice for subsistence as well as cash.

Jones points out that as regards foodstuffs, East Africans have changed both production and consumption patterns in response to market prices. For example, in 1953, after a year of poor food crops caused by poor rains in Uganda, the price of all staples in the Kampala market, with the exception of corn, was greatly increased. Corn prices were held relatively stable by government control. And corn was plentiful--the year before there has been no price control, and with the shortage of all staples, farmers had been able to get a very high price for their corn, which

had motivated them to considerably increase their corn acreage. Consumers of all tribes responded to the price differential by decreasing their consumption of their preferred staples (bananas, manioc, sweet potatoes) and increasing their consumption of corn. One group, the Banyankole have since continued using corn meal as a major staple (along with banana) replacing the previous manioc flour. Other groups substituted the corn only during the year of prohibitive prices for their traditional staples.

In discussing this situation, Jones comments:

> The data obtained by the Kampala expenditure studies are entirely consistent with orthodox notions of economic response. They also suggest strongly that even the most firmly rooted consumption habits can be upset by a sharp change in relative prices" (1960: 119).

Beidelman, in a recently published ethnography of the Kaguru of Kilosa district, Tanzania, points out that whereas:

> Government officers . . . berate the Kaguru for not planting more cash crops such as castor, tobacco, cotton and sunflowers, rather than maize" (1971: 21),

the Kaguru have good empirical reason for their refusal to substitute the cash crops for some of their maize production. The Kaguru suffer a poor harvest about one year in every three. When this happens, they have to purchase maize

from Asian merchants who charge high prices. (Indeed they are often buying back some of their own crop at a greatly increased price.)

It would seem, then, that although it may be true, as Herskovits contends that markets were non-existent in East Africa before the colonial period (1962: 65). East Africans are not lacking in so called rational market mentality. Indeed there is every evidence from studies of traditional cultures that, if markets were unknown, trading, and particularly trading in foodstuffs was very common. Many such examples of trading between villages, tribes, intra-tribal trade partners, affinals, etc., have been given.

Schneider, in a study of economic behavior of the Turu, claims that this tribe showed familiarity with market principles when the Germans first contacted them. With the Germans came the traders, Arabs and Nyamwezi, to whom the Turu sold cattle for cash. Schneider believes that to the Turu, their cattle traditionally functioned as money; today the cattle money and East African shillings are interchangeable in economic transactions; cattle are exchangeable for grain at the rate of 20 debes (gasoline tins) of grain for one heifer, or 12 debes of grain for a steer; one debe equals four East African shillings; one goat equals 20 shillings (or 5 debes or 1/4 heifer). (1964: 57).

Colonialism

All the cases considered in this study were initiated during the British colonial period. All but four of the schemes were directed by colonial agents. (The two Sukuma marketing co-ops, cases 5 and 6, were initiated by tribal members; the coastal smallholders scheme, case 22, was attempted by a European estate; the Kikuyu pineapple scheme, case 16, by European cannery owners). It is therefore necessary to summarize briefly the history of colonialism in East Africa, particularly as it affected agriculture.

The effect exerted on agriculture by colonialism was both direct and indirect. From the very outset, colonial policy was agricultural policy. As Lord Lugard stated (1965: 43), the objectives of the European powers in colonizing Africa were two-fold: to obtain a cheap supply of raw materials for the factories of the home countries and to provide additional markets for the products of its factories. Since the great preponderance of primary products of East Africa are agricultural, the first aim largely dictated agricultural policy.

Further goals of the colonial powers included settlement of Europeans and provision of a cheap labor supply for settler enterprises. Alien settlement, of necessity, reduced African lands, whether obviously, as in the case of early German settlement in Tanganyika where large numbers of Africans were moved from the densely settled fertile Kilamanjaro slopes, or latently, as in the case of Kenya where Europeans were settled on temporarily vacated Kikuyu lands. To African swidden

cultivators, loss of land represents not only the loss of an immediate cultivation resource but implies the additional burden of limiting movement to fallow land, an essential part of their cultivation system. Exaggerating the restriction of movement imposed by land alienation, was the fact that, for administrative convenience, the European powers set fixed boundaries to tribal lands.

East Africa officially came into colonial status in 1890 when the Heligoland Treaty gave Tanganyika to Germany and Uganda and Kenya to England. Although the early colonial history of the three countries differed in certain respects, the effect on their economies was to produce models which were similar, according to Seidman (1969) in that each represented a dual economy consisting of a small export enclave and a much larger hinterland.

In Tanganyika, German colonists developed plantations emphasizing sisal, rubber and cotton. African peasants were encouraged to grow coffee and cotton, the first primarily on Mt. Kilimanjaro, the second primarily in Sukumuland. Both of these early peasant industries have prospered and continue to do so today.

After their defeat in World War I, the Germans lost Tanganyika which was ceeded to Britain under League of Nations Mandate. The British sold the German plantations to other Europeans and to Asians, but insecurity attached to the mandate status discouraged large investments by the new owners. These plantations continued to produce sisal, and also coffee. After

World War II tea was added as an additional plantation crop. These aliens share the export enclave with the African cotton and coffee producers whose number and contribution has greatly increased due to increased agricultural extension and agricultural marketing schemes.

The export enclave of Kenya, from the time of the Crown Lands Ordinance of 1902, has largely been made up of white settlers cultivating huge estates in the highly fertile "white" highlands. This ordinance assigned better than 13,000 sq. mi. of highland to the relatively few European settlers and less than three times that amount to Africans. Many Africans made landless and/or occupationless due to crowding in their "non-scheduled" areas worked as laborers on the European plantations, helping to produce their major exports of tea, coffee, sisal as well as maize, wheat and cattle. African farm hands were often permitted small homes and plots on plantation land, rights granted in return for labor.

In Uganda, huge grants of mailo land were made to the Kabaka of Buganda and his subchiefs by the Buganda Agreement of 1900. Thus was created a landowning class of about four thousand Africans. This transformed chiefs to landlords, and their subjects, to whom the chiefs had customarily allocated usufruct land, to tenants. In Uganda it is Africans, often tenant-peasants, who make up the bulk of the export enclave, producing largely cotton and coffee with the help of migrant laborers.

An agricultural development in East Africa was designed to fit the needs of the home country, it also reflected events

in the distant land. The great depression of the 1930's, reducing the market for raw materials, and World War II, draining personnel and funds from the colonies, brought agricultural development to a virtual standstill. Immediately following the war, the grand-scale Groundnut Scheme conceived in London by the newly formed Overseas Food Corporation to provide fats for the needs of the English and to serve the needs of economic development in East Africa, was initiated in East Africa with enormous expense and minisoul results.[1] It's failure, conceeded in 1951, discouraged the trend to large area schemes in East Africa. In the late 1940's and early 1950's, emphasis, especially in Kenya, was on developing group farms. By 1955, all Kenya group farms had been abandoned. The history of two (cases 3 and 4) are reported in this study.

Following publication of the East African Royal Commission Report in 1955, planning was conceived mainly on a local basis, emphasizing the individual farmer. In Kenya, the major model for development was provided by the Swynnerton Plan published in 1954. This plan aimed to increase by ten times the incomes of African peasants in the fertile areas as well as to increase the export of cattle and encourage consolidation of fragmented farms. Many of the schemes of the African Land Development Board reported in the following chapter were initiated in accordance with the Swynnerton Plan.

In Tanganyika, after World War II, British policy was to encourage both increased European settlement of the highlands

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[1]According to Weidner (1962:402) an expenditure of £35,000,000 yielded 9,000 tons of nuts, about 1.5% of expectations.

and increased African production. According to Ruthenberg (1964:45-60), implementation of the latter aim went through three stages: provision of increased development services; compulsion by means of administrative ordinances (see case 15, Enforced Cultivation of Manioc, case 24, Uluguru Land Usage Scheme and case 25, Iringa Dipping Scheme); and, when compulsion was judged a failure in the late 1950's, persistent persuasion. This last policy, which depended on extension services, continued to the time of independence.

The history of colonial agricultural policy in East Africa, designed as it was to manipulate African agriculture for the primary benefit of an alien land and alien settlers, had much to do with the success or failure of specific schemes. Often farmers were not motivated to cooperate in a scheme in which they could see no benefit to themselves. Later, as the move toward independence gathered momentum they were disuaded from accepting a colonial government scheme by leaders of the movement. At least two instances of active revolt against European land policy occurred. Both served to increase agricultural development. The first, the Maji-Maji revolt against the Germans (and their Arab agents) in Tanganyika in 1905, ended when the German imperial army burned the rebels' crops. Though many of the rebels met with death, their protest served to bring the plight of the Africans to the attention of the mother country so that German policy underwent reforms which stimulated agricultural development. The second, the Mau Mau

revolt of the early 1950's in Kenya was instrumental in furthering agricultural development in that, after the Emergency the administration had control of former Mau Mau whose labor they could command (see Mwea-Tabere Irrigation Scheme, case 14), and the "temporary" villages set up for control of other Kikuyu, as well as the detention of their leaders, provided an ideal situation for promulgation of land consolidation schemes. (Contrast cases 1 and 2.)

Summary

The foregoing discussion of the natural and socio-cultural ecology of East Africa and its relation to local agricultural practices was designed to show the scene into which agricultural development schemes have been introduced, in order that the fate of these schemes might be analyzed with some degree of validity. In other words, attempts at agricultural development may not be looked at as merely attempts to change behavior. They are, in actuality, attempts at influencing an ever ongoing evolution in subsistence cultivation practices.

It is hoped that certain systematic conditions affecting agricultural evolution in East Africa have been demonstrated, so that they may serve as a guide in analyzing the development schemes. They are:

1. Everywhere in East Africa cultivation practices have evolved as more or less successful adaptations to the opportunities and limitations, i.e., the environmental potentials, of the local environments, Environments may be very localized in East Africa, and so are the cultivation practices. Agricultural development planners should be sure, therefore, that they are aware of local environmental conditions and that the proposed innovation is adapted to its site.

2. Since local environmental conditions in East Africa vary greatly from year to year (rainfall variation, disease and vermin occurrence, etc.) subsistence adaptations have customarily been to minimal rather than to average environmental conditions. This allows very little play in the adjustment of cultivation practices to environment. The first requirement of agricultural development schemes is that their technological feasibility must be established without risky experimentation.

3. The major concern of most East African peoples in their adjustment of subsistence practices to environmental minima is to insure against subsistence risk. Looked at in this way, much of the culture content of East African groups not usually classified as subsistence practices can be understood as defenses against subsistence risk, and therefore, as subsistence practices.[1] These include social organization (the stem family of the Haya, for example); status related exchanges (as cattle between Samburu stock friends); ritual practices (killing of animals only for ceremonial feasts), etc. Subsistence practices have been incorporated into every area of culture; they are woven

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[1]These subsistence serving "non-economic" culture traits are part of what Steward terms the "culture core" (1955: 37).

very tightly into the lives of the people. Historical records, show, however, that they do change and in their wake, the "non-subsistence" areas of culture change as well. The next suggestion for development planners is borrowed from Hamilton:

> . . . the way to avoid great social cost is to avoid tampering with the social system directly, limiting innovation to technical change, which will allow the social structure to adapt by itself in only those ways necessary (1969: 25).

4. African cultivators are aware that their environment has become ever more limiting within living memory, whether due to increase of tsetse, restriction of movement (movement has traditionally been one of the chief strategies of both cultivators and herders in the struggle to avoid subsistence risk), or extra pressure on the land. They have made their own attempts at adjustments to these extra threats to subsistence. They have shown a readiness to adopt adjustments presented by others, whether by borrowing from a neighboring African group, or, as directed by foreigners, where they have been convinced that the practices not only do not threaten subsistence security but will, in fact, offer them some real advantage. ("Real" refers to "as perceived by them," or "in their understanding"). Since most East Africans have had experience

with some form of the market economy, "real" advantages include cash income, as long as markets are available where the cash can be used to protect against subsistence risk, and perhaps offer other commodities.

It is against this background of the limitations of the physical surround, the cultural pervasiveness of subsistence concerns, the desire to better (and the fear of worsening) the conditions of life, that attempts of agricultural development must be evaluated. In other words, the questions to be asked in planning an agricultural development scheme should include: 1. "On what basis have the people come to their decisions as to subsistence strategies?" 2. "Will the strategies we propose work in their situation?" 3. "Will the people have to give up too much in adopting the proposed change?" and 4."What's in it for them?"

CHAPTER III

CASE STUDIES OF AGRICULTURAL DEVELOPMENT IN EAST AFRICA

The following forty-one cases of agricultural development schemes in East Africa have been chosen from among the many recorded for the area to meet certain requirements. First, in line with the point of view of this study that type of change is relevant to acceptance or rejection of change, schemes chosen must be representative of the various types of agricultural change attempted in East Africa. In classifying types of change I have followed the typology presented in the Introduction to the Library of Congress bibliography, "Agricultural Development Schemes in Sub-Saharan Africa" (1963), choosing representative schemes from each category--with one exception to be explained below--as met further requirements:

There must have been completeness of report. Completeness, as required for this study, includes an account of the interaction of the innovation with the existing ecology as well as the essential elements cited by Arensberg:

> It requires a record of the needs and the problems before the project, the plans and their implementation during the project, and the response of the recipients to the innovators and the innovation. It includes as well how local people worked out the "bugs," with or without the help of the innovators, how they fitted the amended technique into the other knowledge, resources, habits, and concurrent changes in their way of life, and finally, after the project, how the technique was finally incorporated into their culture--something that comes only when the receivers can pass the technique on to their neighbors and their children--in short, amongst themselves (1967: 66).

The schemes are presented in groups following the classification borrowed from the above mentioned Library of Congress bibliography (1963: VI, VII). These include: 1. attempts to transform or adapt indigenous systems of land tenure; 2. attempts at organizational improvements such as marketing cooperatives and group farms; 3. attempts to innovate improved practices--including mixed farming; mechanization, water control, cash crops and soil conservation; 4. livestock improvement schemes; and 5. resettlement schemes.

A final type of scheme included among those in the bibliography--community development schemes--is not among those included in this study. In community development schemes, agricultural change is only part of a change

packet; often it is tied to some extremely popular innovation, such as literacy training, which may be made contingent on acceptance of the less popular items in the packet. It seemed to me, therefore, that acceptance of agricultural innovations under those circumstances are not comparable to acceptance of innovation in the purely agricultural schemes and would obscure the dynamics of acceptance of innovation in agriculture which this study attempts to identify.

Comparability of cases is necessary to lend validity to conclusions as to factors influential in acceptance of change. Ideally, any attempt to establish cause and effect relationships should follow the laboratory method of the pure and natural sciences. Here the subject to be tested is compared with a control which is similar to itself in all respects except the one variable under study, so that conclusions can be made with "other things being equal." In schemes involving elements so complex as ecology and human groups it is not possible to find a situation, "other things being equal." In order to approach this ideal laboratory situation as closely as possible, cases are presented, as mentioned above, according to category or type of change. Within these categories, wherever possible, cases will be presented matched with another or others with

which they share one or more factors--same tribe, for example, or same scheme presentation, again, to limit the variables. In fact, some schemes involve more than one tribe, thereby very closely approaching the laboratory situation of "other things being equal." In cases where different schemes are quite similar, and some succeed, while others fail, successful cases are presented first so that they may, to some extent, be considered the control for the failures.

In many cases a scheme might justifiably be classified under more than one of the classifications used. Mwea-Tabere (case 14), for example, is a settlement scheme; a cash crop scheme; an irrigation scheme; and a scheme which transforms land tenure. Since, for the subjects of the scheme, who were chosen exclusively among landless people, it seemed to me the major change required was the change to irrigation agriculture, the scheme is classified as an irrigation scheme. Similar decisions were made in other cases where schemes involved more than one type of change.

The Case Studies

1. Attempts to Change or Adapt Indigenous Systems of Land Tenure

Case 1. Nyabondo Luo Land Consolidation and Farm Planning Scheme, Central Nyanza District, Kenya[1]

This improved farming scheme depended on the prior consolidation of each farmer's fragmented holdings which were scattered at random throughout his lineage (Jokakware) land. Initial attempts at persuasion for consolidation met with severe opposition, particularly from the 50% of local men who worked away from home and whose financial remittances contributed importantly to support of those left behind. The District Officer's attempt to influence the absentees by holding barazzas for them in Nairobi and Mombassa ended in uproar.

After farmers of one small Luo area who had decided for consolidation in early 1957 were dissuaded by local politicians, who spread the suspicion that improved land would be alienated to Europeans,[2] the scheme directors

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[1]This case is based on McEntee, 1960.

[2]Fear of further land alienation to Europeans was a frequent cause of negative attitudes towards agricultural development schemes in East Africa.

decided to officially discourage consolidation. To this end they held local barazzas in which the people were told that, inasmuch as they were unready for consolidating, they would be offered no help in doing so. Only those who were able to consolidate on their own would then be offered assistance.

One Luo group on asking for help, was taken to visit areas in Elgon-Nyanza where the people had begun consolidating. Within three weeks after being shown this example they had completed their own consolidation.

This was done within the traditional system by which land was allocated by joint action of the jokakware elders, as well as that of the entire jokokware. Each man's plot was then enclosed by hedging with the help of communal labor. All of this was encouraged by the local agricultural officer whose help was always available on request.

The scheme prospered under this system of assisted self-help; at the time of report (1960) 220 groups had completed consolidation. Help in farm planning (including cash crops) was available on application.

Analysis

This scheme met with opposition from two sources:

1. male absentees who saw it as a threat to their traditional authority, and 2. politicians desiring to fan the flames of nationalism. This aroused a negative attitude toward the scheme. Government's ploy to counteract this was to make the scheme "hard to get." Many wanted to take advantage of farm planning; it was consolidation which was resented. Farm planning, therefore, was made contingent on consolidation. With this tempting reward, villagers ignored the propaganda against consolidation. They were also motivated toward consolidation by seeing how well it had worked elsewhere. (This is demonstration, the best form of communication.) Consolidation was implemented according to traditional ways of land allotment and through the traditional land authorities.

To summarize, factors working towards success of the scheme were: 1. the "real" advantage of farm planning; 2. demonstration of feasibility and benefit; 3. adaptation to the culture.

Case 2. Land Consolidation in the Fort Hall District (Kenya)[1]

From 1952-54, during the Mau Mau Emergency, Kikuyu farmers had been settled in villages for easier control by the colonial government. Immediately after cessation of hostilities, taking advantage of this--as well as of the

[1]Unless otherwise noted, this case is based on I.B.R.D. 1967: vol. 2, 5-13.

absence of the rebel leaders who were being held in detention far from their home areas--government propagandized for land consolidation.

