

This work is licensed under a
Creative Commons Attribution-NonCommercial-
NoDerivs 3.0 Licence.

To view a copy of the licence please see:
<http://creativecommons.org/licenses/by-nc-nd/3.0/>



RESERVE (832)

IDS/WP 319

915 7WA 207

VEGETATION CHANGES IN

MBERE DIVISION, KENYA

VEGETATION CHANGES AND CONSERVATION
IN MBERE DIVISION, KENYA

by

David Brokensha and Bernard Riley

WORKING PAPER NO. 319



6

INSTITUTE FOR DEVELOPMENT STUDIES

UNIVERSITY OF NAIROBI

P.O. BOX 30197

NAIROBI, KENYA.

After general observations on vegetation and
species diversity, there is a detailed examination of selected species
of various trees, including changes in use and occurrence. The conclusions
consider implications for the future and for development.

1ST SEPTEMBER, 1977

Views expressed in this paper are those of the authors. They should not be interpreted as reflecting the views of the Institute for Development Studies nor of the University of Nairobi.

VEGETATION CHANGES AND CONSEQUENCES:
MBERE DIVISION EMBU

By

David Brokensha and Bernard Riley

ABSTRACT

We emphasise several points: Vegetation (especially the major trees) is an important part of the resource base in areas such as Mberere; the local Mbeere people have built up a highly detailed knowledge of their plants; Mbeere perceptions are often more appropriate than external ones; development planners should pay more attention to indigenous plants, and indigenous knowledge of the plants.

After general observations on Mberere division, its vegetation and research methodology, there is a detailed examination of selected species of savanna trees, emphasising changes in use and occurrence. The conclusion considers implications for the Mbeere and for development.

Views expressed in this paper are those of the authors and do not necessarily reflect the views of the International Development Research Centre.

VEGETATION CHANGES IN MBERE DIVISION, EMBUINTRODUCTION

Mbere Division is in the western part of Eastern Province. It is the southeastern section of Embu District lying wholly east and south of the town of the same name, down to the Tana River and its tributaries. In outline it is a pie-shaped wedge, oriented, when compared to the face of a clock, at the three to five hour positions with the outer circumference formed by riverbanks which define the boundaries.

For our research, we confined ourselves to that part of Mbere Division (Mbete, Mavuria, Nthawa and Evurori locations) that falls within the area of the Special Rural Development Programme. The area is 1,630 km. in extent, and was occupied by 60,051 inhabitants in 1969, according to the census of Kenya. The present figure is probably about 75,000 (assuming a 3% p.a. increase in population.) The overwhelming majority of the inhabitants are Mbeere people, though significant numbers of in-migrants have been attracted to the more favoured areas, since land sales increased rapidly a few years ago.

Several topographical features are worth identifying. Altitude range in the northwestern corner, which forms the lower footslopes of Kirinyaga (Mount Kenya), is as high as 4,500 feet (1,370 m.) which drops down to the outer rim of the Mbere Division at the Thiba River in the south, at 3,500 feet (1,065 m.), dropping also along the Tana River to the northeastern boundary, at the Thuchi/Mutonga confluence with the Tana, as low as 1,750 feet (530 m.). Within this altitudinal range the most prominent physical features are three hilly inselberg cores. These are; Kiang'ombe, the most northernly and highest at 5,917 feet (1803 m.), distinguishable by the forest remnants clothing its summits; Kianjiru, the westernmost and ridgelike in form rising to 5,050 feet (1,549 m.); Kiambere, the most isolated and easternly, has the lowest altitude of the three, rising only to 4,900 feet (1,493 m.)

The fieldwork enquires, on which this paper is based, were conducted by the authors in Mbere Division in 1970/71, 1974, 1976 and 1977, a total of two and a half-years having been spent in the field. We gratefully acknowledge support from the National Science Foundation (grants GS - 42842, 1974, and BNS76-10704, 1976/77).

In the western portion of the division there are small areas of level ground, underlain by volcanic tuffs and ash of Tertiary age ejected from Kirinyaga, which have been deeply incised by stream erosion. The general topography, however, is one of irregular slopes developed over Basement Complex metamorphic rocks that show varying resistance to weathering and erosion, and which are covered by detrital material and soils to very variable depths. These formations cover major areas within Mbere Division.

Lateritic surfaces are found in ^{many} places, but the geologically recent uplift precludes the presence of extensive level surfaces or soil horizons that are persistent over measurable areas. Only western sections of Mbeti and Nthawa locations have areas where black marginalitic clay soils (that are water retentive) occur in depressions or in areas of impeded drainage along water courses. A few of these are of utilizable importance.

Riparian areas exist at the northern boundary, along perennial water channels of the rivers Thuchi and Mutonga; from these water is extracted for an irrigation scheme and a piped-water supply around Ishiara -- along the southern boundary on the Thiba river, and on the Tana River itself, which forms most of the eastern boundary. Within Mavuria Location, the riparian areas of the last named river, the most important in the nation, have been considerably effected by construction of Tana River Development Authority hydro-electric power dams at Kamburu, Gitaru and Kindaruma. The road atop the dam wall at Kamburu replaces the old suspension bridge which once marked the only road-crossing point of the river between Embu and Kitui, although pedestrian ferries exist at Irira, Karangiri and Karura, crossing in to Kitui District. Kamburu now forms one of the major transportation routes traversing the division. Gitaru dam is currently under construction (1977) and Kindaruma -- the oldest of these schemes -- is now accessible only from the Kitui side. A fourth dam has been announced -- tentatively called Kiambere Dam -- downstream from Kindaruma. Access roads to these projects ~~have had~~ important social consequences directly and indirectly to the inhabitants of Mbere Division, even though their location is peripheral (and their human occupation has been spasmodical).