In Kenya, for many years, agriculturalists had been bemoaning land fragmentation as one of the leading deterrents to development. Fragmentation was most exaggerated among the Kikuyu whose inheritance pattern was to divide each of a man's many plots among his several sons. It was felt that the post rebellion control should be used to promulgate consolidation and registration of land, not only to overcome the agricultural problems stemming from fragmentation, but also, according to Sorrenson (1963), to promote counter-revolution to Mau Mau. For this latter object it was planned that consolidation would create a conservative middle class of Kikuyu large farmers.[1]

Fort Hall was the last of the Kikuyu Districts to undergo consolidation. Management considered that speed was important. For this reason it was planned to complete the tasks of consolidation in the period between the two planting seasons. The consolidation unit was therefore kept small, being limited to a single itura. (As mentioned

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[1]It also created a landless class, since those landholders whose total holdings were considered to be too small for economic farming were deprived of their land.

in case 23, the itura is a local land holding unit, the smallest to have traditionally been under the rule of a Council of Elders; five ituras make up a location.)

Persuasion followed the following course. 1. Location chiefs were taken to visit other Kikuyu areas where consolidation was obviously prospering; the scheme was then proposed to the Land Board of the African District Council and then to the people as a whole; the chiefs consulted with their elders, the traditional land authorities; actual decisions as to ownership and reassignment of fragments were left to a committee composed of a chief, his headmen, the leaders and a registrar from a local African court.

Traditionally, Kikuyu had owned land and had been permitted to mortgage it for goats under condition of redeemable sale to other Kikuyu from outside their own district. All such land was redeemed so that only community members would own land in the itura. Farmers' requests that consolidated holdings, in as far as possible, be organized in strips running down the hillside so that they might have land of the total catena as their customary famine insurance had dictated were included in the planning. Farmers were usually surprised and pleased at the unexpectedly large size of their new consolidated plots. They were also pleased at the promise of reduced time spent in

walking between their often far separated individual holdings. Where a farmer had to leave permanent crops on some holdings, these passed with the land to the new owners, by whom he was compensated for their loss.

Consolidated plots were usually in the area of each farmer's largest holding. For holders of large plots their homes were to be on these plots. For holders of small plots, termed "cottagers," their homes would be in the village along with those of the landless (Aldev 1962: 94). Where one group of farmers refused to move to a ridge which they held to be bewitched, they were allowed an alternate site.

The scheme succeeded. In one sample itura, in the five month interplanting season, 1200 acres had been consolidated and divided among 200 land holders after 300 mortgages had been redeemed.

Analysis

Since all Kikuyu consolidation schemes were instituted during the absence of potential subversive elements of the population and while the remainder of the population were living under government control, an element of coercion undoubtedly existed.

However, in implementing the scheme, traditional leaders and total population were consulted, and traditional land authority, along with other community leaders, were included on the land allocation committee.

Flexibility was sufficient in most cases to honor landowners' desires to include various levels of the mountainside in their consolidated holding, and, to allow those allocated land in an area they held to be bewitched to move elsewhere.

Farmers saw the advantage of having all their land in one piece, obviating the customary long walk between plots. They saw benefit too in the unexpected large size of their plots.

Logistics were well planned in that the work of consolidation was entirely accomplished in the recess between two planting seasons, and farmers were compensated for the loss of any permanent crops.

2. Attempts at Organizational Improvements

Case 3 Planned Group Farming in Nyanza Province (Nyanera)[1]

Following a resolution adopted by a Conference of

[1]This case is based on 3 biennial reports of the Colonial Office of Great Britain (1951, 1953, 1955).

Agricultural Officers in Kenya in 1947 to encourage cooperative effort in order to raise the standard of living of the people and improve and preserve the productivity of the land, a number of schemes for group farming, which was considered to be "in accord with former indigenous methods of land usage and social custom" (1951: 1) were started.

The Nyaneri Group Farm was opened in 1948 with 77 members on 960 acres of land. Members were cooperative at first. They exchanged their fragmented land parcels to consolidate invidual holdings, moved their houses so that all could be located on a single contour, planted designated rotational strips with grass leys and made use of manure in their gardens.

The first of three biennial Colonial Office Reports enthusiastically deemed the scheme a success (1951: 1). Two years later a second report noted the decline of the scheme (1953: 1). At the time of the final report (1955), the scheme was entirely abandoned, the reason cited for failure being the apparent misunderstanding on the part of the settlers that technical and financial aid provided at the opening of the scheme would continue.

The fate of the Nyanera Group Farm was repeated throughout Nyanza Province; the 1955 report states "the Group Farm Principal has failed completely" (1955: 27). In

fact, according to Aldev, by December 1954, "every group farm started in Nyanza Province was completely moribund as such" (1962: 175).

Analysis

This scheme, as most group farm schemes, was based on the mistaken notion on the part of Government, that constant cooperative work in agriculture was "in accord with former indigenous methods of land usage and social custom," whereas in fact, most East African tribes had reciprocal help groups which performed certain obligatory occasional tasks for each other in exchange for beer. They were not particularly adaptable to steady, year round cooperation in all phases of cultivation.

Insofar as this farm appeared to succeed, initial cooperation was due to the mistaken notion on the part of members that they would receive continuous financial help. When this was not forthcoming, members could see little advantage to the scheme; membership declined, eventually to zero.

Failure can be ascribed, in part, to a two-way failure of communication.

Case 4. Gusii Group Farms.[1]

Arthur Phillips, in his introduction to anthropologist Philip Mayer's study of the cooperative agricultural work groups among the Gusii of South Nyanza, Kenya, stated his belief that it "provides the indisputable basis for administrative experiment" (1951: 3).

The work groups studied by Mayer (1951) are based on membership in the neighborhood (small risaga) and the larger community (large risaga). Members of these groups recognize a reciprocal obligation to exchange communal work for beer when called upon to do so by one of their group. It is the fact that these groups are based on neighborhood rather than on political or kinship organization that suggested to the authorities that they might serve as a means of "supplying the pressing need of Africa today--an effective means of mobilizing the cooperative effort of peasant agriculturists for measures of rural improvement" (Phillips, 1951: 3).

With this in mind, Government organized Group Farms among the Gusii to coincide with the risaga groups. As with the other Nyanza Group Farms of the late '40's and

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[1]Unless otherwise stated, this case is based on Fearn, 1961.

early '50s, initial financial and technical aid was provided. As with the others, this aid was withdrawn after the first year. As with the others, the scheme failed when its subsidy was ended.

The risaga cooperative work groups traditionally were called into action when one of their members needed assistance with a specific project. They did not adapt to functioning on a regular basis. Nor, as Fearn points out (1961: 204) was service truly reciprocal. Rather, one man who owned a plough and knew how to use it was called upon to plough another man's field. Since cash profits were involved, the old system of payment in beer was no longer suitable.

The risaga cooperative tradition could not save the Gusii Group Farms.

Analysis

Comment on this case would duplicate that on the preceding one with the additional fact noted that identifying the tradition of cooperative unit, and planning the cooperative farm around it did not help because the group was expected to function far beyond its custom. Also, since in the scheme, effort should be rewarded with profit,

it was unrealistic to expect the man whose time would be worth more money (due to his ownership of the plough) to be satisfied with compensation in the amount of beer he could drink.

Again, there was a two-way failure of communication as Government misinterpreted the meaning of risaga and farmers misinterpreted the meaning of initial subsidy.

This scheme was planned to be adapted to the local culture; it was not. Culture need not be considered a variable here. What did contribute to failure, as with all group farming schemes, was lack of any real advantage to compensate for the social cost of change.

Case 5. Cotton Cooperatives in Sukumaland[1]

The Victoria Federation of Cooperative Unions is the largest organization of its type in Tanzania. It had its start in 1950 when a group of Sukuma cotton producers decided to appoint their own weighers at various cotton buying posts. One of their tribesmen had demonstrated with a pair of scales that they were being short-weighted by the cotton traders. The traders, largely Indian, used this

[1]Unless otherwise noted, this case in based on Lang, Godfrey and Martha B. Lang, 1962.

method to get around the price control for cotton supported by Governmental subsidy.

The Sukuma are the largest tribe in Tanganyika. Since 1946 their several chiefdoms had been constitutionally united in the Sukumaland Federation (Malcolm 1953: 156). They had been accustomed to a cash economy since shortly after the First World War when the British had encouraged cotton cultivation. The awareness of being cheated by the cotton traders fed both their desire for financial gain and their resentment of the foreigners. Despite initial Governmental opposition, it was easy for Paul Bomani, a young Sukuma who had had experience in an established marketing cooperative, to organize growers to form several local primary societies which would sell their crops directly to the cotton ginneries, thereby eliminating the cotton traders (Bomani, 1956).

The Sukuma were accustomed to cooperative effort. Each village customarily had one or more Basumba Batale, elected labor organizers, who could call upon members of the various village young men's associations to perform necessary group tasks. The political structure of the tribe was hierarchical, with an ascending series of headmen, subchiefs, and chiefs, each responsible for

increasingly large areas and populations, and for certain specified services. In the villages, headmen ruled with the aid of a council of elders.

The organizers of the cooperatives enlisted the aid of Sukumaland's various established leaders, especially the Basumba Batale, in recruiting new members. By 1952, Government had reversed its attitude toward the Sukuma cotton cooperatives and established a provincial branch of the Cooperative Department; Cooperative Department agents were assigned to the local societies. In 1953, thirty of these, organized into thirteen regional unions, were registered with the Cooperative Department. In 1954, the unions united to form a federation, thereby completing the cooperatives' structural resemblance to Sukuma Society.

The Victoria Federation grew steadily in both membership and responsibilities. It includes nineteen unions, each corresponding to the area served by a ginnery.

Since 1957, when a Government appointed examining group decided that ginners were charging too much for their services, the Federation has been acquiring the ginneries (I.B.R.D. 1961: 125). It supervises and services the cotton crop as well as markets it. It also handles its members' produce in hides and skins, as well as in

maize, paddy and sisal, providing, as necessary, subsidy for the sisal. The Federation has its own sisal factory and it owns a modern office building and hostel in the provincial capital of Mwanza.

Analysis

Felt need was stimulated for this scheme when farmers realized that much of their profit was being siphoned off by foreign traders. Nationalist enthusiasm enhanced its attraction.

Local culture was used in that the organizational structure of the co-op was modelled after that of Sukuma society. Local leaders were given a role in organizing the co-op. Financial profit was high, resulting in a real advantage to co-op members.

Case 6. Sukumaland Cattle Marketing Coops[1]

The success of the cotton marketing co-ops described in the previous case suggested to a Sukuma teacher that cattle marketing co ops might serve his people equally well.

The Sukuma traditionally are primarily cultivators. They keep cattle, as do many East African farmers, partly

[1]Unless otherwise noted, this case is based on Lang, et al, 1969.

for subsistence, partly for ceremonial and social exchange purposes, but primarily as famine insurance and for capital wealth (Malcolm, 1953: 67-72). They were accustomed to selling ghee as a source of income, and, during the Second World War, they had been forced by the British, who needed meat for their armies, to sell the animals themselves. After the war they sold cattle in established cattle auctions.

Cattle auction prices were undependable. After a period of low prices in 1956, the aforementioned teacher attempted to organize cattle co-ops. At this time cattle prices rose, thereby weakening his main argument for the cooperative movement. At the same time, the Government Cooperative Department, which, by this time, was assisting with the Sukuma cotton cooperatives, was against formation of the cattle cooperatives, thinking that they were designed to serve traders rather than producers.

By 1960 there were 4 registered cattle marketing societies in Sukumaland. One was new; three were in operation. These three sold cattle at a fixed price per pound, according to grade. Sales were at weigh bridges, often less conveniently located for members than were the auctions.

Early in the year, members received a better price from their society than they did at either market. But when, later in the year, a higher price was obtainable in the traditional markets, the societies stopped trading (Tang. Rept. on Co-ops., 1960: 15).

The cattle cooperatives never found the popularity of the Sukuma cotton co-ops. This was probably due in part to the dislike of Sukuma cattle owners of exposing their cattle transactions, and therefore, their wealth, to their fellow co-op members. Probably too, the auctions had an attraction: they had become a "popular feature in the social life of cattle people" (Aldev, 1962: 5).

Analysis

Cattle co-ops failed primarily because they offered no advantage to the members. They were less convenient and less entertaining, and they were more likely to expose business dealings which people preferred to keep private.

In order to guarantee them a minimum price and to keep a steady supply of cattle for sale, the co-op denied its members the opportunity to hold animals in a rising market. This decreased profit. That members sold alternatively through the co-ops or the auctions, depending on price, showed the importance to them of the profit motive.

Case 7. Coffee Cooperatives Among the Embu of Kenya[1]

With strong encouragement from Government, the Embu have been growing coffee on the southeastern slopes of Mt. Kenya since 1934. At first only a few could be persuaded to do so, but when their persistence proved profitable, others followed. In 1946, assisted by the Department of Agriculture, 181 growers started the Ngandori Coffee-Growers Cooperative Society Ltd. under the chairmanship of their chief who was one of the principal growers.

Growth of the co-op continued--even during the Emergency (in which Embu were involved along with the neighboring Kikuyu). The only interruption of a steady increase in coffee production occurred during 1962 and 1963 when Government implemented land consolidation in Embuland. This necessitated large scale transplanting of coffee trees, a process which results in a two year interruption in cherry bearing.

By this time nearly every Embu landholder was a small coffee cultivator. The new holdings were prepared carefully. Planters constructed terraces as needed.

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[1]This case is based on Saberwal, Satish, 1966.

They set out new seedlings in addition to transplanting the mature trees.

By 1963 the co-op was running five factories, with each member required to contribute some labor to the factories. Each paid a thirty-five shilling fee for the privilege of selling all their cherries through the co-op, providing they abided by certain rules. Members exchanged help with neighbors and kin, and sometimes used hired labor in order to harvest cherries at the time of optimal ripeness.

The co-op is run by a management committee of members which in turn elects a technical staff. It owns, in addition to factory and office equipment, two vehicles which members may rent for personal use. It supplies credit and material to members for the locally popular corrugated iron house roofs. It has an education fund which enables members' children to obtain higher education.

Over the years members have increasingly taken over the operation of their co-op. In 1964, immediately following the Kenya Independence, a Kikuyu was appointed to replace the European Registrar of Cooperatives.

At about this time, against the urging of the former Registrar and of their chief, its members divided

the Ngandori cooperative into five smaller ones, each to service one of the five factories. It was their intention to have closer control over their cooperatives. Each of the smaller co-ops encompassed a homogeneous ecological unit, and is of a size to be more easily understandable and handleable by the largely illiterate members. Each has appointed an inspection team to supervise members' cultivation with the aim of insuring a uniformly high quality product, in order that more careful growers might not be penalized by the lowered average price received for a mixed quality product. The de-facto monopoly of the co-ops, as well as the more personal relations in the smaller groups is a strong weapon in ensuring that members heed the advice of the inspection teams. The new, smaller unit organization has increased the success of the cooperative scheme.

Analysis

This scheme has a nearly thirty year history with continuous attention of Government, the chief, and local farmers. It has been marked by steady growth and steady profit.

Demonstration of profit to early coffee growers was instrumental in getting others to join.

The Co-op continued the trend of increase in membership and increase in profit and started a new trend of increase in independent management. As part of this trend members eventually broke the large cooperative into smaller local ones. Response to the resulting more personal relation of members to their co-op has increased product quality, and hence further increased profit. In this case the growers' confidence that they knew best how to handle their people was well founded.

Mention should be made that education, in this case, contrary to what development planners so often insist, was not a necessary preliminary to agricultural development; the farmers were aware of their lack and organized their cooperatives accordingly.

3. Attempts to Innovate Improved Practices--Mixed Farming

Case 8. Mixed Farming Among the Teso[1]

During the last century, the Teso of Teso District, Eastern Province, Uganda, have become sedentary cultivators as well as the cattle herders they had been traditionally. Concerned that the cattle should not hurt their crops, they grazed the cattle away from the cultivated

[1]This case is based on Parsons, 1960a.

areas, sometimes in the care of hired herdsmen, but often in the care of the young boys of the family. When the boys started attending school their fathers took on the chore of herding the cattle. Since these men are occupied with farm tasks in the morning, grazing is often delayed; they return home for lunch, thereby further reducing the grazing day. To reduce the danger of theft, the herd is kraaled close to the homestead at night.

The Teso, in effect, had developed a system of crop cultivation in parallel to their system of cattle herding, rather than a mixed farming system. Their system of stock management deprived the crops of manure and offered the cattle a very short grazing day.

The Teso for twenty years had resisted propaganda to make use of the manure from their home kraals to fertilize their arable fields. They argued that it would be too much work to cut grass for bedding and take it to the kraal and then to cart the manure to the fields and spread it on the surface. Grass needed for bedding was also in short supply. For proper preparation of bedding manure, a covered shed is needed. The Teso kraals were uncovered; to cover them with a thatch roof, the Teso claimed, would be asking for an enemy to set fire to the kraal.

More recently, in order to lengthen the grazing day, as well as to bring dung to the arable land, an attempt was made to persuade the Teso to night-paddock their herds in their resting fields. This too was resisted, the Teso claiming that their herds would be in danger from both wild beasts and cattle thieves.

Farmers then were persuaded to use moveable kraals in the resting fields. These had been used at a prison farm with obvious benefit to later crops. In Teso the farmer found the work of moving the kraals too demanding; the supposedly moveable kraals soon became permanent.

Finally it was decided to turn the resting fields into fenced leys and to night-paddock the cattle in the leys. The cattle were circulated in an annual cycle over the ley by using moveable folds. They were protected from theft by a herdsman who slept in a field shelter in the paddock. Expenses of paddocking in this way were paid for by the increase of marketable crops harvested in the following season. Since the paddock guard let the cattle out of the fold early in the morning, the cattle were able to graze the ley until the owners were ready to take them out to the communal grazing area. Thus both objectives of the mixed farming scheme--fertilization of fields and

longer grazing day for cattle--were met.

Analysis

Persistence on the part of agricultural personnel certainly aided this scheme, as did their flexibility in suggesting other methods when early suggestions were rejected (for valid reasons) or tried and found impractical.

Essentially this was a scheme to outwit the ecology (including the neighboring tribesmen) as well as to improve it for the benefit of cattle and crops. When the Teso were convinced that integrating cattle and cultivation would neither endanger their cattle nor increase their workload unduly, they willingly converted to mixed farming.

Benefits included healthy cattle, increased crops, and increased income.

It is important to note that whereas the Teso appreciated these benefits, they were only interested in them when assured that threat to livestock--and therefore subsistence--was eliminated.

Case 9. The Ngogwe Livestock Improvement Area in Buganda[1]

Early in the 1940's the Uganda Government designated certain areas of the country as Livestock Improvement

[1]This case is based on Kerkham, R.K. et al, 1947.