The division is traversed by only one other permanent water course, the river Ena, -- which lies close to the northern border of Mbere Division. The river's depth and rate of flow, coupled with an increasing siltation rate that has accelerated greatly in the last seven years, makes it a questionable source of rural water-supply development. Only one minor stream -- and that seasonable flow only -- has its catchment basin entirely within the division; this is the Thura River in Nthawa and Mavuria locations (draining Kiang'ombe's southern and eastern flanks.)

This, and other minor stream catchments, could do with further survey and developmental study as prospective water-supply sources from run-off and drainage of the three inselberg cores, to ease the problems of domestic water supplies for the many inhabitants of Mbeere Division who are located at a distance from riparian sources. Some natural rock-basin catchments do exist, but they are entirely inadequate. Water supply procurement and protection is perhaps the most ubiquitous physical and socio-economic problem for Mbeere people throughout their administrative division. This problem is emphasised by the following findings of our research investigation.

Other factors

Although our emphasis in this paper is on plants, we do not attempt to make any simple causative corrections. Social change and ecological change are complex processes and it is seldom possible to isolate single factors in considering "cause" and "effect". Plants are useful and sensitive indicators, because of two main reasons: first, they form an important part of the resource base of Mbeere, and must be seriously considered in any plans for development. For example, until recently more than 90% of all Mbeere material culture came from plants: this included virtually all the materials used for a wide range of needs - food; condiments, and spices; beverages, including water substitutes, tea, beer; fodder; bee-hives and has/for hanging hives; oils; medicinal and veterinary uses; poisons and /trees antidotes; soaps, gums, dyes, cosmetics, perfumes; fibres of all sorts; fences; house poles, rafters and laths; heavy timber; tools, weapons, pestles; mortars, walking sticks, combs, toys, "wrapping paper"; mattress stuffing; abrasives; charcoal, firewood and torches; weather indicators; ritual uses - The list is endless. (See Irvine, 1961:XV-lxxv; Williamson, 1972 : 155-166) Even today, plants - despite some modifications and substitutes in use, mentioned below - are still of overwhelming importance in Mbeere economy. The second reason for choosing plants is that the occurrence of plants, and also their uses, are changing very rapidly in Mbeere: the process of modernisation has been accelerated and telescoped into a few years, compared to some other parts of Kenya.

GENERAL OBSERVATIONS OF MBERE DIVISION VEGETATION

The vegetational cover of Mbeere Division falls within sub-divisions of what is generally referred to in environmental literature on Africa as derived savanna. It is derived in the sense that the present vegetational cover is different from what it once was--or even now could be--were it

not for the impact of cultural practices which have imposed changes on its original characteristics.

It must be understood that we regard the identification of anything labelled 'natural vegetation' with some scepticism--particularly as a result of our study of Mbere Division. What was described by Colin Maher in 1938, after his exploratory investigation of the then Embu Reserve (Mbere Division nowadays), was even then an ecological consociation of plants which had been modified by the Mbeere people's utilization of their surrounding plant resource base. The differences between what Maher then described and what we investigated are directly attributable to three interacting processes. These are, in order of decreasing impact importance:

1. population growth and its resulting pressure on rates of utilization of the plant resource base;
2. increased physical access which infrastructure development, such as all-weather roads, brought in its wake;
3. changes in land-tenure patterns and holdings which adjudication and registration of title-deed to land plots induced in some sub-locations. This process is presently continuing (see Brokensha and Njeru, 1977)

Of these three processes outlined above, the most serious in implications for future development, has been the last listed. It has initiated a fundamentally different concept by its consequences--fixed internal boundaries have now appeared where they were once traditionally flexible, temporary or even absent. Internally within Mbere Division there have appeared 'barriers of exclusion' where none existed before.

Examples would be barbed - wire fences, farm names and owners identities on sign-posts and even warnings (Nairobi style) of an "MBWA KALI, keep out" are found at gates of access.

(In addition to these three major interacting processes, we should mention the recent rapid spread of education, the greater availability of consumer goods, increasing internal social stratification, all of which influence Mbeere values and behaviour, and indirectly affect the perceptions and uses of plants.

Finally, there is the recurrent factor of food shortages. Mbere is a marginal area, drought-prone, and has had a recent succession of bad years, with low rains and poor crops. In recent years, the following rainy seasons have been very poor in most parts of Mbere (This ignores other localised shortages)

	long rains (March-May)	short rains (October-December)
1976	X	
1974		X
1973	X	
1972	X	

	long rains (March-May)	short rains (October-December)
1971		X
1970		X

This means that six out of fourteen reasons produced grossly inadequate harvests.

Despite these changes, compared to other areas of the country, Mberere Division's greatest asset for this study lies in the fact that it is perhaps more ecologically intact than similar areas elsewhere. Many other areas in the nation have seen far more extensive substitution of indigenous exotic imported vegetation—and this process operated over a far longer period of time than our own period of fieldwork (1970—77).

Ecological intactness has carried over into Mbeere people's knowledge of their plant resource base; more of it is familiar to them (or many more of them have first-hand knowledge based on greater familiarity through necessity) than applies to inhabitants of regions with a longer history of economic development. In short, we can be more certain that the derived nature of the vegetational consociations present in Mberere Division has been predominantly the result of Mbeere people's traditional cultural activities, and changes in of those activities, for which they themselves have been largely responsible.

Natural and Cultural Factors

Sub-divisions of any savanna type are in effect vegetational responses to inter/combinations of local natural circumstances and /related conditions over which, by and large, man's activities have little or no control. In Mberere Division these inter-related conditions, listed again in order of increasingly restricted and localised effect, are:

1. altitude modifications on the length and reliability of rainfall seasons and totals, which are themselves modified by
2. cool-season cloudiness interacting with
3. topographical aspect with regard to major air-mass movements, as modified by adjacent physical features as agents which reduce evapotranspiration rates locally, but which are themselves sensitive to
4. slope and soil-drainage conditions and the chemical constituents derived from the parent rocks of the mantle.

The areal distributions over which these interacting factors apply vary greatly. There are small areas of higher altitude and greater reliability of precipitation, and large areas with significantly less altitude and precipitation reliability. Stated another way this means that

greater areas are subjected to more severe detrimental environmental factors. However, that general condition is true for most of the African continent.

Throughout Mbere Division there is a continuum of transition of vegetation ecological consociations--from moist broadleaved Combretum-Acacia open woodland savanna--in general less extensive but with higher population densities and better access--down to extensive areas of dry thorn-bush scrub Acacia-Commiphora savanna--of greater extent but with greatly reduced population densities (even some uninhabited localities) and far more difficult of access. But this foregoing ecological transition is a description which applies to vast areas of Africa's surface. Why, then select Mbere Division?

Mbere Division has the added advantage of displaying this continuum of transition over attenuated distances, with manageable areal proportions in the right order of distribution. Together these suggest that our research findings might be of wider value. For we believe the proportional differentiations outlined above represent a microcosm for Kenya as a whole, and for other parts of tropical Africa. It is a microcosm of cultural impacts on a transition-continuum of savanna types, with the latter viewed fundamentally as a rural resource base representative of many areas for which development projects are planned or are already in operation. In short, it is a microcosm which displays a range from restricted areas of high potential development to abundant areas of low potential for development. There is, thus, an aspect of replicability of this research approach to larger areas of Third World countries.

RESEARCH METHODOLOGY

A 'vegetational' ecological consociation has major and minor components. The former occur in the type-name; other components are discovered only by detailed botanical analysis. Thus dominants are easily identified, but, even so, there is little differentiation beyond two or three associated genera. The names of 'natural' vegetation are broad categories of convenience; they mask, more than they expose, what may be crucial differentiations within the consociation. Here lies the greatest limitation of western scientific taxonomical systems. They are essentially based on inventorial criteria as a shorthand. The assessment of utilitarian value--differentiations of what is and what is not of value as in integral part of the vegetational resource base--is not really possible.

Perhaps nowhere has this limitation more-overlooks- involved than in the case of tropical-vegetation consociations. Tropical areas are generally far more heterogeneous than their temperate-zone counterparts. Ecological homogeneity, not surprisingly, is an exceptional circumstance in Mbere Division, and this is true whether one considers natural or cultigen

vegetation.

This study is pre-eminently focussed on qualitative rather than quantitative differentiations, particularly because this is the fundamental concept of the Mbeere people's taxonomical system. Utilitarian value is paramount within indigenous classificatory systems when a people's cultural constructs and activities associated with their creation and maintenance are involved. Here we take cultural constructs to mean the necessities of life such as shelter (housing for people; granaries for food supplies; livestock enclosures etc.) and utensils (handles for hoes; bows and arrows; gourds for water storage and transport; beehives etc.) necessary to accomplish tasks which ensure continued occupation of the environment.

Utilitarian value is the prevailing vector of vegetational change in rural tropical areas. To limit a classification to Linnaean-type binomial categories which inventory dominants, co-dominants and sub-dominants by phylae, genera and species, could classify many vegetational ecological consociations from an erroneous premise. Vegetational dominants can be so as the result of cultural rather than natural vectors of change. Even if it is argued this may not have been true for large areas of tropical Africa in the past, our research in Mbeere Division suggests that natural have been overtaken by cultural vectors in a growing number of cases and areas.

Utilization of vegetation as a resource base has had, is presently having, and will continue to have profound effects that could **alter** its identity in a binomial taxonomic classification. What once was the conspicuously dominant or visible component (ecologically dominant and type-named) is not likely always to remain so. This points to a further limitation of identifying consociations by means of binomial shorthand; it does not take into consideration details of ranking a given plant's occurrence so that it reconciles regeneration power with utilitarian value, nor with increasing and changed differential rates of utilization consequent upon altered cultural factors.

Our research has as its cardinal direction an attempt to work from the point of view of what is important to Mbeere people. We started from their ideas of what is useful or worthless in their vegetational resource base, and continued by studying ranking systems within this. We also assumed at the outset that Mbeere people are fully aware that changes in their vegetational resource base are taking place. We attempted to assess how this alteration is viewed and what responses if any have been made to these changes. The least contentious way to approach this was to compile the evidence from their, rather than our, criteria.