Areas--really pilot schemes for the improvement of animal husbandry and its integration with farming for the purpose of introducing the manuring of crops. In the Ngogwe area of Kyagwe county, Buganda Province, the improvement program was markedly successful.

The work of the two Government departments involved, Veterinary and Agriculture, was coordinated by the appointment of officers from each to a single Husbandry Committee which could serve as an advisory board to personnel of both departments.

After formal approval for the scheme was obtained from local chiefs, African assistants of the two departments approached stockmen both individually and through their association. This association had been formed by stock owners to serve as a purchasing group and to supervise the carrying out of regulations against Sleeping Sickness. It also arranged for its members, who frequently were well educated, to make visits to modern farms. It was an ideal channel for promulgating improved livestock husbandry.

Improvements were aimed at four areas of stockkeeping: management; feeding; breeding; utilization of manure.

Changes in management included the keeping of animals near the home and banana gardens rather than the joint herding of cattle far from their owners homes under the care of a hired alien herdsman. This resulted in a marked decrease in cattle deaths as owners were able to keep an eye on their own animals. Most owners were persuaded to build a cattle shelter in which animals could be housed during mid-day, protected by smoky fires from the daily attacks of the stomoxys fly. This last, together with the supplementary feeding provided for cattle (cassava, cottonseed, elephant grass and household waste consisting largely of banana peels) resulted in a large increase in milk yields.

The services of selected bulls of indigenous superior herds were used to improve herds throughout the area. All other bulls were castrated. The high fee paid to owners of selected herds motivated other herd owners to cooperate with the breeding rules; they hoped that their own improved bulls might one day be hired as studs.

Since the cattle were kept close to the banana gardens, it was a simple matter to manure the plants and many farmers did so, some purchasing wheelbarrows to further simplify the task. Bananas always fetch a good price in

the nearby Kampala markets, and the resulting increased banana yields helped to insure success of the livestock improvement scheme.

Analysis

The organizers of this scheme had the advantage of being able to approach an effective group, organized among local cattlemen, to help themselves to become more modern stockmen. Persuasion was scarcely needed.

Approval of the chiefs further aided acceptance.

Also, in a pilot scheme, since conditions must be controlled, attention of personnel is greater than in other schemes. Expertise of departments involved was well coordinated.

Mixed farming resulted in an improved environment.

As stockmen cooperated in each phase of the scheme, they were rewarded by clearly perceived benefits in improved cattle and increased marketable crops and therefore increased income.

Case 10. Integration of Cattle and Coconuts on the Tanganyika Coast[1]

Farmers of the Tanga region of the Tanganyika coast

[1]This case is based on Childs and Groom, 1964.

were often both cattle and coconut palm owners but the husbandry of the two were kept separate with evident detriment to both. Tree owners had rights of cultivation only on land in the immediate vicinity of their trees, and since these trees were on land belonging to others, no grazing rights whatsoever on coconut plantation land. Those who had usufructory rights in the land cultivated plots so scattered that they were unable to keep down the regeneration of undesirable bush. Spontaneous annual fires raged through this bush, killing the new palms and damaging mature ones with the results that production was limited to an average of fifteen nuts per tree per year.

Farmers did not herd their own cattle but let them out to others who, in turn, delegated their care to young herd boys who often did not start the grazing and watering trek (which averaged six to ten miles a day) till 10 A.M., In general grazing was sparse and often located in tsetse areas. Cattle suffered from heat stress. Cows were milked by itinerant milk retailers for sale to individual customers. Herdsmen kept the profits from milk sales but returned any calves to the cattle owner. The consequence of this poor management was that

yields of milk averaged only about 75 gallons per lactation and calf mortality was higher than 50%.

Trials at the Tanga Livestock Experiment Station had shown beneficial effect on production of both coconuts and milk when cattle were grazed on coconut plantations. Trees benefitted from manure and cattle received extra graze without trekking.

In 1961, after consultation with the local people, a pilot scheme was started in four square miles of coconut land at Mkinga, 20 miles north of Tanga. It was a demonstrable success.

Farmers agreed to divide their land into two parts, one to be reserved for coconuts and communal grazing, the second, near the village, to consist of their consolidated arable plots. No interference with cattle or land ownership was necessary, and no attempt was made to limit any cattle owner's grazing rights in keeping with the size of his land holding.

Services provided to the farmers included the use of arboricides to clear bush and tree stumps from the grazing areas; provision of materials essential for communally dug wells; barbed wire for fencing of both grazing and arable areas; cattle dips; provision of superior breeding

bulls; and demonstrations of better milk production methods. Cattle were milked in a communal shed; the milk was sold cooperatively.

At the time of report (1964) thirty-two cattle-coconut schemes were in operation and more had been requested.

Analysis

This highly successful scheme for better adaptation of subsistence to ecology, was obviously carefully planned, integrating innovations with customary ways, after both feasibility study and pilot scheme demonstrated success.

All inputs except labor were provided by government.

Farmers were shown how to integrate cattle and coconut cultivation without infringement of their basic land tenure rules simply by reserving land on palm plantations for communal grazing and reserving village land for individual, consolidated plot cultivation.

Hired herdsmen were eliminated as cattle did not have to be trekked to grazing; milk was sold cooperatively by herd owners, resulting in better control of price. This, together with greatly increased yield of milk (as well as of coconuts) added considerable to farmers' profits.

It is notable that consolidation of holdings, often difficult to innovate by itself, was easily accepted as an essential part of this highly profitable scheme.

3b. Attempts to Innovate Improved Practices--Mechanization

Case 11. Rufiji Rice Mechanization and Share Cropping Scheme[1]

In 1948 free ploughing for the preparation of paddy was carried out on riverine land used by the Warufiji to cultivate flood irrigated rice on their several scattered small and irregular shaped plots. People were asked to consolidate their plots; when they refused this as risky (the river flooded to different levels annually, they claimed), they were asked to square off their plots, and, in one area to cultivate as share croppers on government land (used for rice trials). Share cropping was rejected categorically as unnecessarily sharing profits; squaring off of plots was, at first, also rejected, but when farmers were offered lengths of cord, which would measure a square acre, and told to measure their own plots, this was done.

The following quotes taken from the biennial Colonial Office reports describe the course of this scheme.

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[1]This case is based on three successive Colonial Office Reports (Gt. Britain, Colonial Office, 1951, 1953, 1955).

1. An attempt to interest the Africans in a share cropping scheme for paddy in connection with the Agricultural Department's rice trials . . . was unsuccessful. The idea was utterly unacceptable to the Warufiji, who, though they magnify the chances of losses due to drought or floods, are not prepared to risk someone else benefitting from a good harvest. . . (1951: 9). (italics mine).

2. Land Tenure: Land is available to the Rufiji considerably in excess of requirements under native methods of cultivation . . . a man may cultivate unoccupied land without asking permission except where he wishes to cultivate near somebody else's plot and, in that case, he asks the family elders of his neighbor . . . As the fertility of the land is maintained more by river floods than by fallowing, all rights in fallow land are extinguished after a few years (1951: 6).

3. 200 of the 300 acres ploughed and drilled for the Agricultural Department in 1949 were killed out by the high floods. . . . (1951: 10).

4. Difficulties encountered . . . The flood plain is subjected to floods of varying depth according to topography. In seasons of exceptional flooding considerable areas of rice fail due to excessive water, and in seasons of poor flooding there is failure of the higher-lying areas. Both have occurred since 1948. . . (1953:6).

5. The Rufiji farmers customarily have several plots at varying heights above river level so that whatever the size of the annual floods one or more of the plots should succeed (1951: 10).

6. Climate. The flood plain is subjected to varying combinations of flood and drought. Thus, those dependent on cultivating in the riverine areas are likely to experience any one of the following in any year.

1. A moderate flood and good rainfall giving excellent crops and depositing fresh silt.
2. Excessive flood in which all crops are washed away.

3. Drought combined with no flood.
4. Excessive rain when weeds may become rank and crops choked. A combination of excessive flood during a district wide drought has been known and proved disastrous in 1951/52 (1955:71).

Share cropping was not accepted; when the idea was dropped by management the scheme was highly successful, in terms of its broader objective of increasing irrigated rice production by means of mechanization.

At first farmers did not subscribe to mechanization of their established plots, but only on plots newly opened for the purpose, treating these as an investment, When mechanization proved itself on these plots, it was accepted for all plots.

Farmers would not give up their pattern of several small plots at varying elevations, but, offered pieces of cord that would measure an acre, they did agree to square off their paddies to allow for mechanical services. Farmers opened their plots by hoe and paid for tractor service in ploughing, and, should they desire it, for harrowing as well.

In this modified form the scheme prospered:

> While many entrants to the scheme begin with only one acre of paddy there are now a number of well established farmers who have built up their area to three, five, ten or more acres (1955: 72).

Analysis

This scheme nearly failed because management would not believe the Warufiji's claims that the uncertain level of the annual riverine flood necessitated each farmer having small paddies at several levels. It is a good example of the wisdom of planners' consulting local people as to their knowledge of the ecology.

With no land shortage the Warufiji saw no advantage in paying to use government land.

Allowed to continue their subsistence insurance practices, the Warufiji cooperated with mechanization. Finding mechanical help in paddy preparation profitable, they took increasing advantage of it to increase their marketable rice surplus.

Their initial acceptance of mechanization only on plots other than those needed for subsistence shows that: 1. The first concern of the Warufiji was to avoid subsistence risk and 2. with no danger of increasing subsistence risk, they were motivated to change by hope of financial profit.

Case 12. Tractor Hiring Schemes in Buganda and Lango[1]

In the late 1940's the Uganda Government introduced tractor hire schemes in various types of agricultural areas. Mr. Stanley Takarambudi, a member of the Ganda tribe, served as extension agent on schemes in two of these area types--in Buganda (moderate to heavily populated areas where permanent crops predominate) and Lango (areas recently settled and brought under cultivation) (Uganda, Off. Bull., 1954: 282).

To introduce the schemes, chiefs and other men of the community were taken to visit experimental farms to see the advantages of mechanization. It was hoped that they would sell the scheme to other villagers.

Government offered to subsidize half the tractor hire fee for the first year. Since tractors are only economical on large continuously cleared areas, it was hoped that farmers would group together to hire a tractor cooperatively. To encourage this, tractor hire charges were considerably less for plots of over ten acres than for those below. In Buganda, however, charges were set at ten percent more than in other areas to compensate

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[1]Unless otherwise noted, this case is based on interviews with Mr. Stanley Takarambudi.

for more difficult ploughing conditions. Charges in Buganda were 32 shillings per acre for the larger plots and 52 shillings per acre for the smaller ones (Uganda, Off. Bull., 1954).283).

Tractors would enable farmers to open new land in shorter time. Thus larger plots would be ready for the first rains. Tractor use resulted in definite increases in yield per man, though not in yield per acre.

The schemes in Lango, where Mr. Takarambudi was a stranger, were successful. Those in Buganda, Mr. Takarambudi's home area, failed. Mr. Takarambudi felt that this was due to cultural differences between the two groups. The Lango were accustomed to cooperate with neighbors and kin in agricultural work. The Ganda, on the other hand valued privacy. He felt they not only would not care to cooperate with neighbors or kin, who would then know too much about their work and hence their finances, but they did not even want to discuss their situation with him; the Ganda, he felt, might have responded better to an alien. This judgment would seem to fit M. Southwold's description of the Ganda residence pattern as one of movement away from close kin and toward distant kin, reflecting their feeling that "kinship is a good thing--but you can have too

much of it." (Southwold, 1966: 102).

It is also true, however, that the fate of Mr. Takarambudi's schemes were typical of that of similar schemes in their area type. According to the Official Bulletin of Uganda schemes succeeded more readily in the less thickly populated areas where group farms developed more easily, and where no tradition of private ownership of land existed. The Lango situation fit both of these conditions. As a recently settled area, it was lightly populated; land was leased from the government; farmers interested in forming tractor hire groups could lease adjoining plots.

Buganda, on the other hand, was densely populated. Land was privately owned. The Baganda were accustomed to hiring farm hands at times of heavy work (Parsons: 1960b: 10). Considering that, as mentioned above, tractor hire charges were higher in Buganda and tractor use did not increase yield per acre, it is quite possible that the hired hand was a more economical aid than the tractor.

Analysis

Tractor hire was accepted where it was of economic advantage and rejected where it was not.

Tractor hire increased production per man, not per acre. With the Lango, who had plenty of land, increased production per man was economically advantageous. For the Baganda, who had limited land, but plenty of labor in the form of low cost hired men, it was not economically advantageous.

Other factors reinforced decisions based on economic advantage, such as the dislike of the Ganda for cooperation, and the preference of the Lango for this type of labor.

3. Attempts to Innovate Improved Practices--Water Control

Case 13. Taveta Irrigation Scheme[1]

This scheme, located in the hinterland of the Kenya Coast Province, illustrates dramatically how the best laid development plans may be frustrated by the vagaries of nature.

In 1946 the Aldev Board decided, after a survey of the Goodwillies area, that it was unsuitable for settlement but could be used by local Taveta tribesmen to cultivate such crops as experiments by its supervisor might

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1 This case is based on the two Aldev reports (1946: 173-74; 1962: 194-95).

indicate could profitably be grown under supervision and with the aid of irrigation to be drawn from the nearby Lumi River. Most of the tribesmen involved appear to have been already using the area to grow maize and beans and the Board's early report remarks that they "were not interested in better methods of cultivation" (1, 173).

The scheme was abandoned after the Lumi River, in each of two successive years after original dam construction in 1950 had changed its course, both times rendering necessary engineering changes in the newly constructed irrigation system. After the second time the scheme was abandoned on the opinion of the local authorities that "the Taveta would never pay for the water" (1946: 174).

Subsequently the Kimala Scheme, designed to accommodate those displaced from the Goodwillies was opened, largely by volunteer labor.

Analysis

The implication of the report of the irrigation scheme is that the Taveta were too niggardly to pay for a third rebuilding of the original irrigation system, whereas the likelihood is that the Taveta knew from long experience that the Lumi River might continue to change its course annually. That they were not averse to cooperating in a

feasible scheme is indicated in the note that when the Goodwillies scheme was abandoned, the same people contributed labor to open a substitute area.

Here is another scheme in which, had its feasibility study included investigating the local people's knowledge of their area, disaster might have been averted.

Case 14. Mwea-Tabere Irrigation Scheme[1]

"Mau Mau detainees have dug, by hand, many miles of channel and bund on the Mwea-Tabere Plains. . . ." (Huxley, 1957: 101). These miles of channel and bund outline the paddies of what has become the highly successful Mwea-Tabere Irrigation Scheme. This scheme was begun in 1951 to provide useful employment for Mau Mau detainees who, in addition to laying out the irrigation works, experimented with cultivation of various crops. Rice proved the most rewarding. While only one crop of rice could be harvested per year, during the short rains, yields were very high.

In 1954 the area was opened for settlement. Settlement was limited to landless families from the Central

[1] Unless otherwise noted, this case is based on a World Bank Report (deWilde, 1967: V. 2, 221-241).

Province; they might be from any tribe. They were nominated by clan committees of their own clan. If it is true, as the scheme's Assistant Agricultural Officer reported, that this method of selection motivated the committees to "unload their least desirables" (Giglioli 1965: 202). this did not prevent the success of a scheme that made considerable demands of its members.

Each settler was allotted four rectangular one acre "black"[1] soil plots for paddy, plus additional red soil lands for subsistence cultivation.

Neither the settlers nor the staff had had previous experience with irrigation cultivation. Trial and error suggested changes in technology and organization which resulted in a highly successful scheme.

Paddy preparation was at first accomplished with ox-drawn equipment. This proving inefficient as well as exhausting for man and beast, tractors were substituted. The tenants, who at first objected to having to carry portable bridges for the tractors to enter their plots, were afterwards so pleased with the mechanically prepared paddy that they requested further mechanization.

Even with mechanical help paddy cultivation was

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[1] "Black" soil is soil that will grow no cotton. It is "black" for cotton. Paddy rice derives its nourishment primarily from water.

demanding; men between 35 and 40 years of age, with one or more wives and adolescent children proved to be the most able to meet its demands. Settlers were issued a year's license of occupancy after agreeing to an eight page booklet of regulations.

Those who met the settlement conditions were assured not only of annual renewal of licenses, but of the right to bequeath their lands, though not so as to cause its fragmentation. Those who did not meet settlement conditions were subject to having their licenses cancelled after written warnings and required prosecution.

Satisfaction of tenants was so high that few left voluntarily and, in three years, with 1,340 tenants, only 15 had been ousted for ignoring the rules.

Some rules, such as the one requiring each tenant to maintain and fertilize his own rice nursery involved considerable responsibility. Some, such as the requirement to live in villages, involved an unwelcome change from custom.

Administration of the scheme was under an Assistant Agricultural Officer. Extension was in the hands of four field assistants. Irrigation was controlled by six water guards. The scheme was divided into units, each served

by its own water intake point; groups of 150 tenants formed a village which was served by a field assistant. The field assistant gave group instruction prior to each phase of cultivation (mechanization allowed all tenants to be ready to embark on each phase at the same time). Communal work was organized by the Head Cultivator of each unit; new techniques were introduced to the villagers through the Head Cultivator; he set the pace of the farm work; and he served to keep the staff in touch with the mood of the tenants. He was also a member, along with elected villagers, of a Tenants Liaison Council.

Economists consider the scheme a success on three counts: It has given land and income (£80 per year, far more than the national average), to a number of landless people; it has provided work for others as farm hands (tenants pay an average of £60 per year for labor). By 1963 the scheme's revenue from tenants considerably exceeded its current expenditures (de Wilde, 1967:222).

Settlers also consider the scheme a success. In addition to the relatively high income, they have come to like rice and have adopted it as their staple food.

Technicians, too, consider the scheme a success. In 1964 the rice harvest was 58.8 bags per acre, thought to

be a world record (Nderita, 1967).

Analysis

This scheme's outstanding success can be traced to two principal factors: it gave land to landless people and provided a good cash income.

Required burdensome work of land preparation was done with prisoner labor.

Although all snags had not been ironed out in advance, adequate feasibility studies had determined the fitness of the rice crop on which the rice depended. Settlers were given needed guidance.

There was structure for give and take in technology and between settlers and management.

An unpopular living pattern was accepted because of the obvious benefits of the scheme, as were quite demanding rules.

3d. Attempts to Innovate Improved Practices--Cash Crops

Case 15. Enforced Cultivation of Manioc in Tanganyika

Almost all areas of Tanganyika are subject to occasional periods of famine. To provide insurance against starvation, the German Administration had required that specific plots in famine prone areas be planted to manioc, which in addition to being a drought resistant crop is

not subject to depredation of locusts and birds; nor does it have a specific harvest time, storing under ground for up to two years.