The initial part of this research consisted of compiling in Kimbeere vernacular a botanical dictionary. Specimens were collected for botanical identification by Dr. Joh. O. Kokwaro at the University of Nairobi Botany department and East African Herbarium staff. From the beginning all this material was annotated according to lists of uses, which was later refined in subsequent surveys which contained built-in cross-checks to confirm and expand the precision of criteria used. The goal is to gather some indicators which are the basis for an ethnotaxonomy.

The assumption of Mbeere people's awareness of change implies that choices must now be made which did not necessarily have to be taken into account in prior times by previous generations. Surveys were conducted which were designed to collect and assess indigenous attitudes or opinions as to which have been their most significant adjustments to alterations in the resource base.

We are attempting to reconstruct, from the information supplied by our Mbeere informants, what was formerly utilized (and why) in preference to that which is now used for similar purposes. A possible outcome of this research might help Government Development Planning to become aware of, and to use, traditional Mbeere knowledge.

The obvious place to start was through a detailed examination of traditional material possessions, beginning with basic cultural constructs such as housing and utensils that utilized major components of the resource base— woody vegetation, both trees and shrubs.

Changes in occurrence of vegetation

We present below some details of changes in the occurrence of certain plants: some new species have been introduced, a few of the indigenous plants have increased, and many have undoubtedly decreased in number. We base our conclusions on several different sources, which we were able to check against each other.

(a) Sources

First, there are the Oral accounts of the Mbeere people themselves. During our field research, we came to know several older men and women who proved to have accurate and detailed memories of earlier days. We asked such people simple questions - "Is tree 'X' more or less abundant now than when you were young?" We also put these questions in more sophisticated form, by asking about trees used for particular purposes - bee-hives; granary load-beams; bows - and finding out which wood is actually used nowadays. In many instances, people say, "Yes, we would prefer to use such and such a wood, but these trees are no longer available in our area". - Examples of depleted vegetation include:

(mu)-BINGO (non-spiny) - Diospyros mespiliformis

(mu)-GURUKA - Securidaca longipedunculata

(mu)-KURIA MBUNGU - Ekebergia capensis

(mu)-THIGIRIRI (II) Lonchocarpus eriocalyx

A second source is provided by the archives, both the Kenya National Archives (KNA) and the Embu County Council (formerly the Embu Native Local Council, ENLC. References, though scattered and usually tantalisingly incomplete, do provide some evidence of vegetation cover in earlier days. An example is a 1927 list of all the iiri or "sacred groves" in Mbere Division.

"A list of Sacred Groves accepted under Section 8 (g) of the Native Authority Ordinance" is contained in Political Record Book (DC/EBU/3/2, 1927/28). For Mbere, the following are listed:

34 iiri ("sacred groves")

52 matiri ("dancing places")

37 kivaro (fields for dancing)

Few of these survive today, most of the last remaining ones having been distributed - and thus doomed - when land was allocated to individuals.

Here are some examples. In his opening address to the first session of the council on 12th July 1925, the Governor talked of three main topics - the need for better medical services, the importance of roads, (as "roads to progress") and forestry; while, he noted, firewood was easily obtainable (unlike other districts) it was still essential that "more trees must be planted." By 1927 however, it was decided that "all divisions must plant trees except Emberre, where a tree-planting scheme could not meet with any success." (ENLC, No.66/1927) Throughout its recorded history, successive administrators have stressed the need to plant more trees in Mbere, though with little apparent success. In March 1977, The District Commissioner Embu elaborated on this theme

(From 1939 to 1942 there are several references to the summit of Kiang'ombe Hill, where a forest reserve was established in 1942. The forest reserve was established after complaints that cattle had been "grazing up to the edge of the forest 2 or 300 from the summit", that cultivators had encroached on the forest and also that there were frequent uncontrolled grass fires. (Maher, 1938, I, 151, and D.C. Embu Annual Report 1942, KNA, DC/EBU/1, p.16.)

And in 1942, it was decided that "when Mukau (Melia Volkensii or) Mukweigo (Bridelia Micrantha)

trees were used for camps or bridges in Mbere, these should be paid for, but that all other trees should be supplied free as they were almost valueless "(ENIC, No.108/1942). This last statement reflects, unfortunately, an all too prevalent official prejudice against indigenous vegetation; we argue below that failure to recognize the potential value of indigenous trees has been a significant obstacle to economic development. The same minute noted that "Thatching grass was to be paid for if planted by individuals for their own use," a useful confirmation that, even thirty-five years ago, people deliberately planted grass that they would use for thatching. This was usually done in abandoned gardens.

Other reference include Orde-Broune (The Vanishing Tribes of Kenya) who states that there is "no doubt that there used to be a stretch of forest reaching far down into what are now the bare plains of the Tana." And according to Maher (1938, I.129) there was "dense scrub near the River Tana for a depth of about half-a-mile, but much, especially mi-rava (Combretum Zeyheri) has been lopped for fencing." May Crawford (Near the Snowy Peaks on the Equator - ?) also refers to a journey through heavily wooded country, in what are today parts of Nthawa and Mavuria locations; unfortunately, her geographical references are very imprecise.

And indirect evidence is provided by a comprehensive list of birds seen in Mbere Division, written by a missionary lady who was a keen and competent ornithologist. (DC/EBU). Many of the species mentioned are no longer to be found in Mbere, because they prefer densely wooded areas, indicating that fifty years ago the tree cover was much thicker than it is today.