Manioc never became a popular food in Tanganyika (Jones: 1960: 232); most manioc cultivation was dropped with the ending of German rule.

In the late 1940's, the British colonial administration reinstated the enforced cultivation of manioc in famine prone areas, the object being local self-sufficiency in food. Regulations were drawn up by the local authorities who were also responsible for punishing those who did not comply. Fines were exacted. Where necessary, agricultural officers accompanied by armed policemen enforced the planting of the required manioc.

In some areas excess manioc found a ready market. Where this happened, farmers increased their manioc cultivation beyond that required by law. Dried manioc became their cash crop.

By 1952 people of Newala District, Southern Province, were exporting such a large quantity of manioc (as dried roots) that the Annual Report of the Department of Agriculture suggested "it would be best to discourage

production in the Newala District to some extent" (pt. 1: 16-17).

From the point of view of the Department of Agriculture this "overproduction" of manioc was undesirable since it did not lead to local self-sufficiency in food. It did, however, lead to protection against famine, the stated purpose of the scheme, in that the money earned from manioc sales enabled farmers to purchase food when necessary (Dept. Ag. An. Rpt., 1950: 155).

Similar results are reported by Ruthenberg for the Tanga area of the coastal region (1963: 51).

Analysis

This highly profitable scheme would never have been accepted without initial severe coercion.

Management considered manioc planting a failure, inasmuch as it did not lead to the local self sufficiency in food to which they were committed. The farmers, finding their subsistence security increased by planting more manioc (which could be easily sold, providing money for food purchase) and less of their staple which often yielded an insufficient harvest, were behaving more in line with rational economic behavior than was management. Trade in food, as illustrated so often in the previous chapter, had long been an East African method of decreasing subsistence

Case 16. Kikuyu Pineapple Scheme[1]

In the early 1950's a group of European cannery owners who wished to increase their source of fresh pineapply visited Gakoe, a community of Kikuyu small farmers near Thika in Kenya and proposed to any farmers who would listen (individually and at a barazza) that they engage in pineapple cultivation. Previously only European farmers had grown pineapple, though some of the Thika farmers had worked as laborers on their plantations. The cannery men offered the same price for African as for European grown fruits, with the price tied to quality. They offered to help any interested farmers to get started, depending on the financial success of these pioneers to stimulate later producers.

In this locality, pineapple would grow where nothing else would except for the wattle trees from which the local people had been accustomed to get their income. At just this time the income from wattle was declining.

This was also the time of growing anticolonial feeling which led to the Mau Mau revolt. The possibility of being self-employed rather than working for Europeans

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[1] This case is based on information supplied by Mr. Augustine Kenyanjui, whose uncle, with whom he lived, was one of the founders of the pineapple cooperative.

was attractive to those who worked on the plantations. So also were the chance to avoid the long walk to work and the hope of earning more money.

Those who first grew pineapple formed a marketing co-op, with the guarantee that the factory would buy any produce of good quality. They prospered and imposed a restrictively high co-op membership fee in order to give themselves a de facto marketing monopoly. Others, however, continued to turn to pineapple cultivation, selling their products through the co-op which controlled the price, quality, and quantity of fruit, thus guaranteeing that overproduction should not force a lowering of price. The net result was to raise income in the area generally and to create a separate, wealthy, entrepreneur class, some of whom invested their profits in other enterprises.

Analysis

All factors for this commercial fruit growing scheme were positive. The initiators--the cannery owners--did not hope to sell the scheme to all they approached but offered help to those who did respond, in accordance with the focal point approach.

Timing was good in two ways. The customary cash

cash crop was becoming unprofitable; growing nationalism motivated many Kikuyu to want to work for themselves rather than on European plantations.

Perceived benefits included not only an increased profit, but a reduced effort in that many would have less distance to walk.

The good income to first growers was an effective demonstration. These first growers formed a restrictive co-op which held a marketing monopoly. Perhaps, again, being hard to get into enhanced the attraction of this scheme to late comers.

Case 17. Kimulet Tea Scheme[1]

In 1951 high rainfall land on the edge of the Mau Forest in Kericho District, Nyanza Province, Kenya, was offered to the Kipsigis for settlement and development in compensation for an adjoining area which had been alienated to a European tea company. Settlement and development was completed in 1955.

With the object of meeting the Swynnerton Plan goal of £ 100 cash income per year per farmer, a tea nursery was started to provide 174 of the 234 farms in the settlement with enough tea stumps for 1/3 acre plots. Local

[1]This case is based on Aldev, 1955: 164-66, and 1962: 187-88.

tea companies were prepared to process the settlers' crop.

When the first tea stumps were ready for transplanting in 1957, only 106 of the settlers had prepared tea plots; whereupon the nursery sent its surplus stumps to Kisii, which "taught the settlers a lesson and the development of holdings has since proceeded well" (1962: 188).

In 1959 the first scheme tea was ready for processing.

By 1961, seventy settlers had increased their tea plantings to one acre and were planning to expand further. Incomes from tea were exceeding the goal of £100 per year.

Analysis

Success of surrounding European tea estates provided a demonstration for this scheme which really succeeded from the start. Those farmers who were laggard in entering it were motivated to hurry and do so when it looked as though they might lose the chance. Making something hard to get may increase its desirability. Profits proved to be high.

Case 18. Fish Farming in Uganda[1]

Early in the 1950's the Uganda Government, drawing on experience in the Congo, decided to encourage the

[1]This case is based on Stoneman, 1966: 441-45.

development of fish farming by individual native farmers. It was hoped that fish farms would provide a source of cash as well as additional protein food for the family in areas too closely cultivated to allow for herding. Siting ponds on farms would avoid loss of fish in transport and would turn otherwise worthless land to economic production.

In 1954, after successful experimentation at a fishery research station in Kijansi, the Fisheries Department initiated a program in various parts of Uganda using extension agents of the Department of Community Development to advise prospective fish farmers on the siting and building of ponds which were then stocked with the Tilapia which had proved successful in the Congo. Enthusiasm for the project was so high that many more farmers than could possibly be contacted by the extension service undertook to construct ponds. In all, five thousand ponds were dug, many of which proved to be useless.

The results after two years were disappointing, indicating that pond conditions did not necessarily reproduce those in the research station. In Kijansi, yields of Tilapia had been 600 lb. per acre, while in the field ponds the yields were only 200 lb. per acre. Wild

Tilapia did not do well in the farm ponds where over-production led to runting and an overall reduction of weight of yields. Compounding the technical failure was the Ugandan's abhorrence of eating small fish. (Congo farmers are fond of small fish.)

Experiments in Kijansi produced a hybrid of the local Tilapia with Carp imported from Israel which could be counter upon to produce 4-500 lb. of acceptably large fish per acre. After various other technical difficulties (of drainage and feeding) were worked out, fish farming proved to be a success economically as well as a status symbol. (Indeed, many farmers who had built ponds had done so with no intention of cultivating them, but solely for their status value) Cost was slight in that ponds were build by family labor on unused land, stocked with fish which were supplied by the Government and fed with plant wastes. Profit was relatively high. By 1966, after family consumption, Uganda fish farmers were selling 500 tons of fish for £25,000 per year.

Analysis

Benefits were perceived as high in nutrition, income and status. Management backed this project with research as needed. Farmers persisted through initial

disappointment. Indeed some built ponds with no plans of using them. Obviously the status motivation was high, but we are not told why fish ponds were considered a basis of status.

Case 19. Pyrethrum as a Cash Crop for Njombe District[1]

This successful scheme for establishing pyrethrum as a cash crop for independent farmers in Njombe District, Southern Highlands, Tanganyika, might be said to have sold itself.

The Tanganyikan government had decided, in 1955, to encourage the cultivation of pyrethrum by small farmers living in mountain areas which were not suitable for coffee. Accordingly, when the chief of Njombe requested help in finding a suitable cash crop for his district, research was conducted in the area to see whether it was suitable for pyrethrum. The tests proving positive, barazzas were held in which the chief explained the methods and advantages of growing pyrethrym; no money was required to become a grower, since splittings of the plant would be supplied free; all that would be required would be the work of clearing, weeding, picking and drying; agricultural extension

[1]This case is based on Ruthenberg (1964: 71).

personnel would provide necessary advice; there was the example that nearby European growers were making money from pyrethrum.

Only ten farmers responded by volunteering to try the new crop, and these were men who were accustomed to employing seasonal wage laborers who could work on the extra crop; one of the group had had experience as a foreman on a European pyrethrum plantation.

Initial plantings were on quarter acre plots: these received close attention of the extension staff.

The first harvest was bought by the staff who then destroyed it, since it was too small to market profitably.

When, after this demonstration of profits to be made had induced several more farmers to request a chance to become pyrethrum growers, they were issued licenses to cultivate a single acre, the licenses to be retained only as long as cultivation standards wee maintained. Splittings were sold to applicants from a nursery established on the site by the Agricultural Department and financed through the local authorities.

Responding to the instruction of extension personnel, growers accepted many techniques of improved cultivation as part of the method of pyrethrum cultivation:

terracing, regular weeding, and the application of mineral fertilizers were all adopted.

Growers have established cooperatives which now have the power to issue licenses as well as pyrethrum land to prospective growers.

Analysis

At the outset, this case presented all the classical correct factors for acceptance--felt need, if not from the populace, at least from its chief. This, of course, meant the scheme was promoted by the local leader. Feasibility tests were positive. Material inputs were offered free of charge. Nearby European planters making money with pyrethrum provided a demonstration of success.

Very few farmers responded to all these positives.

However, after these few original planters sold their crop at a profit, several more joined the scheme despite newly imposed licensing restrictions and charges for supplies.

It would seem that until local farmers saw some of their own number carrying out the scheme they could not be sure of their own ability to do so. The demonstration of European success obviously did not assure them of this. This

is borne out by the fact that the few early adoptees were in a position to try the scheme with no risk to their essential work, in that they could leave the extra tasks entirely to hired hands.

In this case, clearly, demonstrated profit to people with whom the farmers could identify was the decisive factor in successful adoption.

Note should be made of the successful use of the "focal point approach," whether by intent or at convenience. This refers to the focusing of extension services on the few willing farmers in the hope that others will be motivated by their success to follow suit.

Case 20. Bena Wattle Scheme[1]

The Colonial Development Corporation had had, since 1949, a wattle plantation in Ubena in the Southern Highlands of Tanganyika. In 1953, at the request of Government, the Corporation agreed to help the local Wabena people to cultivate wattle, and to buy their wattle bark at harvest. The local district officer won the cooperation of the tribal elders who set aside 20,000 acres for the scheme in scattered 500-1000 acre blocks of poor

[1]Material for this case was provided by Prof. David Brokensha who had substituted for the district officer in the early days of the scheme.

unused land.

After consultation of the native authorities, and a series of barazzas the scheme was opened in four subchiefdoms. The remaining two subchiefdoms joined after a year. Applicants were allocated initial one acre plots by their village headmen, which they were to hold according to the traditional system of right by usufruct. The scheme was administered by a management committee serving under the chief, and including the two district officers. Growers purchased trees and hired technical services from the Colonial Development Corporation.

Wattle trees take as long as nine years to mature. The plan was,therefore, for each grower to plant a newly allocated field each year for about seven years, so that once he should begin to market an annual harvest he could continue to do so. Wattle trees require a sequence of annual tasks during the first four years. There is also the work of bark preparation in the harvest year. Wattle trees, after being cut for harvest, regenerate spontaneously, the second growth being superior to the original. In addition to the harvested bark, growers would have use of the logs. Although there was to be no income for up to nine years, the regular decrease in annual labor required and improvement of the product

inherent in the natural life cycle of wattle trees, would, after that time, it was thought, insure growers of a steady, if small, annual source of revenue, with relatively little work to interfere with their regular subsistence activities. This, it was hoped, would prove attractive to a people who had made no previous use of the scheme land, and who had no regular cash crop beyond small quantities of cotton, maize and cowpeas.

Despite various threats to its progress; i.e., rumours that, like the Germans before them, the British were planning to take the land; or, when this did not materialize, that they were waiting for the trees to mature and would then take the trees; the opposition of TANU[1] to a scheme initiated by a foreign government; the relative failure of trees in one of the three scattered plots planted and conscientiously tended by Mr. Brokensha as a demonstration of the rewards of careful husbandry; and finally, when the first crop was marketed, accusations of witchcraft against those more careful growers who received a better price for their bark, response was good to this scheme which required a long wait for rewards. This was undoubtedly in part due to the popularity of one of the

[1] Tanganyika African Nationalist Union.

district officers who had married into the society.

Practical problems arose at harvest which required careful attention to the cut bark for about three weeks, not easy for owners whose family farms were as far as thirty miles from their wattle trees. Nevertheless, there was a first bark harvest to sell and the price received for it repaid the long wait.

Unhappily, the reward was not often repeated. The scheme was abandoned a few years later when the market for wattle bark fell due to the invention of a synthetic tanning agent.

Analysis

This scheme required so much effort and so long a wait for reward, that the wonder is that it could have been adopted.

In contrast to the previously described pyrethrum scheme, all factors should have been against success. Farmers had to pay for inputs and technical services. The scheme was initiated at government request. Demonstration of success was that of a European corporation. Benefits could only be expected after many years.

One of three on site demonstration plots yielded poor results, meaning the people were being offered a gamble,

rather than a sure success. Political agitators talked against Government's motives. Farmers with better crops were thought to have used witchcraft.

The positive factors would not seem to have had much chance against so many negative ones. There was use of local leaders in introducing and implementing the scheme. Land allocation was according to local custom. It is possible that farmers were interested in acquiring extra land, but this seems unlikely since the land is described as "poor unused."

The Wabena, unlike the people of Njombe, must have been confident of their ability to duplicate the Europeans' success.

Perhaps the opinion of David Brokensha (himself a local District Officer), that the popularity of another District Officer involved in this scheme largely accounted for its unlikely success is a valid one. One hears occasionally of change agents who seem to be able to "sell" anything. Certainly his marriage to a tribeswoman must have gone far to counteract charges against Government's motives.

Case 21. Purko Masai Sheep Ranch[1]

This scheme originated to a large extent with the younger and more progressive Purko who were confident they could emulate the success of the European sheep farmers on their borders in the high Mau. The objects were:

(a) to breed up the red Masai sheep which is in danger of degenerating or disappearing;

(b) to improve Masai methods of sheep farming by demonstration;

(c) and to introduce a co-operative principle into Masai stock management.

The land is a salient into European farms, and was thus already fenced on two sides. The well-known risks of sheep-farming are minimised by the altitude and climate, which are ideal, and by the fact that the sheep were, until 1957, uncrossed natives. The Purko were expected to contribute, as shares, 3,000 sheep selected by the Veterinary Department. The capital required for staff, housing, water supplies, demarcation of paddocks, etc. was £7,500, which was issued as a loan in June, 1955, repayable over 20 years with interest at 4-1/2 per cent, starting the fourth year.

In the first year progress was extremely poor and the number of deaths averaged 19 per month due to a combination of enzootic pneumonia and worm infestation. Movable sheep folds were constructed and the posting of an experienced manager in September, 1956, resulted in an immediate improvement in the health and condition of the animals. By October, 1957, there were 317 rams, 1,284 ewes and 94 lambs on the ranch and the mortality rate had dropped to negligible proportions. By the beginning of 1959 the figure had risen to 3,624 head and losses among the lambs were slight.

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[1]The account of this case is taken in its entirety from the Aldev volume of 1962. Its early history was reported in greater detail in the 1946 volume (p. 78).

Experience showed that the Kenya Meat Commission could not pay more than Shs. 21/- a wether, and even under the best management conditions it appeared that better prices were unlikely to be paid for Masai fat tailed sheep. As a result it was decided in 1959 to sell off the entire Masai flock and bring in European sheep with the proceeds. Effect was given to this decision and the Ranch has gone over entirely to wool and exotic mutton economy. The sheep have done well and the 1960 clip and meat sales have realised £2,000.

In 1956, in order to clear the land of the predominant berberis scrub it was decided to invite neighbouring European farmers to plant wheat on successive ridges of the ranch on a share cropping basis. Agreement was reached between the farmers and the Masai that profits would be divided in the proportion of 20:80 between the scheme and the farmers. The arrangement has proved profitable to both sides and in 1960 the ranch received £5,000 from its share of the wheat crop. Pyrethrum was also planted as part of the share-cropping policy (Aldev, 1962: 82, 83).

Analysis

Essentially this is a cash crop scheme, one that succeeded due to the perseverence of members who wanted the scheme, through four years of disappointment, as the native sheep first proved unable to adapt unaided to the new highland environment, and later failed to command as good a price as European sheep. When the members of the scheme were permitted by a flexible management to substitute the more profitable European sheep for their own, they were indeed able to "emulate the success of the European sheep farmers" (Aldev, 1962: 82).

Masai have a strong antipathy for cultivation. To allow Europeans to cultivate as necessary on their land rather than insisting that Masai themselves do the cultivating was a good example of the wisdom of, insofar as possible, adapting the scheme to the local culture. In this case, it worked out to the economic advantage of both groups, certainly perceived as a "real" advantage by the Masai, who, for no expenditure of work or land, enjoyed an increased cash income.

Threats to the success of this scheme were both ecological and related to the external economy. There was also, at first, a conflict of goals. The desire to preserve native sheep conflicted with the goal of economic profit.[1]

Aiding its success were ecological suitability, real benefit, perserverance of members, flexibility of management, and adaptation to culture. Surely, in this case, primary among these positive factors was ecological suitability, since unsuitability had to be overcome before the scheme could prosper.

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[1]"Economic profit" is not listed as one of the scheme's objectives in the Aldev account, but all Kenya Government sponsored schemes, in accordance with the Swynnerton Plan, incorporated the aim of greatly increasing incomes (Swynnerton, 1954).

Case 22. Tanganyika Coastal Smallholders' Scheme[1]

This smallholders' scheme which seemed to have everything going for it, nevertheless failed for such a multiplicity of reasons that it might well be used as a conclusive example of how agricultural development may be frustrated by non-environmental, non-technical factors.

Temporary use of a plot of land at one end of a coastal village in Pagani District, Tanga Province, Tanganyika, had been granted to a non-African estate by the local chief and his council. Despite this official sanction, the secretary of a local branch of a national political party posted notices around the area proclaiming that the land was being stolen by the estate.

The estate returned the land freshly cleared, ploughed and harrowed, a condition greatly enhancing its value. An agricultural officer reported the land to be good for fruit trees and legumes. A public meeting was held to discuss allocation of plots; it was decided to forestall jealousy by having plots awarded to winners of a balloting among all male cultivators.

After allocation, only about one tenth of the land was ever cultivated; most of this fraction was abandoned

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[1]This case is based on Tanner, 1958.

before the first harvest, the landholders complaining that the soil was poor.

An analysis by Mr. Tanner, provincial administrator, pinpoints several of the factors contributing to the scheme's failure--while serving to describe the scheme.

1. opposition of the local politicians contributed to the suspicion that the estate might be planning to seize the crop, or to plough it under for the planting of sisal.

2. The unorthodox method of freeing and allocating land led to a doubt as to security of tenure by those who had received plots.

3. The land was made available so late in the agricultural year that many farmers could not fit its cultivation into their work schedule before the coming rainy season.

4. Some of those chosen by ballot as holders of this new land had their regular plots so far at the other end of the village that it was physically impossible for them to work both areas in the same season.

5. Some of those chosen by ballot had no desire for new land; some were not good farmers.

6. Cultivators were ignorant of the effect of mechanized land preparation and thought the land was more

thoroughly prepared than it actually had been. They were therefore delayed in planting by the necessity of completing plot preparation.

7. Women cultivators, many of whom, being divorced, were dependent on hired men to clear their land, might have been more eager to use the prepared land, but they were not considered in the balloting for plots.

8. New land is customarily opened up with ritual observances which were not performed on this land which had been opened by foreigners.

9. This land had been chosen for the convenience of the estate, and did not really suit the needs of the villagers. The "good land" of the agricultural officer was not necessarily good land for the crops the villagers were interested in growing.

10. One quarter of the village men, including many with plots in the newly opened area, were drawn away from the village during this cultivating season by the high wages being paid in the clove fields of Pemba.

Analysis

Little needs to be added to Mr. Tanner's analysis, except to categorize his factors in terms used in this study.

Basically this scheme failed for two reasons. Firstly, cultural practice was neglected although it could very well have served the needs of the scheme. This was true particularly in the matter of land allocation. Had land been allocated according to the traditioaal practice of application, people with a true need for land, and particularly prepared land--like the single women cultivators--might have been granted land. So might people for whom the new land was conveniently located. The cultural way of opening the land might have been performed. The land might have been offered at a time when the local agricultural schedule allowed time for its cultivation. Land suitable for the villagers' preferred crops might have been chosen.

The second basic cause of failure was competition of the economic reward offered by well paying employment in Pemba.

Other contributary causes of failure were political opposition and poor communication (villagers misunderstood degree of land preparation).

It is also true that some of the causes for failure listed under cultural really were logistically impossible; they could not be fitted into allotted work schedules or distance. Some of them could be considered ecological

problems--land unsuited for desired crops. In any case, what this case demonstrated is the need for planning, and the need to include some knowledge of the local culture in the plan.

3. Attempts to Innovate Improved Practices: Soil Conservation

Case 23: Soil Conservation in Fort Hall, Kenya[1]

This scheme organized shortly after World War II, enlisted the indigenous self help or ngwatio groups of the local Kikuyu in the building of terraces as a step toward soil conservation. Ngwatio groups of six farmers, including men and their wives, worked together to terrace itura land. The itura is a local land holding unit, the smallest to traditionally have been under the rule of a Council of Elders. Under the British, ituras were combined into sub-locations to be administered by a headman.

The ngwatio groups were transformed into a land authority responsible, under supervision of an assistant agricultural instructor, for terracing the land and in other ways restoring and maintaining its fertility. The elders, cooperating with the headman, were responsible for assigning time and place of work.

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[1]This case is based on Rice, 1947.

The ngwatio units worked well, completing 25 running feet of terraces on each tour of duty, of which there were two per week from dawn to 9 A.M.

The author states that the people were aware of the deterioration of the soil and were eager to correct it --so much so that they continued terracing even in a time of food shortage. He feels that the methods used in explaining the problem and its solution helped to gain their cooperation. These included blackboard diagrams and calculations of probable profit. Posters, photos, and amusing drawings all contributed to enthusiasm, when accompanied by adequate explanation and assurance that their work would result in immediate benefit to their own farms. Since itura units average only one and one-half square miles, no family had to wait long for work on its holding.

The author also feels the scheme was helped by the personality, linguistic ability and enthusiasm of the agricultural officer and the influence of a strong chief.

Analysis

This scheme was desired by the participants and was well planned to maintain their enthusiasm.

Communication methods were efficient and attractive,

and the scheme was led by a popular agent. The scheme was adapted to the local culture. It worked through the traditional authority. There were immediate advantageous results to individuals in the cooperative group.

Case 24. Uluguru Land Usage Scheme[1]

This poorly planned and inflexibly administered conservation scheme became a political cause in a time of emerging nationalism in Tanganyika and ended in so explosive a failure as to dangerously set back the cause of erosion control it was designed to serve.

The scheme was begun in 1949. Its purpose was to correct the dangerous destruction by the Waluguru of mountain forests which protected the rise of tributaries of the Ruvu River, the source of water supply of Tanganyika's capital city, Dar-Es-Salaam. There was danger not only of flash flooding of the Ruvu, but also of reduction of its feeding tributaries from constant to seasonal streams. Effect of overuse of their mountain slopes was felt by the cultivators themselves; in 1947, the amount of land required per person for subsistence (the cultivation factor) was four to five times greater than it had been only thirty

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[1]This case was abstracted from Young and Fosbrooke, 1960, chapt. 7.

years earlier.

A staff of five European agricultural officers and 60 alien African agriculture instructors were assigned to the scheme which was started, seemingly successfully, in three pilot areas, before being extended throughout the land. Personnel then spent six months in explaining to the Waluguru the need for and anticipated advantages of the scheme. Bush schools instructed farmers in the required techniques.

For the first few years the scheme seemed destined for success; through 1954 annual terracing quotas were exceeded. Resistance gradually developed as farmers realized that after the arduous and uncomfortable work of constructing the narrow bench terraces (terracing by hoe was difficult, and available spades required foot pressure on the sharp upper edge) impractical for shoeless farmers), they were rewarded by smaller crop yields than they had been accustomed to harvest before terracing. This was due to the fact that bench terracing led frequently to removal of the shallow top-soil so that cultivation took place in the clayey sub-soil. Even more resented was the prohibition against burning of crop waste which was to be saved for construction of trash bunds. Not only did this

interfere with custom, but the bunds became infested with maize borers which bred in the straw to damage the subsequent crop.

As resistance increased, agricultural instructors acted as policemen in enforcing regulations. They were greatly resented by the peasants who referred to them as an "army of black locusts."

Resistance became active when people were asked to move to the plains in order to decrease overcultivation and therefore erosion of the hills and loss of the capital's water supply. They claimed, correctly, that their health was better in the hills; the high elevation protected them from the malarial mosquitos which infested the plains.

At the same time, the death of an influential traditional leader (but one who had been bypassed for a less legitimate relative when the British had appointed a Native Authority "Sultan"), who had been a supporter of the scheme was taken as a bad omen. Representatives of the emerging nationalist party, TANU, took advantage of this to rally the rebellious peasants against the colonial administrators. A series of meetings found the peasants increasingly angry until one finally ended in riot during which the British appointed "Sultan" was attacked. Several

English policemen were also attacked, and one, in shooting to frighten an agitator (thought to be a TANU organizer), hit and killed him. Several peasants were arrested. Others, to show their support of the demonstrators, destroyed their terraces, and burned their crop refuse, thereby producing the "Smoke in the Hills" which is the title of the book from which this case is drawn.

The scheme was abandoned to prevent further disorder. Hope of protecting the city water supply faded as the scheme left farmers with a distrust of development schemes and personnel. The Tanganyika Agricultural Department summed up the damage two years later in its report for 1961. "The extreme conservationist is as dangerous as the land miner" (pt. 1: 33).

Analysis

One could draw up two long lists of factors impinging on this scheme, one pressuring for success and the other for failure. But, essentially, one fact led to failure of the conservation segment of the scheme and one fact led to rejection of the settlement aspect. In the first case, greatly increased labor (of terracing, and bund building) led to smaller crops (from removal of top soil and increase of maize borers). In the second case, as the

Waluguru knew well from experience, moving from the mountain heights would greatly increase the incidence of malaria.

Clearly, to the Waluguru there was no real benefit.

In terms of innovation techniques, management was extremely inflexible, depending finally on coercion to carry out its plans.

In terms of objectives, there was a conflict of interest. The scheme had been designed primarily not with the objective of helping the Waluguru, but of safeguarding the capital's water supply.

It is also worth noting, that though this was a large scheme, and of vital importance to the capital city, no effort was made to ease the labor of terracing by providing a spade for shoeless men--one perhaps with a broad footrest attached to one side of the upper edge, surely a technological improvement not beyond the abilities of the controlling powers.

4. Livestock Improvement Schemes

Case 26: Kitui Grazing Scheme[1]

The object of this scheme which was launched in early 1953 was to restore the enormous area of denuded and

[1] Unless otherwise noted, this case is based on Jordan, 1957.

eroded land in the Kitui district of Ukambani, Kenya, by means of controlled grazing and limitation of stock in carrying capacity of the land.

Persuasion methods included demonstration tours of reclaimed areas and slide shows. These were greatly reinforced by the loss from thirst and starvation of from thirty to forty thousand head of cattle as a result of the failure of the March and April rains of 1953, followed by repeated high mortality from further drought in 1954 and 1955.

The scheme involved a quarter of a million Kamba whose custom had been to graze their animals as close to home as possible. By 1957, however, all the communal grazing areas (6,300 square miles) were under controlled grazing which was designed to make maximum use of water while allowing all lands ample resting time. This was accomplished by grazing all animals from a location in a single section of that location at one time, and then moving them en masse to the next designated area irrespective of the site of owners' homes. Locations were divided into four grazing areas, each used for four months. This allowed all areas a full year's rest so that grass growth would be encouraged under all seasonal conditions.

To allow for stock limitation, local markets were increased from two to ten with sales organized by the Veterinary Department, but directed by location councils. In 1956, with few cattle deaths, stock sales had increased nearly ten-fold from those in 1954.

In 1957, the Kitui District Agricultural Officer reported the grazing scheme to be a success with the caution that its continued success "depends almost entirely on marketing facilities, which implies a regular consumer demand outside the district" (Jordan, 1957: 88).[1]

In 1962 the Aldev Board calculated that "destocking has been averaging slightly more than 10% which has in the past been accepted as the natural increase in African areas. But it is becoming clear that 10 per cent is too low and calculations should in future be based on a figure nearer 20 per cent" (Aldev, 57).

Analysis

This scheme, basically intended for soil restoration, happens to coincide with a time of repeated severe stock loss due to drought. The Kamba were ready to accept

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[1]Cattle marketing schemes in East Africa must depend on such demand, since East African cattle are banned from the international markets of Western Europe (F.A.O., 1967: 13).

help that might protect their animals.

Persuasion methods resulted in good communication.

Markets for the sale of stock as herd size increased were available and provided a financial profit taken advantage of by the Kamba once they were assured of the reduction of their subsistence risk.

In sum, this scheme succeeded because it reduced subsistence risk by modifying the cultural way of using the environment, and because it offered financial profit. Possibly, also, it succeeded partially because, as Oliver (1965) reports, the Kamba are only loosely committed to their culture.

Case 25. Iringa Dipping Scheme[1]

In order to extend grazing in Iringa District, Tanganyika, a scheme for enforced "dipping" of cattle against ticks which cause the locally prevalent East Coast Fever was imposed on local Hehe herders in 1953.

After construction of dips was completed, veterinarians explained the aims and advantages of the project to local chiefs; supervisors organized the scheme to ensure that all livestock would undergo dipping. A fee for the

[1]Unless otherwise stated, this case is based on Ruthenberg (1964: 51, 52).

service was imposed.

After four years of compulsory dipping, East Coast Fever, once responsible for a mortality rate as high as 50% among calves (Brown and Hutt, 1935: 164), was virtually wiped out and the cattle population had increased almost 20%. Nevertheless the scheme was unpopular and coercion was still necessary to ensure dipping. To the stock-owners the seemingly endlessly repeated long treks to distant dips seemed unnecessary and burdensome. They particularly resented having to pay for a service they did not want.

Support from the chiefs added little to the acceptability of the scheme, since, by 1953, they had begun to lose their hold on the tribesmen. At the same time local TANU representatives took advantage of the general discontent to strengthen their own popularity. When, in retaliation, the administration banned TANU from the area, the people finally refused to comply with the dipping ordinance.

The trusteeship status of Tanganyika set a limit[1] to the amount of force with which Government could back up its directives, and the Iringa Dipping Scheme was completely abandoned.

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[1]So says Ruthenberg (1964:52). Coercion was much more severe in enforcing manioc planting (case 15).

Analysis

This scheme, initiated through coercion, met with cooperation, however reluctant, on the part of herders until they no longer felt it was necessary to protect their herds. No more cattle were dying yet dipping, with its burdensome trekking and expense was still insisted on. Refusal to modify dipping rules with decrease of ticks was surely inflexibility of management.

There was misunderstanding on the part of management as to the current identity of effective local leaders. People now followed TANU more readily than their chiefs.

This scheme, counted a failure, could equally be analyzed as a success. People used the dips till the disease was wiped out and the safe grazing areas extended--the original purpose of the scheme.

People used the dips while they perceived a benefit; they rebelled against it when they could perceive no further benefit.

Case 27. Samburu Grazing Scheme[1]

This grazing scheme was started, with the cooperation of their elders, among the Samburu of Kenya in 1958.

[1] Except as otherwise noted, this case is based on Aldev, 1962: 141-143.

1958 was a year of unusually good rains.

The carrying capacity of the grazing land (number of stock-units per acre) was determined and members were asked to remove any excess beasts. This they did. They were charged an annual fee of two (later raised to three) shillings per unit grazed on the scheme. The grazing land was divided into four blocks to be grazed in rotation for four months each, thereby allowing each block a full year rest between its periods of use.

Various sources of water supply were constructed.

The scheme progressed well in 1958, its chief officer stating in his annual report:

> Writing as one who saw this country in 1951/52, the effect of these schemes is remarkable. The countryside was red, now it is green. Possibly it could be said this is due to good rains and not grazing control, but not all, as between the two schemes of Seya-Barsalinga and Wamba there is a stretch of country which is not controlled and which is still showing red" (quoted in Aldev, 1962: 142).

The scheme, enlarged by the annexation of the one at Wamba continued to prosper through 1959 though that year saw both drought and epidemics of foot-and-mouth disease.

In the following year, 1960, the drought increased and large numbers of game animals entered the scheme area

to share the water and grazing. This made it impossible to preserve the rotation schedule. In 1961 it was agreed to kill the game in an attempt to preserve the scheme. The scheme was closed in July of 1961, however, along with all other schemes in Samburu District. Spencer (1965: xx) reports that the Samburu grazing schemes were abolished by decision of the Samburu themselves when Government left it up to them to retain or abolish the schemes.

Spencer says of the government sponsored Samburu grazing schemes,

> It was the elders who among themselves decided their own courses of action, and government innovations impinged on the society in much the same way that some ecological change would impinge: it was accepted almost as an incontrovertible fact and the social system adjusted itself accordingly (Spencer, 1965: xx) (italics mine).

Analysis

Spencer's quotation describes very well the influence of ecology on culture and on culture change in an environment which does not allow much choice of subsistence strategies.

This scheme depended for its success on the provision of artificial water sources and on the maintenance of a carefully calculated ratio of grazing animals to

grazing land as well as the periodic resting of that land. So long as rains were fairly good, the technology of the foreigners was adequate as was the cooperation of the Samburu graziers. The scheme was defeated by local ecology in the form of thirsty and hungry wild animals which upset the crucial beast:land ratio, and grazed the resting fields.

It is important to note with this scheme that, had it been analyzed just a short time before its invasion by game, it would have been counted a success. This emphasizes the need for a long time follow up of adoption of innovation before a scheme can be judged a success (Arensberg, 1967: 66). However, the point to be checked over time here is not the peoples' willingness to accept an innovation but rather whether the innovation will work under all possible local environmental situations. In other words, this scheme failed because it was adapted not to <u>minimal</u> environmental conditions, but rather, to average ones.

Spencer reports:

> When I revisited them, at the very end of the year, far from regarding the drought they had suffered as a . . . disaster, they regarded it as accompanying one of their greatest moments of triumph in recent years: a definite step towards a return to their traditional way of life (1965: xxi).

One must remember that their traditional way of life, whatever the cultural embellishments, was first and foremost based on a nomadic pattern adapted to the minimal conditions of their environment--they could move from areas of no water right now to areas of some water right now; from areas of no graze remaining, to yet ungrazed areas; from areas of disease occurrence to areas free from disease. Thus their normal subsistence pattern was a defensive adaptation to subsistence risk. The innovated pattern increased subsistence risk.

Case 28: Iraqw Destocking Scheme[1]

Since 1947, Government had been propagandizing the Iraqw people who lived on the western escarpment of the Rift Valley in Mbulu District, Northern Province, Tanganyika, as to the need for restoring their degenerating grazing lands. By 1949 this need was evident to all, but there was considerable resistance to any destocking scheme. However, faced with the imposition of compulsory destocking if they could not agree to help Government devise a scheme, the people, persuaded by several of the tribe's influential elders, finally acceded.

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[1]Unless otherwise noted, this case is based on a report of the Tanganyikan Dept. of Veterinary Services, 1955.

At this time, too, a positive attitude toward Government prevailed, the result of recent help in providing water.

The scheme aimed to achieve and maintain an adequate land to stock ratio. This was to be accomplished in two ways: the tribal grazing area would be greatly extended by freeing large blocks of adjacent land from tsetse; in the meantime, the people in the overstocked areas were called upon to sell their excess cattle. Individual destocking quotas were issued after a cattle census was conducted by a culling clerk working with the village headman to decide each man's share of the common grazing land. Markets designated for the scheme would issue receipts which sellers could use as proof that they had met their quotas. Orders to sell came from the Provincial Commissioner in order that people might not turn against the native authorities.

Cooperation with the destocking regulations was sufficient that by 1953, the cattle population had been reduced by more than one quarter. But, as Meek reported in 1953, stockowners engaged in a continual battle of wits with management, resulting in ever new methods of evasion of required sales (Meek, 1963: 64).

Ploys used by stockholders in this battle included: the general use of required sales to not merely destock, but to cull the herds--poorer quality stock was sent to market; Barabaig stock owners in areas adjacent to the scheme sold cattle in the Iraqw markets and then sold the destocking tickets to Iraqw; some Iraqw moved to the Barabaig area just ahead of the census taker to return after his departure; others moved permanently to Barabaig, thus causing overstocking there (T.D.V.S., 1955: 33), and Iraqw from areas not marked for destocking charged those in the destocking areas for selling cattle in their name (Meek, 1963: 65).