Our own visits to protected areas (sacred groves and Kiang'ombe Forest Reserve), when accompanied by one or two of the old men, have provided another useful confirmation of what the vegetation used to be. We found some species that are practically non-existent in other parts of Mbere - e.g.

1. (mi)-KAME - Elbizia coriaria (30m.-36m.)
2. (mu)-KUI - Newtonia buchananii (25m.-36.)
3. (mu)-RURI - Chlorophora excelsa (IROKO OR MVULE) (45m.)
4. (mu)-TUNTU - Cylicomorpha parviflora (20m.+)

We also saw much larger individual trees of species that are widespread elsewhere, but of much smaller size.

- (mu)-KUYU - Ficus sycomorus (25 m.)
- (mu)-RIRU - Syzygium guineense (15m.)
- (mu)-TUNDU - Croton macrostachyus (20m.)

Finally, we have relied to some extent on our own observations over the last seven years, supplemented by photographs. For example, we have photographs of several hills - Kiang'ombe, and the smaller hills near Siakago, at different dates, showing the decrease in tree cover.

Landmark trees, removed since 1970, included eleven exotic planted eucalypts (15+) near the B.A.T. compound at Mondu, and 19 mature indigenous (mw)-OMBOMBWE in a roadside stretch (approximately 90m. long) from the B.A.T. drive and the Ina River bridge, that ended up in charcoal sacks.

Savanna Vegetation

In a very simple way, savanna woody vegetation in East Africa is composed of members of three great pan-tropical phylae. These are: Combretaceae, Leguminosae-Mimosoideae and Burseraceae. The convenience behind this order is that they are, respectively, a progression from areas where evapotranspiration moisture surpluses occur to those where evapotranspiration moisture deficiencies exist for the majority of the annual cycle of growth and regeneration. Each phylum has representative genera, and within a genus representative species which are integral parts of the vegetation resource base. Transitions can be shown by statistical frequencies--some decreasing as others increase in abundance--which characteristically overlap like the colours of a spectrum. This point is abundantly borne out by the plethora of sub-species and varieties of natural hybrids as documented in the relevant volumes of Flora of Tropical East Africa.

Some minor components from other phylae and genera are also included in the following text where they are prominent as important Mbeere plant resources.

Broadleaved Components

i) Combretaceae

Members of this phylum which are important in the woody resource base, belong to two genera; Combretum and Terminalia. Species of both are found in varying amounts throughout the whole of Mbeere Division. Five will serve as illustration.

Kimbeere vernacular Botanical identity

(mu) - REMA	<u>Combretum molle</u>
" - GEREKI	<u>collinum</u> subsp. <u>binderanum</u>
" - RABA	" <u>zeyheri</u>
" - RURUKU	<u>Terminalia brownii</u>
" - TORORO	" <u>prunioides</u>

Mu-REMA is in Western areas of Mbeere Division, in Mbeti, Nthawa and upper Evurore, the numerical dominant. As its botanical name indicates, it is distinguished by its hairy leaves, soft and velvety.

The most frequently stated use of this is 'for toilet paper'. While its timber is not totally worthless, which is true of some of its ecological associates, it is not sufficiently durable for house construction posts. There are many preferred alternatives, less susceptible to termite and fungal pests. This is partly the explanation why many individual trees display no signs of cutting or pollarding.

MU-RABA is the member of the genus which one sees most frequently pollarded though rarely felled. It is a preferred source of flexible regrowth branches, useful for threshing flails, and also for house rafters, especially for rectangular houses with corrugated iron roofing (IVATI), if money for sawn timber, or for Forestry Department 'thinning' poles, cannot be purchased when needed. Our investigations revealed not a single unpollarded example of this tree throughout the entire duration of fieldwork (1970-1977). The apparent abundance of (mu)-RABA must, in certain areas, be attributed to recurrent utilization. At present it seems capable of meeting a traditional demand. The intervention of alternatives could already apply, since maize is replacing bulrush millet as the staple grain crop and more power operated posho mills now exist. Demand for threshing flails must be in decline.

(mu)-GEREKI, among the common Combretum species, has the best durable heartwood--resistant to termite attack and fungal decay-- therefore its quality for house construction poles is prized. In addition, it is the preferred wood for black-smithing, when hard discrete charcoal that does not collapse in the forge is essential for this purpose. It is regarded in some areas as unsurpassed. This same quality now represents its greatest threat.

Charcoal-making, to supply the insatiable demand from urban areas, is an activity ubiquitous to all Third World nations. Improvement of infra-structure during the Special Rural Development Programme period (1970-77) in Mbere Division had largely unforeseen side effects--exacerbated without doubt by contemporaneous drought and food shortages. New roads gave increased access to charcoal wholesalers pickup vehicles; they now operate scheduled times and places for collection that certainly did not exist when this research study was initiated. While the activity within Mbere Division is not new, the distribution of the product to destinations outside the area has provided an income source which did not previously exist. This is identified by many as the reason for the rapid decline of this resource tree now beyond its regenerative capacity,