Cooperation in contributing to communal labor (forty-five days were required of each man) was more thorough. By the end of 1952, six hundred square miles had been cleared of tsetse by communal labor. As newly cleared areas were opened for grazing, destocking quotas could be reduced so that, after four years, regular quotas were withdrawn, Government ordering sales only when voluntary sales did not offset annual stock increases.

The success of this scheme was undoubtedly aided to a great extent by the nature of its management: there was unusual continuity of both government officials and an

unusually large staff; considerable flexibility was shown in managing the scheme.

When the stock census disclosed that one third of the cattle were held on loan (loaning of cattle, always common among East African herders, is even more so among the Iraqw who do not night kraal their animals as do other peoples of the area; instead, one room of each Iraqw home is reserved for its cattle, and no family will keep at home more animals than it can take into the house at night (Meek, 1963: 61), an agreement was reached between the scheme managers and stock owners that loaned stock would be assessed to the borrower, who would be required to turn over to the owner the sale price of his animal. When cattle prices declined, stockholders were permitted to delay selling, or else to seek other markets. When stock too young to bring maximum profit were put on sale to meet quotas, an auxiliary holding ranch was opened.

A final factor in the success of this scheme was fortunate timing. Its inception coincided with the start of a steadily increasing demand for meat in Tanganyika, and a consequent overall rise in price.

Analysis

People voluntarily cooperated in this scheme, only when threatened with coercion if they refused. Therefore one may say it was started with coercion. However, management (Governmental) had a good image for the Iraqw, having recently provided them with increased water. Also their own leaders promoted the scheme.

Management was continuous, alert and flexible; reduction of stock sale quotas were issued whenever possible. Postponement of sale to await a rising price was allowed; selling rules were modified to take into account cultural stock sharing habits as well as new ones devised to defeat the scheme.

Luck helped in that, as the scheme progressed, rising markets made the Iraqw appreciate the benefit of financial profit.

Primary to success of the scheme was the undeniable real benefits, not only of profit from sales, but of increased grazing land.

5. Settlement Schemes

Case 29. Olenguruone Settlement Scheme[1]

Settlement by local Kikuyu and Dorobo was begun on this scheme in the Makuru District, Rift Valley Province, Kenya in 1941, on land bought by Government from the Masai. Settlers were allotted eight acres per family plus five acres for each extra wife, with stipulated amounts to be used for homes, paddocks, cropping and cultivation.

Settlement rules, issued in 1942, were not put into effect until the end of World War II, four years later, due to war-time shortage of personnel. At that time, all of the 54 Dorobo settlers, but only a very small proportion of the Kikuyu agreed to abide by the rules. The Kikuyu resented in particular the ban on maize cultivation, maize being their accustomed staple food. The ban was invoked when it was found that maize took thirteen months to mature at the extreme altitude (9000 ft.) of the scheme, thereby providing not even one crop per year. (At other sites mentioned in this study maize was reported to have a three to six month growing time.)

The Kikuyu agreed to leave the scheme, but only under conditions which scheme administrators considered

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[1]This case is based on Mitchell, 1947: 23.

impossible. Eviction orders, subsequently upheld by the courts, were finally carried out in 1949.

Dorobo settlement has continued. In 1957 there were 863 families. Pyrethrum and sheep are the cash producers and in 1959 a sheep and pyrethrum cooperative was established.

Analysis

Olenguruone succeeded with the Dorobo and failed with the Kikuyu, probably due, in large part to the differences in their past. The Dorobo had, till very recently, been hunters and gatherers, whereas the Kikuyu were cultivators accustomed to growing maize as a staple. The ban on maize growing did not pose the hardship to the Dorobo that it did to the Kikuyu.

Current political conditions probably also led to lack of Kikuyu cooperation, since this was a time of increasing Kikuyu resentment over land policy which was to culminate shortly in Mau Mau.

Case 30. Shimba Hills Settlement Scheme[1]

In 1952 an area in the Shimba Hills twenty-five miles south of Mombassa and twelve miles inland from the

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[1]Unless otherwise noted, this case is based on the Aldev reports (1955: 174-80; 1962: 199-201).

Kenya coast was opened to settlement after a year's trials had indicated that, with proper application of manure and phosphates, it would produce sufficient harvests for both subsistence and cash income. Cultivation was to be aided by mechanization. Government would clear tsetse bush, Manure would be provided by a scheme herd till further clearance would enable settlers to bring in their own cattle, the number to be set at eight head per family.

During the first year, only four families of the many parties of local Taita, for whom settlement had been primarily intended, elected to become settlers after visiting the scheme.

The Aldev report speculates that "one reason for the poor response from the Taita may have been the distance to water which would appear a hardship to people accustomed to clear rills near every village"(1955: 175).

The following year Kamba from Machokos in the distant Southern Province, where uncertain rainfall and overpopulation made for subsistence insecurity (Porter: 1965: 418) were invited to visit the scheme. Kamba response was so enthusiastic that applicants' names were put on waiting lists. At the end of two years, ninety Kamba had joined the original four Taita settlers and it was decided to limit further settlement to one hundred families a year.

During the years to 1962 and particularly since the 1960 drought in Ukambani, Kamba continued to dominate settlement, joined by members of other tribes, particularly a large number of Nandi from the Rift Valley Province where spreading cultivation had left a shortage of grazing land. Nearby Nyika had turned down invitations to join the settlement because "they were not willing to give up their independence from Government control simply to obtain the benefits of Government assistance and agricultural machinery" and they believed "The Shimba Hills area is haunted by evil spirits" (Gerlach, 1965: 249).

Analysis

This scheme provides a good laboratory situation since four tribes were tried on the same scheme. Their reactions depended on the relation of their need to the cost the scheme would have for them:

The Taita's need for new land was insufficient to make the unaccustomed long trek to water worth the effort.

For the Kamba, always living with an insufficiency of water, and with severe land need, the advantage of new land outweighed the disadvantage of the distance from water. They did not object to walking for water.

The Nandi, badly in need of grazing land, also did not object.

The Nyika, as quoted above, did not feel the benefits promised by the scheme were worth sacrificing their independence.

In balance the scheme is to be counted a success, since full settlement was achieved.

Case 31. Shinyanga Resettlement[1]

The people of Old Shinyanga in the Lake Province of Tanganyika, having had to flee their traditional home area because of a sudden severe influx of tsetse, petitioned the government to clear it of fly so that they might return. Their petition was granted and scheme administrators thought to take advantage of the situation by building reservoirs for water before opening the area to resettlement. The inhabitants were, however, so eager to return, that they requested permission to do so before the reservoirs could be constructed. Rather than waiting, they agreed to help in the preparation of a water tank from one of the many huge kopjes with which the area was studded. Settlers also agreed to bring only a limited number of their cattle until the area might be demonstrated to be fully safe for herding.

[1]Unless otherwise noted, this case is based on Hatchell, 1959.

The cleared area was to be maintained fly free by means of continuous cultivation. To this end, each returning family was allotted four acres of arable and ten acres of grazing land according to traditional tribal ways of land allocation and tenure.

It was hoped that the fly free area would gradually be extended by cultivation from its periphery.

In order to enable settlers to take full advantage of the impending "short" rains they were assisted with housing.

Settlers were so overjoyed at the chance to return that they voluntarily cooperated in building a new house for their chief in the traditional tribal headquarters.

There followed a series of disappointments: baboons which had moved in when the inhabitants moved out proved formidable competitors for the crop; the first year's sorghum crop was badly attacked by striga; their cultivation methods did not permit the settlers to keep even the existing fly free area cleared and would certainly not allow for its extension.

A year after their triumphal return, the returnees reabandoned their home area to take up available land elsewhere, where cultivating conditions might prove easier.

In 1950 the Shinyanga Settlement area, having been finally abandoned by its original inhabitants, was opened to resettlement by outsiders. Nearby Sukuma, with a severe land hunger, moved in. As had become their custom, the Sukuma used ox ploughs to cultivate cotton and in this way were able to maintain tsetse clearance by continuously and constantly cultivating the fly free area, and, by extending cultivation beyond this area, to extend it--so effectively that a 1959 report describes Shinyanga as having taken on the appearance of true Sukumaland Cultivation Steppe (Welch, 1959: 259).

Analysis

This scheme, judged by the positive rating of all the classical innovation variables should have succeeded with the original settlers. It failed because the demands of the scheme were beyond the technology of the people of Shinyanga. This was reinforced by a hostile ecology--baboon predation; striga; tsetse.

Although the felt need of the Sukuma was not as great as that of the original inhabitants, being merely a need for usable land, not for this specific land, they succeeded where those had failed because their technology was able to meet the requirements of the project.

Case 32: Gede Settlement

Since before World War I, Giriama tribesmen, freed from slavery to the Arabs, had migrated to the Kenya coast from their inland tribal reservation to grow cotton as squatters on Crown Land. With the aim of stabilizing their settlement and converting them from shifting to permanent cultivation, Government, in 1938, opened 10,000 acres of Crown Land to squatters near Gede, site of the ruins of a 12th Century Arab city.

The Gede area was chosen because it was thought that the nearby squatters would be more receptive than others to organized settlement. They would be settled as a group; it was hoped that their satisfaction with the scheme would facilitate its expansion by the successive inclusion of adjacent groups of squatters which were scattered north and south along the coast.

Settlers were required to accept scheme rules concerning land conservation, and against fragmentation of holdings. To anchor the settlers to their holdings, permanent tree crops were emphasized. These tree crops also would provide a source of lumber and of various marketable produce. The remainder of the twelve acre allotments

[1]Unless otherwise noted, this case is based on Humphrey, 1939.

would serve for home compounds and rotated annual crops, including cotton as the main cash crop.

The center of the settlement area was reserved for social services including a market and a school; nearby the staff cultivated a demonstration plot.

The scheme expanded as planned. The coral studded sandy soil proved surprisingly fertile under proper management. The 1962 Aldev report states, "a great deal of cotton is produced from Gede and its neighborhood. The settlement has now ceased to be supported by public funds" (211).

Success has not come without effort on the part of both administrators and farmers. On a visit to Gede ten years after its inception Elsbeth Huxley was told by a scheme officer that success was only possible because "we push them into it if you keep on and on" (Huxley, 1960: 8). He complained that during the war, when supervision was reduced and cotton prices increased, the Gede settlers extended cotton cultivation to their subsistence plots and had to be fed through famine relief.

Still, Mrs. Huxley marvelled at the fertility coaxed from the sandy soil by the foreigners "push" and the Africans' toil.

Analysis

This settlement scheme incorporated Giriama squatters who had already chosen the area.

The settlers liking of cash income endangered the scheme; when supervision relaxed they gave over their subsistence plots to cotton, thereby, seemingly, inviting subsistence risk. The Giriama, however, probably had learned from being settlers on government land and beneficiaries of so many government services, that government could be depended on to provide subsistence security, and so, indeed, it did.

Case 33. Oyani-Miguri Rivers Settlement Scheme[1]

The object of this scheme was to ensure that the valleys of the above two rivers in South Nyanza, Kenya, which had been cleared of tsetse bush by the Veterinary Department during 1946-49, should be secured from regeneration of bush by means of proper land usage.

The Oyani valley was suitable for agriculture, and the Miguri for cattle farms.

Settlement rules were accepted by the local African District Council.

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[1]This case is based on Aldev, 1956, 156-62.

After construction of three dams and a dairy, plots were demarcated and settlement opened both to former rightholders of the area and, where there were no claims to the land, to new immigrants from overcrowded areas.

So few settlers moved in that the scheme was abandoned in late 1951.

Failure was ascribed to three factors:

(1) Lack of pressure of the land in South Nyanza.
(2) Numerous claims of previous ownership which tended to scare off new immigrants.
(3) Reluctance, common to farmers all over the world, to submit to regimentation" (1956: 162)

Although, in fact, the scheme as planned did fail, its purpose was accomplished inasmuch as, after its abandonment there was a spontaneous movement into the area of settlers who farmed it under the normal supervision of agricultural instructors sufficiently well that the Aldev report for 1956 notes that "the bush has never regenerated, the dairy has flourished. . ." (1956: 157).

Analysis

This scheme presents a strong case against unnecessary regimentation. As with the Mariakani Milk scheme (case 34), provision of a fly free settlement area and water would seem to draw in settlers with no further persuasion.

Assessment as to the extent of land hunger was

probably too high, but in any case the object of the scheme was not to give land to land hungry people, but to use settlers to keep a newly tsetse cleared area free of tsetse. In other words it was not planned primarily to meet the needs of settlers.

Case 34. Mariakani Milk Scheme[1]

This scheme, initiated in 1950, was designed to increase the supply of milk to the city of Mombassa on the Kenya Coast and, at the same time, to draw away excess cattle from the area along the railway line leading to Mariakani, the site of the Veterinary Department's milk processing plant.

Dispersion of cattle occurred spontaneously following the opening of a large strip of sparsely occupied coastal hinterland to settlement through tsetse clearance and provision of water sources, and access roads, and the establishment of milk collecting stations where cattle-keepers could sell their milk at a fixed price regardless of their distance from the Mariakani processing plant.

The processing plant was turned over to the two

[1]Description of this scheme is based on Gt. Britain, Colonial Office Report (1955: 17, 18) and on three papers by Gerlach (1963, 1964, 1965).

local African District Councils (Kwali and Kilifi) to be run under supervision of the Veterinary Department.

By the end of 1954 much of the necessary technical work had been accomplished. The Colonial Office was able to report of the scheme: "It is certainly achieving its objective of expanding the milk industry, and dispersing cattle from the railway zone" and "Local Duruma and Giriama have moved into the area without disruption of their normal society" (p. 18).

In the meantime a class of African traders had been emerging in the area. Traveling by bicycle, they bought and sold milk and produce in the countryside, effecting an exchange of food products between herders and cultivators; they also sold the milk and vegetables of the countryside in the nearby coastal fishing village of Vanga; from Vanga, they brought fish and palm wine to customers in the country.

These traders, while not providing the only means of food exchange between the local farmers, herders, and fishermen (food was also shared by gifts and feasts) (Gerlach, 1964: 22), were important in that exchange. In addition, in order to increase their sales, they sometimes introduced new foods to their customers. (A case in point

was that of fresh fish, often eschewed locally as dangerous for the health.) (Gerlach: 1965: 264). Indeed, Gerlach contends that, whereas the local people tend to reject Government's attempts at introducing new custome, they often accept those introduced by fellow tribesmen.(1963: 34).

In the late 1950's, in an effort to further increase the supply of raw milk to the processing plant, the scheme's administrators arranged to have Indian bus and truck owners purchase milk from cattle-keepers along their routes and deliver it to Mariakani. This effectively eliminated competition from the African traders. It also cut the supply of milk to the nearby farmers and the townspeople of Vanga. In fact it cut the supply of milk of the cattle keepers themselves since they were often in debt to the Indian traders and had to deliver to them their total milk supply.

In terms of its original objective, to increase the supply of fresh milk for the city dwellers of Mombassa, this scheme was initially so successful that, in 1961, it received a large loan from UNICEF for the purpose of rebuilding and enlarging its plant. The loan was to be repaid by provision of free milk for local children (Aldev, 1962: 204).

Recent news of the Mariakani Milk Scheme indicates

that the independent Kenya Government has furthered the trend set by its colonial predecessor. In order to keep the profits of the scheme high, milk is turned to butter which is sold abroad in the U.K., thus further raising the price of milk locally. The city people, for whose benefit the scheme was originally designed, can no longer afford the high price of milk (Belshaw, 1969). The scheme's original objective has obviously been forgotten.

Analysis

Early on, this scheme met with remarkable success in terms of its original objectives: Manipulating the environment and equalizing the profit for herders regardless of relation to the railroad led to their spontaneous resettlement. Increased well-being of cattle increased the supply of milk for Mombassa.

Sociologically the success of the scheme is questionable. The choice of Indian large scale traders to divert business from African small scale traders should be noted. It is an illustration of the caste-like nature of East African society in colonial times.

In terms of its objectives this scheme was originally a success. (Diversion of milk--as butter--to Britain has occurred under new sponsorship.)

In terms of culture change instituted, this scheme is also to be rated a success, whatever its social or nutritional cost.

Case 35. Lambwe Valley Luo Settlement Scheme[1]

The object of this scheme in South Nyanza, Kenya was to open up the Lambwe Valley to Luo from supposedly overcrowded locations in South and Central Nyanza. Rainfall in the area was good (50") and fertility, thanks to protection of tsetse, was high.

Government provided roads, water and first ploughing in addition to clearing non arable land of fly bush. Bush on arable land would be cleared by individual farmers.

Settlement commenced in 1951 in line with plans agreed upon after a series of meetings with the people. Settlement was slow and could not conform to the plan, in that pressure on the home area land was insufficient to provide large groups of settlers and the plots assigned proved to be more than twice too large for individual families to manage according to the requirements of the scheme. Additionally, Luo were deterred by the early ban on cattle.

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[1]This case is based on reports in the two Aldev volumes, (1956: 151-154; 1962: 178-181).

Settlement was stepped up after tsetse clearance was sufficiently advanced to remove the cattle ban, but the area of the scheme could not be increased according to plan because there was never a sufficiency of Luo settlers, and the African District Council, despite six years of propaganda, would not agree to admission of non-Luo. Further development was therefore ruled out and the scheme has been continued only on a "care and maintenance basis" (1962: 180), designed to prevent the return of tsetse. Settlement has fluctuated but the trend has been decline, which the report attributes to "disinclination to accept control when there is still uninhabited land in the district which can be occupied without restriction" (1962; 180).

This judgment is supported by the fact that at one point close to one quarter of the settlers were composed of "141 families who had crept in as squatters on the periphery but have since been brought into conformity with the rules" (1956: 153).

There is an intriguing mention of local radioactivity which "has apparently been responsible for the legend that the valley is haunted by spirits" (1962: 181). One wonders if this spirit population isn't in some part responsible for the limited response to propaganda for settlement.

Analysis

This scheme failed due largely to a misunderstanding on the part of management of the land situation of local Luo. Most felt no land shortage and were therefore unwilling to accept control in order to acquire new land, nor were they willing to share their tribal land with aliens, since they could perceive of no benefit accruing from so doing.

Also the blue print of the scheme was dependent on an impossible amount of work by settlers. A feasibility study might have disclosed this planning failure.

Case 36. Kigezi Resettlement Scheme[1]

In 1946 Kigezi District of Southwestern Uganda was showing signs of overuse of its most populous and most fertile southern section. It was therefore decided to encourage settlement by the local Bakiga people elsewhere in the district. To this end the senior chiefs of the Bakiga were invited to select a suitable site after touring former tribal areas in northern Kigezi which had been abandoned due to game and tsetse. Volunteers were then taken to visit the chosen site and promised two years of exemption from

[1]This case is based on Purseglove, 1950.

poll taxes should they decide to settle. Normal moving procedures of the Bakiga were studied and were to be emulated in the settlement process.

About half of the first visitors decided on resettlement. This percentage was increased in later groups when applicants were limited to men who had insufficient land at home.

Early settlers were allowed free choice of site and amount of land. The aim of providing each family of six with twelve acres--three to be under cultivation, three to be resting, and six to allow for expansion--was fairly well achieved. This contrasted with the average 2.86 acre holdings in the home area.

Men of the settler families were taken to the settlement area by lorry to prepare their land for cultivation and plant their initial crop. The men chose to do this work in groups of twenty to thirty for security and in order to reduce the amount of damage by game. Game guards were assigned to shoot intruding animals (elephants and buffalo) and the carcasses were distributed for food. The men were housed in temporary grass camps, fed, and provided with seed--routinely for subsistence farming, and upon their request, with groundnuts and flax for cash crops.

Subchiefs were appointed from their own people. Staff members visited regularly to provide supervision. (No additional European staff was appointed for the project which was carried out by the regular District officers with the cooperation of the Kigezi African Local Government.) Midway camps were constructed between the settlement area and the home area for the convenience of men making home visits.

The scheme was helped in its early days when the new land successfully met the customary Bakiga test: the settlers' chickens flourished, a sure sign that the crops would yield well. Thus reassured, the men built homes for their families, and then, after a final trip home to help with the harvest, returned with their families as permanent immigrants. They brought sheep and goats as well as their chickens to the new home but remaining tsetse ruled out cattle.

As the chickens had predicted, the first crop was a success, and since the scheme's success seemed assured as well, roads and medical and school facilities were built, springs were enclosed, baboons poisoned and weekly hunts were organized to provide meat and keep down game. New crops including coffee and tobacco for cash crops were

cultivated. Cultivation on contour strips built up with bunds was gradually terracing the land.

By 1950 the settlement area had a population of 15,000 and seemed to be meeting the goals of the project which were: to make the people self supporting in food; to produce surplus food so that established settlers could provide food for new ones; to provide cash crops. Population pressure was relieved in the crowded area around Kabale and food production for the district as a whole was increased. The original scheme was approaching saturation and its extension was being planned.

Analysis

Land for resettlement was chosen by the chiefs, thus involving the local leaders.

When propaganda was limited to those needing land, a much higher proportion of applications were received. True need was tapped.

Decision making was left to members in many instances--selection of plots; land preparation.

Logistics were carefully planned and carried out according to the cultural ways.

A cultural test for success fortunately was met when the chickens responded well. (It occurs to me that this folk test of a good soil may be scientifically valid,

since chickens eat grainsseeds; perhaps where chickens thrive on naturally occurring grains, grain cultivates will thrive as well. In other words, foraging chickens may be indicators of agricultural potential.

Case 37: South Busoga Settlement Scheme[1]

The fertile land fringing Lake Victoria in South Busoga, Uganda, had been virtually emptied of its human population following two severe sleeping sickness epidemics, the first in the early 1900's and the second in 1942. People who had given up land pressed the authorities to reopen the area. Government responded, hoping that continuous settlement would result in permanent bush clearance which would in turn protect the area from fly.

Plans as to how to use the land were changed frequently for a variety of reasons: aims of the several Government Departments involved were at variance as were the methods they suggested; anticipated city markets for suggested crops failed to develop; the administrative bodies responsible for the management of the scheme, as well as their personnel, were frequently changed, and

[1]This scheme is based on Ilingsworth, 1964.

each new administrator was allowed considerable scope in deciding the scheme's day to day operation: conflict of claims among former users, whose rights in the land were based on different interpretations of traditional land tenure, made it difficult to allocate parcels among applicants for settlement; indeed, as it turned out, those who had petitioned Government to reopen the area were not motivated by any personal need for land, but rather by the hope of leasing their holdings for profit, or in some cases, by desire to thwart the ambitions of rival claimants: local chiefs, whose authority lay in their traditional power to allocate land were particularly concerned with plans for the area's resettlement; the degree of their cooperation varied as they felt the scheme might effect them.

The area was finally opened to settlement in 1956. Small scale peasant farmers responded in far smaller numbers than had been anticipated. They were required to pay lease fees to successful claimants; they were expected to clear the ten acre plots by themselves; no provision was made for their first year's subsistence and they were given no tax concession.

The objective of continuous cleared blocks was impossible to attain since settlers could not at first

clear enough land even to feed their families, but had rather to continue cultivating off-scheme plots for their subsistence.

After five years so much bush remained in the settlement area that new allocations were limited to seven acres except on request of individuals who planned to privately finance larger scale cultivation. These more ambitious settlers were given little encouragement and less help and consequent failures were frequent. It is pertinent that traditional South Busoga farms averaged only 3 acres. which should have suggested to scheme administration the size plot a farmer could be expected to clear without outside help.

In 1964, the scheme was reported to show "no evidence of planned settlement . . . the few new settlers unsupervised and sleeping sickness control almost nonexistent" (p. 6). Perhaps this sad state of affairs is at least parly explained in the earlier note in the report that the administrative body which had recently again undergone change had "no money this year because of the failure of the cotton crop" (p. 2).

Analysis

This scheme suffered from poor planning and poor management. Need was misrepresented. Settlers were given no help with logistics. The scheme depended on their accomplishing an impossible task. The anticipated market did not exist. There were conflicts of interest between local leaders and between government departments.

However, the basic cause of failure was that the ecology (prevalence of tsetse) did not allow for the scheme, as planned, nor did it allow a profit (through the failure of the cotton crop).

Case 38: Bunyoro Agricultural Company, Uganda[1]

In 1951 two private corporations joined the Protectorate Government, and the Uganda Native Government in forming a company with the object of turning unoccupied virgin bush into small privately owned farms. The protectorate government provided half the necessary funds with the private companies sharing the remainder of the cost and the Bunyoro Native Government receiving a share in the Company equal to those of each of the private firms in return for its interest in the land.

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[1]This case is based on the Bunyoro Agricultural Company Report (1956).

For three years the area was run as a centrally controlled farm increasing gradually from 90 to 1000 acres in size. After this preliminary period the sixty-six settler families were issued small holdings of 20 acres each.

Original cash crops were cotton and tobacco but continuous experimentation was conducted to test possible additional sources of income. At first the company provided full mechanical services for cultivation with the understanding that peasants would pay after their crops were harvested. The area had been unoccupied for fifty years; thebefore that the Bunyoro had used it for grazing cattle, but had abandoned it when a rinderpest epidemic destroyed their herds, it was thickly covered with bush.

With certain adjustments suggested by the three year trial period, i.e., limitation of mechanization to the early phases of cultivation, since, after planting, hand cultivation had proved to be both more efficient and cheaper; the introduction of pig-keeping to utilize the sorghum which grew well, but for which there was no market; and the maintaining of cattle with antricide as prophylactic against the prevalent tsetse, the scheme seemed to be succeeding.

After the fourth year the two private firms abruptly withdrew, thereby ending both the company and the scheme. They had been sustaining major financial losses from the start and could foresee no reversal of this trend.

The scheme had been overcapitalized in that the price paid to the Native Government for the unused land was far greater than its actual value. Clearance costs were much higher than anticipated as bush proved resistant to the machines. Finally, when the first cotton crop ripened, although it was the best ever grown in Uganda, tenants generally declined to harvest it. They had been so highly subsidized that the entire crop would have gone to repay their debt to the company; from their point of view the effort of harvesting would go unrewarded.

Analysis

This scheme primarily failed because of poor planning on the part of management. It was over capitalized, and technology was inadequate under prevailing ecological conditions--the machines were not capable of clearing the bush as planned.

Members could perceive no real benefit in harvesting the cash crop since they already owed management all

their prospective receipts.

Causes of failure were really external. Members had cooperated in all aspects of the scheme.

Case 39. Aba-Ha Concentration[1]

The object of this late 1930's scheme was to settle in a concentration approximately 1000 families of Aba-Ha living scattered and hidden in the bush over a large area in Western Province, Tanganyika. (One thousand is the minimal number of farms necessary to maintain a continuous clearing large enough to discourage tsetse invasion, since the tsetse fly, a shade dweller, will not travel over more than two miles of open country. A farming settlement which maintains such a clearing is termed a "concentration".)

Persuading the people to move and do the necessary bush clearing was relatively simple since their customary method of cultivation included each of these practices.

Considerable difficulty, however, was encountered in persuading the people of the advantages of living in a concentration, as well as in getting agreement on the area to be settled.

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[1]This case is based on Moffett, J.P. (1939: 35-38).

After several large meetings, resistance to concentration settlement was overcome, but agreement on the site proved impossible since many of the subchiefs wanted the settlement located in their home areas. The settlers were therefore invited to choose an entirely new site in unused thickly wooded country twenty miles from the tribal lands. The chosen site was approved by Government experts as having better soil than the old areas; there was a river for a water source.

The method of land allocation was designed to follow tribal custom after initial division, by their own agreement, between the subchiefs. Each subchief divided his group's portion among its various headmen who then distributed separate holdings to the individual families in his charge.

Two months after receiving their land each farmer had moved with his family into a completed home and started his new fields.

During this two months each farmer had been required to meet the following obligations:

1. Clear a track from his homestead to the main road in preparation for moving his household goods and harvested crop.

2. Move ahead of his family to the new site to clear a space for his house and cut grass for thatching, while his wife remained behind to prepare stores of food and household goods for the move.

Each settler was helped with the transport of his belongings (including a ton of food per family) at first by lorry and later by a "road train" which delighted the people and contributed considerably to the maintenance of high spirits about the move.

After two years (1939) the people were reported as happy with their new life which afforded the additional advantages of a medical dispensary and agricultural instruction.

Analysis

This resettlement scheme was well planned. Careful attention was paid to winning settlers over to the scheme, by holding as many meetings as were necessary to accomplish this.

When subchiefs vied for the settlement area, management avoided taking sides by offering an unclaimed area. Settlers chose the area.

Logistics were carefully planned to take care of

each member's needs; that the road train added entertainment was a slight additional plus.

Living in a concentration provided the people with real advantages (medical dispensary, agricultural guidance) as they had been promised.

Case 40. Tobacco Cultivation and Settlement in Urambo[1]

Urambo, in Tanganyika's Western Province, was one of the sites of the ill fated Groundnut Scheme. In order to salvage the extensive and expensive clearing done for the Groundnut Scheme as well as increase the productivity of African farmers, the land was transferred to the Tanganyika Agricultural Corporation (TAC) in the early 1950's. The East African Tobacco Company offered to buy any tobacco grown on the scheme. TAC, therefore, after a feasibility study, planned to run the scheme as a collection of independent farmers cultivating tobacco as a cash crop.

Settlers were chosen from applicants of mixed tribal backgrounds--some came from as far away as the Rhodesias and the Sudan--as well as from Europeans (usually those who had been employed on the site by the overseas Food Corporation management of the Groundnut Scheme.)

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[1]This case is based largely on information supplied by Mr. Simon Mbilinyi, who had been an extension agent at Urambo.

Accepted applicants spent their first year at a tobacco school on the scheme site, individually cultivating and drying tobacco under supervision. At the completion of the course each farmer was leased a farm, either "small" (approximately 32 acres, including 16 for rotated tobacco), "medium" (about 150 acres, with 60 acres for tobacco), or "large" (about 1500 acres, 240 for tobacco), according to his demonstrated competence and his financial ability.

New settlers were expected to build their own homes and tobacco sheds on their own holdings, as well as to pay rent for their land. They were to receive all necessary inputs from TAC, including, optionally, mechanized cultivation services, charges for which would be subtracted by TAC at the time of its sale of each farmer's crop. Sales were made by TAC through auction to the East African Tobacco Company. TAC ran on site farm stores.

Assignment of farmers to farms was not to be permanent and anyone could later be reassigned to a larger or smaller holding. At first all large farm leasees were Europeans, but before the new government of the newly independent nation discouraged expansion of large farms, as inimicable to its ideal of African Socialism, two Africans had been promoted to that category. As Europeans gave up their

large farms following independence, these were converted to smaller holdings in order to accommodate the increasing number of applicants for the scheme.

The scheme is prospering and evolving. The quality of Urambo flue-cured tobacco compares with that grown in the U.S. (Keegan, 1964: 13). In 1962, with approval of TAC, members formed a Tobacco Growers Co-op. Co-op membership was open to nearby non-scheme farmers. The Co-op and TAC share responsibilities in marketing the crop.

Tobacco profits to tenants are high. The bulk of tenants are small farmers and the average annual income is close to £150--in addition to which each family grows about three quarters of its own food supply. Management has shown a continuous willingness to yield to desires of tenants. For example, practically all small farms now are under hand cultivation. In the early days mechanical help was encouraged though never made mandatory. It proved unpopular when farmers who used tractor services found that although their harvests were greater than those of farmers who cleared by hand, their cash--after paying tractor hiring charges--was less.

The manager of the scheme points out that since it was felt from the start that profit to tenants was

crucial for success, the scheme has always been "crop oriented." In line with this, the prescribed settlement pattern at Urambo is that of dispersed homesteads, each located adjacent to the owner's tobacco fields, rather than the frequent scheme pattern of nucleated settlement aimed at easier provision of social services (Keegan, 1964: 6).

Analysis

This successful tenant farmer scheme benefitted from careful planning.

A feasibility study served to guide growing methods; scheme applicants were schooled at the site. Inputs were provided. Charges for services and rent could be paid from profits; stores on-scheme provided for tenants' needs.

Management was flexible. Farmers who demonstrated that they could manage larger farms were permitted to do so; when mechanical land preparation proved unprofitable financially, it was not promoted; when tenants wished to form a co-op, they were encouraged to do so.

Profits were high.

Case 41: Farming Settlement Scheme at Kongwa[1]

Kongwa was started in the early 1950's as one of the farm settlement schemes which the Tanganyika Agricultural Corporation (TAC) managed on former Groundnut Scheme sites, among the Wagogo, a Bantu tribe who had largely given up cultivation to adopt cattle herding.

Kongwa is in the arid central region of Tanzania; despite the provision of tractors, seeds, fertilizers, know-how and close supervision by a sympathetic management, and cooperation by the Wagogo settlers, who had given up their cattle to enter the scheme, crop yields were consistently low and unreliable.

Cattle were introduced on the scheme in 1957 in the form of Zebu cows in-calf to a Boran bull--a hybrid developed on the TAC's highly successful nearby ranch--in order that the Wagogo, traditionally herders, might be taught the advantages of good cattle husbandry (TAC, 1957: 47).

In 1959, TAC decided to increase the scheme's cattle in order to reduce the financial risks of crop failure. It therefore increased its loan to tenants of high quality

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[1]This case is based largely on information supplied by Professor Peter Rigby.

gravid cows. After repaying the loan tenants might keep any female stock to build up the greatly desired private herds. Male stock--as well as any females that a tenant might wish to dispose of--had to be sold through the ranch, which compensated sellers at a rate approaching twice the national price for unimproved stock. The obvious rewards of scheme membership motivated settlers to comply with the rules of stock management and sale in order to ensure that their annual lease might be renewed. Indeed, after the introduction of cattle, TAC had to increase its settler quota.

Analysis

This scheme duplicated the natural history of evolution of Wagogogsubsistence. The Wagogo were Bantu agriculturalists who, in settling in the arfd and famine-prone central region of Tanganyika, had largely given up their grain cultivation to adopt the herding habits of their neighbors the Masai.

The scheme was started as a farming scheme. Crops continued to disappoint, and gradually a flexible management converted the scheme to cattle ranching. Happily settlers had persevered through the years of successive disappointments.

The scheme nearly failed when its objective did

not fit the local ecology. It prospered when its objective did suit the local ecology.

Had planning included investigation of Wagogo reasons for opting for herding, the scheme might have prospered much earlier.

CHAPTER IV

SUMMARY AND CONCLUSIONS: WHEN DEVELOPMENT OCCURS

This thesis has been an attempt to understand the reasons for the success or failure of agricultural development schemes in East Africa.

Since agricultural development, like agriculture itself is dependent on environmental permissability, the environmental setting for agriculture was first examined. This examination revealed that, although there are many different environments in East Africa, each allowing for different types of agricultural exploitation, most of these environments are fairly explicit as to the opportunities they present to agriculture and most present rather stringent limitations as well. Such limitations constitute an ever-present threat of famine. Defenses against famine, therefore, can be expected to be an essential part of the subsistence system. In an examination of famine in East Africa, this was shown to be the case. Indeed, in an examination of the cultures of various East African peoples it was shown that much of the content of these cultures function as defensive adaptations to the threat of famine.

An examination of various instances of spontaneous development of agriculture (Chagga, Kara, Haya, Sonjo, Turu) suggest that, when properly motivated (usually by restriction to locale), and insofar as permitted by the environment, East African peoples are willing to practice and capable of practicing an intensive agriculture. An examination of in-

stances of reversion from intensive to shifting cultivation (Gishu, Mbulu, Hehe) suggest that, given freedom from land shortage (as followed institution of the Pax Britanica) some East Africans (as do many other cultivators--the Kofyar of Nigeria and the Kachin of Burma were cited) prefer the less demanding shifting cultivation. Taken together, the instances of spontaneous development and devolution suggest that the East African farmer bases his decision about changing his subsistence practices on the relative advantages offered by the old versus the new ways. Where need is greater, benefits of change will seem greater; where need is less the effort required by change may outweigh any advantage it offers.

The study of the dynamics of spontaneous development and change would seem to reveal certain systematic relationships between environmental conditions (including subsistence risk) and subsistence strategies and between peoples' understandings concerning the relative cost and benefit of change to adoption of change.

Forty-one cases of attempts at directed change in agriculture in East Africa have been presented and analyzed. It remains to examine these cases to see whether their adoption or rejection reveals similar regularities.

Cases 1 and 2 are examples of changes of land tenure through consolidation of fragmented holdings and granting of permanent title to those holdings. Both succeeded. Among the Kikuyu success was aided by the forceable removeable of potential political opposition. Among the Luo acceptance occurred

despite opposition. In each case, farmers could see the advantage of having large consolidated plots which meant that they could cultivate a greater amount of land in any season without the usual expenditure of energy required to travel between distant plots. This represented more efficient interraction with the environment without increase of subsistence risk. They had seen evidence that farm planning, which would follow consolidation could be expected to considerably increase their crops and therefore their incomes. Benefit clearly outweighed cost.

It is important to note in connection with these attempts to change land tenure, that the change from usufructuary to proprietary land rights was a common spontaneous development in East Africa where crops had become more valuable or land use had become permanent or where there had been a change from annual to perennial crops.