Mature trees are completely felled for quick profit. Proportionally, the decline is exacerbated by this species having the lowest regenerative capacity of the three *Combretum* species surveyed here. Although this tree once figured highly as a preferred timber tree, many informants doubted that trunks of sufficient size could now be found. For at least one Mbeere informant with his own demarcated land, 'his' (mu)-GEREKI were reserved for future house posts for his sons; he had already declined two offers of payment for their timber. (mu)-RURUKU, (mu)-TORORO, both members of same genus, do not significantly overlap geographically. The first listed is characteristic of the moister western zones, the latter of drier eastern and southern regions. Some large individual specimens of the first can be found on lands yet undemarcated--still considered to be clan property--but some are on private land. Enquiries revealed that without cooperative effort they are often too hard (heartwood) and too heavy (massive trunk and major limbs) to be tackled by individuals. As with (mu)-GEREKI it was also a resource of 'hard' black-smithing charcoal but this activity in neither case required felling--merely pollarding trees of accessible limbs. Since 1974 the largest clear-felled stumps encountered during fieldwork have been, without exception, stumps of (mu)-RURUKU. Large visible individuals that remain are confined to clan controlled land (or land still in dispute) and to private land. In the drier eastern and southern margins, (mu)-TORORO, which never becomes so massive, is, in that ecological environment, a preferred source of long, straight branches for house rafters. The tree may be identified in the landscape frequently by its horizontal branches (called 'cedar of Lebanon habit' by botanists/foresters). Rarely is it felled, but a dying tree has an additional use; after felling its sapwood ring can be used as beehive barrel, and its heartwood for a mortar. But substitutes for the latter utensil are now more common. It is doubtful that (mu)-TORORO was ever as abundant within its ecological range as was (mu)-RURUKU within its own. Yet there is evidence from both areas that supplies of these preferred materials have dwindled to the extent that alternatives are now more common.

What is common to these first five examples of the Mbeere resource base is that, as members of one of the botanical dominants, these are regarded by Mbeere people as having significantly declined, in occurrence and supply; appreciably so within the last generation and drastically so since their grandparents' own childhood days. This phenomenon is by no means confined to this phylum or its genera. Decline almost to the point of threatened extinction applies to other non-dominant genera and species. But we shall illustrate that point below.

ii) Leguminosae - Mimosoideae

Two genera again predominate from this phylum and its sub-phylum. The first is acacia, with its multitude of species, subspecies, natural varieties and hybrids that make up the genus' roster in Africa; the second member is Albizia. In addition, the phylum includes small bushes and woody lianes that occur under additional genera such as Dichrostachys and Entada, both of which contribute to the Mbeere plant resource base. Other minor genera are also present, but they are usually confined ecologically to special zones--such as the riparian distribution of Newtonia ((mu)-KUI).

Because most, if not all, Acacia species are thorn bearing, and have useful properties in their bark, exudates (gums and rosins), pods, roots, and seeds, there is utilitarian value to practically every known example. It is beyond the scope of this working paper to document fully the total material which the research investigation accumulated with regard to the range and the variety of multiple utilization which various species of these genera make to the Mbeere resource base. Therefore, a representative selection has been made. It must be noted that both under-differentiation and over-differentiation are involved here, when trying to reconcile these utilitarian criteria of Mbeere people with species distinction in a binomial taxonomic system.

((mu)-CEMERI (Acacia nilotica)) never really grows to a large size; its value lies in its thick-walled pods, fleshy and juicy when young, and in its bark. The outer bark provides fibres, used formerly for string spun and woven into women's baskets, while the inner bark is still used as an infusion to provide 'tea'--perhaps a 'tannin stimulant' drink is closer to the mark. The young green pods when squeezed will provide a dyestuff (black) and treatment (as mucilage) for arrow strings--attaching feathers to the shafts; the pods are sometimes knocked down from the branches by ~~headboys~~ to provide additional browse for goats when beyond their reach. Its timber is too small usually for construction, but where ((mu)-CAMACAMA (Dichrostachys cinerea)) is not found it appears to substitute for that plant as the preferred wood for implements such as hoe handles because of the tough elasticity of the wood and its lack of splinters to pierce the skin. For this reason it appears formerly to have provided digging sticks and head-rests. In zones, where it is endemic, it was stated to be used formerly for the vital 'Y' posts which support the floors of granaries. The essential property required for such construction material is that it be durable in the ground, and sufficiently termite and fungus resistant to the longlasting. Our survey revealed some older granaries with posts

of this timber, but the majority of recent granary construction has had to make use of substitutes which are known in many instances to be inferior. For this particular purpose (mu)-CEMERI and (mu)-CAMACAMA are in some areas regarded as inter-changable equivalents. We found no individual specimens over about 4 m. height.

(mu)-GAA (*Acacia tortilis* subsp. *spirocarpa*; *Acacia etbaica* subsp. *platycarpa*) does become a large tree often flat-crowned and important in trading centres and elsewhere as a shade tree. It has both straight and curved thorns which are the basis of its main utilization as fencing for stockades; branches are cut from the trees to provide protective barriers around cultivated plots to deter any livestock or wild-life from damaging the growing plants. It is used to hang beehive barrels from—usually suspended by a forked stick from a branch since its natural height (5+ m.) and flowering fecundity attract bees in season, while its thorniness deters NTHEGERE (honey badger, or ratel) from ravaging the hives.

The pollarding of the branches close to cultivated gardens to provide fencing achieves another purpose, since it reduces perching and nesting opportunities for seed-eating pests such as weaver birds. As with (mu)-CEMERI the inner bark can provide fibres for traditional women's carrying baskets (CIONDO), but since the two rarely overlap ecologically there is not really any substitution involved and no suggestion of preference between them. Imported nylon cord, sold in markets, has largely altered this pattern of utilization, if not yet brought about its demise. The timber is rarely used as the Mbeere are aware that it is susceptible to insect attack, and splits and twists badly during seasoning or drying out.

(mu)-GUNGA (*Acacia drepanolobium* - black-gall whistling thorn; *Acacia bussei* - white gall whistling thorn). This is not really a case of under-differentiation since there is no ecological overlap involved. In wetter western Mbeere the trees of the first botanical species are usually found in the seasonal swamp depressions that provide communal grazing areas. They are found in gregarious stands in such situations, where their abundance allows collection of an edible gum from their mealy-yellowish bark on younger trees and branches. In the drier areas of eastern Mbeere Division for the second botanical species it is the timber which is important, although it is never in large pieces. The heartwood is hard enough to provide pegs which can be hammered by honey collectors into the bark of (mu)-RAMBA trees (*Adansonia digitata*—the baobab) to provide climbing rungs to place beehive barrels. Sharpened pegs of this wood were formerly used for stakes to impale wildlife in pit-traps.

10

Recently it has begun to figure in charcoal making, produced for sale at roadside or markets, but it is perhaps the absence in the area of other large trees suitable for charcoal of acceptable quality to middlemen and traders which has brought this about. In addition, the famine during the same period was an additional cultural incentive to sell charcoal to buy foodstuffs.

(mu)-MYUA (*Acacia senegal*) occurs widely and is immediately identified by its curved thorns occurring in 3's, clustered at leaf axils--these are tough and persistent. It is also the chief source of an edible gum exudate from cuts in the bark--this crystallizes into whitish or topaz-brown 'tears'. Its thorniness prevents climbing the trees, but branches are used to protect livestock enclosures or gardens. The timber is not durable against termites, but we have found nevertheless that its common occurrence has been an explanation for its use in house and granary construction poles in some impoverished households, even though its short durability is well understood. It is one of the convincing pieces of evidence that second or third preferences (from what would formerly have been traditionally used) are already having to be resorted to in some locations.

(mw)-OMBOMBWE (*Acacia gerrardii*) in moister areas of Mbere provides the greatest example of numerical decline, and of recent utilization outstripping regeneration capacity. The mature trees can be sufficiently large to enable an individual tree to provide some 15-20 bags of charcoal. Therefore, one felling, dismemberment and entombment into a single large hod on the spot can provide a maximum profit to one, or perhaps two men. During our fieldwork period we witnessed the removal of no less than 19 mature (mw)-OMBOMBWE trees from either side of the road between the bridge crossing the Ena river, past the entrance drive to the B.A.T. leaf-buying centre to the next small stream--a distance of approximately 200 yards. Our latest survey (1977) suggests that this rapid decline has produced a reaction. Some informants stated that nowadays 'these trees are clan property' -- the threat of (mw)-OMBOMBWE extinction within the division may yet be averted!

(mu)-THIGIRA (*Acacia mellifera*) is not confined to the drier areas of eastern Mbere Division; it is common as a smallish tree--but more usually of 'bush' dimensions--only in the lower and hotter zones. In areas of the Tana river valley and the lower courses of its tributaries (the Thiba, Thura, Ena and Thuchi) in spite of its dwarf appearance it is the ecological dominant of the genus. It is leafless for most of the year. Its value lies in its curved, sharp and persistent thorns, which makes it unsurpassed as livestock enclosure fencing. Also its durable dark (often black) heartwood is hard, resistant to termite attack and used for

the crucially important 'Y' support posts for granary floors to raise them above ground level. When in flower it is very attractive to bees due to its abundant nectar. It is also capable of providing hard, slow burning and 'bot' charcoal. In this respect, its generally small bushy form may be its best present safeguard--the yield of charcoal is insufficient in general for this to be used for commercial trade; to gather enough raw material for one sack is thus too great an effort. It is still important as firewood; and retaining embers to rekindle household fires early in the morning. Informants said that this plant once was an important carving wood for ceremonial objects. Today the objects would need to be miniature editions; heartwood timber of any appreciable size within its ecological zone is extremely difficult to find, even in otherwise uninhabited areas.

(mu)-BARWA, (mu)-GANTHEGU and (mu)-KORWE are the chief representatives of various Albizia species. Wherever they occur they are important members of the consociation, but are not dominants. They provide material from their leaves, branches, bark and roots for a variety of medicinal purposes. Leaves can be used to hasten and make more even the ripening of bananas and mangoes on the way to market. Heartwood timber, when used, is for utensils--spoons, bowls, combs etc. (uses which, for many members of the genus, are pan-tropical with almost identical properties of the wood).

Our research with Mbeere informants show one disturbing element that pertains to the many members of these genera which are dominants. The species of varieties which, according to botanical and ecological literature, are the more drought resistant and, therefore, identified as dominants in drier areas of Kenya and similar parts of East Africa, appear to be spreading. As we did not investigate measured areas and contents, we do not have to imply precise counts in exact geographical positions. We suggest here, nevertheless, that one characteristic of the Mbeere resorting to alternative choices, which are recognized as being inferior materials, is that there is a correlation with these alternatives corresponding to drought-resistant survivors of plant communities. These now assure a better regeneration capacity to other species which the plant community formerly provided. Durable heartwood is rarely accompanied by rank regrowth, swiftly replacing what has been removed. Lack of durability of their plant resource base, and the consequent inability to utilize what would be a first preference, is a constant theme from our respondents.