Cases 3 and 4 are examples of organizational improvement through transformation of individual smallholder farms into group farms. Both failed, as did all Kenya group farm schemes. When government aid was removed any advantage was felt to be so reduced as to lower the benefit to cost ratio to the point of discouraging adoption of change. Indeed, on the Gusii Group Farm, certain individuals were asked to contribute more than their share of work with no consequent reward.

Three cooperative marketing schemes are presen-sented. Cases 5 and 6 involve the same tribe, the Sukuma. Their cotton marketing co-ops have enjoyed a high degree of success. Their cattle co-ops have failed. The cotton co-ops, by eliminating middle-men, have increased profits of cotton cultivation greatly. The cattle co-ops have required considerable extra effort in trekking cattle regularly to distant sales points as well as reduced profit in obligating members to supply cattle regularly for sale despite fluctuations in the market. One advantage of cattle is that they are storable on the hoof and can be held for auction at times of high prices, a method of sale which cost less effort and offered more benefit in profit and sociability than did sales through the co-op. The third cooperative, a coffee marketing cooperative among the Embu, fairly well duplicated the success of the Sukumaland cotton cooperative. Adjusting the cooperative unit to ecological units resulted in even greater success of the co-op.

Three mixed farming schemes, cases 8, 9 and 10 all met with success. Perhaps mixed farming rather than parallel animal and crop husbandry presents the clearest example of agricultural development following on more efficient interactionof subsistence technology with environment, the animals replacing in the soil those elements which the crops remove. In each case cost was reduced by elimination of the need for hired herders; financial profit increased as the higher and improved crop yield was marketed. The same was true of increased

milk production in the Mariakani scheme. The Teso, although recognizing its benefits, would not accept mixed farming until assured that risk to their cattle--their insurance against subsistence risk--was removed.

Two schemes of attempts to mechanize agriculture are presented, cases 11 and 12. The progress of the Rufiji rice scheme clearly illustrates the importance of subsistence risk as a factor in scheme acceptance. The Rufiji people rejected the scheme when they were asked to prepare large consolidated paddies at a single river flood level. They accepted it when allowed to continue cultivating sever-small paddies at different levels, thereby increasing their chance of a crop at whatever level of flood the year should bring. The rice scheme also illustrates the importance of an increased benefit to cost ratio, in that, the Warufiji, with no land shortage refused to share-crop on government land which would have entailed sharing their profits with the government. On their own fields, entitled to keep the entire profit, they accepted mechanization, and, as mechaniation allowed them time to prepare more fields, they proceeded to do so, thereby increasing their marketable harvest.

The Lango and Ganda reactions to mechanization are particularly revealing. In the Lango situation, man was the scarcer and land the more plentiful commoditiy. Mechanization increases production per man, not per acre. The Lango eagerly accepted mechanization which enabled them to increase their interaction with their environment, resulting in the

obvious benefit of increased production. For the Ganda, the reverse situation obtained. In Buganda there was no advantage to increasing production per man through tractor hire, since hired labor was plentiful and inexpensive; there was no uncultivated land to allow for expanded cultivation. The Ganda rejected mechanization.

Two water control schemes are presented. The first, case 13, the Taveta Irrigation Scheme, failed because it was ecologically unfeasible in that stationary dams were built to control the water of a river which disappeared seasonally to reappear annually in different courses.

The Mwea-Tabere Irrigation Scheme, case 14, is an example of profitable interaction of technology with environment. At Mwea-Tabere landless people were given land which provided for both subsistence and high profit in return for hard and demanding work. Clearly members felt that the benefits of the scheme more than compensated them for the high labor demands of the scheme. Mwea-Tabere, incidentally suggests that irrigated rice schemes may be the best way to share small amounts of land among large numbers of landless people. It seems to bear out Geertz' contention concerning wet rice--that it "can be almost indefinitely increased by more careful cultivation techniques" (1966:35).

Cash crop schemes are among the most successful of agricultural development schemes. In East Africa cash crops do not ordinarily compete in land or labor with subsistence cultivation and therefore do not increase subsis-

tence risk. (In the case of the Kaguru, as mentioned in chapter 2, they felt that cash crops would increase their subsistence risk; they refused to adopt cash crops, but insisted instead on cultivating corn on any available land, and selling any surplus corn.)

Where an environment presents limits to subsistence cultivation, but is permissive of a profitable cash crop, increasing the cash crop at the expense of the subsistence crop can decrease subsistence risk (as well as provide income) providing there is a dependable supply of purchasable food. This was the case with the first cash crop scheme presented, the enforced cultivation of manioc in Tanganyika, case 15. Actually it was not intended as a cash crop scheme, but as a scheme to provide a famine food. People rejected manioc as a food, and only acceded in its planting when forced to do so at gun point. However, when the manioc proved profitably marketable and the cash realized was exchanged for cereals in nearby markets, these same people, against the wishes of agricultural officers, increased their manioc cultivation and decreased their subsistence cultivation. As Jones reported, only two years after they had complained that the people would not grow enough manioc to forestall hunger in food short times, agricultural officers were complaining that they now insisted on growing too much. Jones comments that "far from being handicapped by the absence of economic man in Tanganyika, the agricultual authorities were embarrased by his presence." (1960:120). Here is a clear case of

agricultural development being accepted as the ratio of benefit to cost was seen to increase, irrespective of the innovation techniques applied.

Six other cases of successful cash crop schemes follow, cases 16 to 21. Each contained its own mix of factors working for or against acceptance; in each case, profit promised to be so high as to insure its acceptance whatever its mix of factors. Each scheme was designed (or, in the case of the Masai Sheep ranch, adjusted) to suit the local environment and the market. None affected subsistence, except as in the case of fish farming, to add to it. Each scheme clearly offered members greater benefit than cost. The only case in which the benefit was short lived was that of the Bena Wattle Scheme which had to be abandoned when the external market disappeared due to the substitution of a synthetic tanning agent for wattle bark. The case of fish farming presented a factor that is not mentioned for any of the other cases studied. Some farmers built farms with no intention of stocking them, but for their status value alone. This suggests that where traditional sources of status present a hindrance to development (as large cattle herds have often been said to do in East Africa) it might be wise to look for other status conferring items. Indeed, one of the chief attractions of a profitable cash crop to East Africans is that cash can be exchanged for such modern status conferring (as well as useful) objects as bicydes, radios, European clothes, and, for some of the wealthier tribes--

like the Chagga--automobiles. Payment for education of children is also motivated in part by the desire to increase status.

A final cash crop scheme might be termed a multi-failure. The Tanganyika Coastal Smallholders Scheme, case 22, was heavily weighted with negative factors. It conflicted logistically with the schedule of subsistence cultivation and therefore cultivators would be risking subsistence risk. The soil was not suitable for crops that cultivators preferred. People who might have benefitted particularly by prepared land were not considered in its distribution. Finally the scheme could not meet the competition offered by highly profitable wage labor available in the clove fields of Zanzibar.

Two soil conservation schemes are presented--one a success, case 23; the other an explosive failure, case 24. In each case farmers were aware of the deterioration of their land. In each case they were persuaded to construct terraces to counterract erosion. In Fort Hall, the scheme was much smaller in scope and in scale. New practices were limited to terracing, the benefits of which soon reached each individual holding. At Uluguru, the scheme was much more ambitious, impersonal and inflexible. Indeed, the real object of the scheme was not so much to benefit the farmers whose labor it demanded, but to save the water supply of a remote (to those farmers) city. Terracing and bunding required enormous labor and resulted in an increase of subsistence risk. For the Waluguru the new interaction of technology with environment resulted

in a considerably increased cost to benefit ratio.

Four livestock improvement schemes are included. The first, case 25, had the limited objective of decreasing the incidence of East Coast Fever by means of chemical dips. The Hehe used the dips under compulsion and at their own expense until the disease was effectively wiped out. After that they refused to continue the burdomsome trekking to the dips as well as the financial cost involved. Certainly the scheme had modified the environment to the benefit of the Hehe. Herders continued to dip as long as they could see that benefits outweighed costs. When cost continued with no apparent further benefit, they stopped. The scheme is rated a failure by veterinary department personnel who feel that continuous dipping is essential to maintain livestock health. I feel this scheme should be rated a success. Presumably the Hehe , who cooperated in dipping as long as it was necessary to eliminate the disease, would be willing to resume dipping should the disease reappear. Since this is only an assumption, the Iringa Dipping Scheme is listed not as a success, but as questionable.

The Kitui Grazing Scheme, case 26, clearly was considered by the Kamba to be beneficial. At the time of its inception, they had just lost great numbers of cattle to drought. Further benefit was provided through sale of excess cattle, once drought-killing of cattle, and therefore subsistence risk was eliminated. Controlled grazing allows for better interaction of herding with the environment, since

it allows for restoration of grazing land fertility.

In contrast with Kitui, the Samburu Grazing Scheme, case 27, had to be closed when drought became so severe as to invite competition for scheme resources from neighboring wild animals. The scheme did not allow for as efficient interaction of subsistence technology with environment under all possible circumstances as did the traditional pattern of nomadism by which the Samburu adjusted the needs of their animals to the limitations of their environment.

The fourth livestock improvement scheme, the Iraqw Destocking Scheme, case 28, succeeded after several modifications. The Iraqw recognized the benefits of cattle sale for profit as well as for maintaining the necessary stock: land ratio on which the preservation of the grazing areas depended.

The final category of schemes, settlement schemes, form the largest portion of our agricultural development schemes, as they do for all of East African schemes. It must be remembered that resettlement had been the traditional way for East African swidden farmers and herders to cope with local environmental deficiencies. It must also be remembered that, by the time these schemes were started, there existed for many peoples, a long backlog of need to resettle since it had been colonial policy from the beginning to construct political boundaries for tribal groups (indeed, in some cases, as mentioned earlier, to construct the tribes themselves) and hence, political barriers to spontaneous resettlment.

For many of our sample settlement schemes it is

not possible to count clear cases of success or failure, since many schemes involved more than one tribe. In such cases the scheme may have been differentially accepted according to tribe. It is therefore necessary in discussing those schemes to subdivide them according to tribe. The first three settlement schemes present such polytribal situations. At Olenguruone, case 29, the Dorobo accepted settlement regulations; the Kikuyu rebelled against them. The Dorobo, new to agriculture and settled living, were undoubtedly less committed to any specific agricultural practice. The Kikuyu rebelled against the ban on planting maize, their accustomed staple, despite the fact that its delayed maturation in the high altitude made it an uneconomic crop. The Kikuyu also undoubtedly felt that the government, which had taken their traditional lands, ought not to interfere with their free use of the poorer substituted land. To the Dorobo, the scheme seemed to offer much benefit. To the Kikuyu, the cost of change outweighed its benefits.

The Shimba Hills Settlemtnt Scheme, case 30, presents a fine laboratory situation. Four tribes were exposed to the same set of conditions. Their reactions varied according to the conditions in their home areas. Nearby Taita did not feel the offer of new land would compensate for the need to walk far for water, a problem they did not have at home. Nearby Nyika, with no great land hunger, did not feel that the new land would compensate for the need to live

under strict government regulations. For these groups, with no great land need, cost seemed to outweigh benefit. Kamba and Nandi, faced with severe environmental deficiencies at home, (insufficient water and land for the Kamba; shortage of grazing land for the Nandi) did not feel that the requirements of the scheme posed too great a cost for the benefit of receiving new land, despite the fact that this new land was far from their homeland.

Shymanga, case 32, presents another laboratory situation. The scheme succeeded with the more technologically advanced Sukuma; it had failed with its original inhabitants despite the fact that those latter had a deeper need for this specific land than did the Sukuma who merely could always use new land. Hoe cultivation could not meet the technical requirements of the scheme. It might be said that the original inhabitants were unable to tame the ecology while the Sukuma, accustomed to grow cotton with the aid of the ox-drawn plough were able to do so.

Gede settlement, case 33, took advantage of the spontaneous resettlement of Gyriama in an area of their own choosing. By making the settlement profitable for the squatters, and giving them a permanent stake in their land (through permanent crops) the planners of the scheme sought to so weight the balance of benefit:cost as to tie the squatters to the area and encourage their use of it in an ecologically efficient manner. Profit proved so attractive to the settlers, that, during wartime, with supervision reduced, they expanded the

cash crops at the expense of subsistence cultivation, providing the sole case of a group willingly increasing its subsistence risk. Undoubtedly, the Gyriama, who had by that time had long seheme-living experience, were confident that the government would supply famine relief food, which, indeed, it did.

Oyani-Miguri, case 33, succeeded when, without intent on the part of planners, the Gede pattern of spontaneous settlement supplanted their intended directed settlement. Obviously, as with the Nyika of case 31, their need for new land was not sufficient for new settlers to agree to live under strict government control. With such control removed, they moved spontaneously into the scheme area to take advantages of its improvements--water and tsetse clearance. Obviously settlers felt that removal of control increased the ratio of benefit to cost. Since, although the scheme did not proceed as planned, it did eventually result in successful settlement, I rate this scheme as questionable.

Mariakani, case 34, might be said to have been designed to follow the Gede pattern of spontaneous settlement. Settlers were not pressured to move. External improvements (roads, tsetse clearance, water) as well as milk price not tied to distance of milk transport, made the new settlement area attractive to herders who proceeded to settle it spontaneously. Increased benefit with no increse of cost was clearly attractive to the dairymen.

Lambwe Valley, case 35, failed, because, with no

shortage of land at home, most Luo saw nothing to be gained by moving to an area to which they could not bring their cattle. Their refusal to permit other tribes to use their land was probably motivated by a realization that to do so would be tantamount to giving up land which they might need in the future, thereby threatening their subsistence security.

Comparison of the three Uganda settlement schemes, cases 36, 37 and 38--the first a success, the other two failures, points out clearly that schemes which are found to work to the advantage of settlers succeed while those that, requiring the upheaval and work of moving for little or no benefit, fail. The difference in these schemes was that Kigezi was well planned so that profit to the settlers was as predicted, while the South Busoga and Bunyoro schemes were ill-planned and yielded no profit.

The Aba-Ha concentration scheme, case 39, succeeded because the people were persuaded that they would benefit from the change in their settlement pattern as well as their settlement area. After the move, they did, indeed, feel they had benefitted from the change.

The final two schemes, cases 40 and 41, took advantage of the large areas of land prepared at great expense for the Groundnut Scheme. The first, at Urambo, was carefully planned around the cultivation of tobacco as a high profit cash crop. The second, at Kongwa, was planned to turn an area of sparsely settled herders into one more in-

tensively settled and cultivated. The Gogo settlers were willing to give up their herding and substitute cultivation but the ecology would not cooperate. It was only when Management gradually changed the scheme to a ranch for improved cattle that the scheme prospered financially. Gogo were willing to abide by scheme rules including the sale of excess stock in return for the chance to build up improved herds and to receive the guaranteed high prices for stock sale. This was an example of the wisdom of consulting local people as to reasons for their choice of subsistence practices.

This final case suggests an important rule for agricultural development. Since subsistence arrangements usually are based on long-time empirical knowledge of local ecology, planners would do well to investigate why the local people use their area as they do. They will no doubt discover that, as mentioned earlier in this study, in areas of high subsistence risk, subsistence adaptations are likely to be to minimal rather than to average environmental conditions.

The Gogo case would also seem to suggest that the often made assertion that herders are intrinsically resistant to change is open to question. In this study, of six schemes involving primarily herding peoples, four succeeded, one failed, and the fate of one is questionable. Although no pretension is made as to the statistical significance of such a small number of cases--indeed no claims are made for statistical significance of any part of this study, not only because the sample of cases is too small, but, more important, because true comparability of cases is not possible--it is well to

point out that the fate of schemes involving herders compares well with the results of all the schemes, counting subschemes as separate cases. In all there are 28 successes, 17 failures and 2 of questionable outcome. The proportion of successes to failures in all schemes is just under 2/3. The proportion of successes among herders is just 2/3.

Without, then, claiming any statistical validity for the judgment, it seems safe to say that a study of agricultural development schemes in East Africa does not support the assumption that, among East African societies, herders are more resistant to change than are cultivators.

For East African peoples in general, it would seem that the suggestion made earlier in this study, that reactions to agricultural development schemes might follow the pattern of spontaneous agricultural change--that in an area of great environmental hazards to subsistence, the first concern of people is to increase subsitence security is borne out. If subsistence security is not threatened, agricultural development is likely to be accepted if the new technology is suited to the environment and if people perceive that such development offers them benefit sufficient to outweigh the total cost of change.

Appendix

SUMMARY OF SCHEMES

Success	Questionable	Failure
1. Attempts to change or adapt indiginous systems of land tenure		
1.Luo land consolidation		
2.Land consolidation-Ft.Hall		
2. Attempts at Organizational Improvements		
		3.Group Farms-Nyanza
		4.Gusii Group Farm
5.Cotton Co-ops-Sukuma		
		6.Cattle Co-ops-Sukuma
7.Coffee Co-ops-Embu		
3a.Attempts to innovate improved practices -Mixed farming		
8.Mixed farming-Teso		
9.Ngogwe Livestock Improvement		
10.Cattle-Coconuts		
3b.Attempts to innovate improved practices - mechanization		
11.Rufiji rice		
12a.Tractor hiring-Lango		
		12b.Tractor hiring-Bugan
3c.Attempts to innovate improved practices - water control		
14.Mwea-Tabere Irrigation		13.Taveta Irrigation
3d.Attempts to innovate improved practices - cash crops		
15.Manioc Cultivation		
16.Kikuyu Pineapple		
17.Kimulot tea		
18.Fish farming		
19.Pyrethrum		
20.Wattle		
21.Masai Sheep		
		22.Coastal Smallholders
3e.Attempts to innovate improved practices - soil conservation		
23.Soil conservation-Ft. Hall		
		24.Uluguru Land Usage
	25.Iringa Dipping	
4. Livestock Improvement Schemes		
26.Kitui Grazing		
		27.Samburu Grazing
28.Iraqw Destocking		

5. Settlement Schemes

29a. Olenguruone-Dorobo

29b. Olenguruone-Kikuyu

30a. Shimba Hills-Kamba
30b. Shimba Hills-Nandi

30c. Shimba Hills-Taita
30d. Shimba Hills-Giryama

31a. Shinyanga-Sukuma

31b. Shinyanga-Shinyanga

32. Gede

33. Oyani-Miguri

34. Mariakani

35. Lambwe Valley

36. Kigezi

37. South Busoga
38. Bunyoro Agricultural Co.

39. Aba-Ha
40. Urambo
41. Kongwa

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F.R.I. Food Research Institute, Stanford U.
T.N.R. Tanganyika (or Tanzania) Notes and Records

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List of Maps