Maher's account from 1938, and the last remnants of a closed-canopy forest atop Kiang'ombe, provides evidence of a once richer and more abundant plant resources base than is now the case. Ancillary evidence is not wanting.

During the entire period of the fieldwork informants failed to find for us specimens of the non-spiny form of (mu)-BINGO (*Diospyros mespiliformis*) a true Ebenaceae, extremely slow growing and of low regeneration rate according to all botanical reference sources, yet it was a part of the resource base familiar to their grandparents. (mu)-KURIAMBUNGU (*Ekebergia capensis*) specimens around Siakago, our research headquarters, may now be counted on one's fingers (one schoolboy asked us to identify it to him), and (mu)-THIGIRIRI (*Millettia leucantha*) is now countable as an ecological component only between Gitibore and Muchonoke, where land adjudication is incomplete because of clan disputes and consequently has an abnormally low occupation density. Considerable evidence points to a significantly reduced plant resource base; this is both qualitative and quantitative.

Changes in uses of plants

We turn now to some more specific examples of changes in use, considering especially the likely effects.

(a) House construction

Although most Mbeere micii (homesteads) contain at least one house "that is "traditional" in style and materials, there have been many changes. Earlier houses were build entirely of materials obtained from plants in the vicinity: today, it would be a rare micii where some materials had not been bought. Early photographs (see Maher, 1938 Vol.I) confirm that the old houses were - smaller, all round, lacked windows, used marigi (woven frames) for doors and had walls build of poles only, not mud-and-poles. This was said to facilitate leaving any nocturnal intruders or wild animals. Today, a major change is in the incidence of corrugated iron (ivati) roop. Several surveys suggest that there is an overall incidence of 40% of micii that have at least are structure roofed with iron, with local variations from 5% in poor remote areas to 90% in the rich pockets of Nguthi and Rianda. This is an important change, both in terms of economic investment and implications for values; we shall explore this at length in our monograph. It is also a recent change - very few villages had any iron roop before 1963.

(b) Charcoal

Although charcola sellers in Embu District were required to pay a Shs.5/- licence fee as early as 1952, (ENIC, No.33/1952), charcoal burning was not conducted on a large scale until the last five years or so. The reasons for increased production include: the excellent roads, the result

mainly of the Special Rural Development Programme of 1970/77, which have vastly improved access; the increasing demand for charcoal, from the growing urban population and elsewhere; the recurrent food shortages, which force poor people to burn charcoal so as to get money to feed their children; the increasing need for cash for consumer goods and for school-fees.

Because charcoal burning and selling are regarded as illegal - or as semi-illegal - activities, we did not attempt an exact estimate of production in Mberere, but we have much informant evidence. This includes periodical counts of bags of charcoal along stretches of roads that have many "charcoal stations" - e.g. Siakago - Muchonoke; Kanyuam - bora - Ishiara - Thuchi River bridge. We have also noted that on certain routes all matatus carry sacks of charcoal on their roof, sometimes balanced precariously in high loads and at least one $1\frac{1}{2}$ ton lorry is engaged full-time in transporting charcoal.

A count made at Ishiara Market in October - December 1976 showed that the following quantities were sold (approx.)

Sacks of standard Weight

	Tuesdays	Fridays	Sundays	Total
October	340	200	80	620
November	235	75	-	310
December	150	70	-	220
Total	725	345	80	1150

These figures are almost certainly an under-estimate, because of the difficulty of counting. Also, they refer only to charcoal sold at the market. Probably 2 or 3 times as many bags of charcoal were sold on the roadside, direct to the buyers. Charcoal production increases during any food shortage, and is concentrated in the dry seasons. Some charcoal is bought locally, especially by teachers, many of whom - particularly if they do not come from the area where they teach - leave their wives in their home areas; cooking for themselves, charcoal is a convenience. Hotels, bars and canteens also buy charcoal, but most of Mberere production is sold outside the division.

An August 1976 survey showed that, of 100 villages,

27 reported no charcoal burners

36 " 1-5 regular charcoal burners

11 " 6-10 " " "

26 " over 10 " " "

The preferred trees were:

mu-gaa, Acacia tontilis
mu-raba, Combretum zeyheri
mu-thigira Acacia mellifera
mu-ruruku, Terminalia brownii
mu-gereki, Combretum collinum subsp binder -anum.
mu-rama, Combretum molle
mu-thigiriri, Millettia leucantha
mu-too Anzanza garekeana
mu-barwa, Albizia anthelmintica
mw-Ombombwe Acacia gerrandii

It is clear that charcoal burning has become an important activity in Mbere, and also that it has already had profound effects on the landscape. In many areas it is very rare to see any "charcoal trees" of a g of more than one meter, as they have all been cut down. We hope that the issuing of land titles will reduce the indiscriminate felling of mature trees, as landowners are likely to protect their property, and even to replant.

(c) Firewood and thatching - grass

Although the use has not changed, the availability of both commodities has drastically decreased, as confirmed by our August 1976 survey of 100 villages, -

37	villages reported sales of firewood, and
59	" " " of thatching grass.

Firewood was sold at Shs.1/50 to shs. 5/- a head load or bundle, and grass at 10 cents to 30 cents a bundle (gichaki) depending on relative scarcity. Firewood, unlike charcoal, is mainly sold locally to teachers or canteen- or bar - owners, and grass mainly to richer people who need it for their own roofs. But there is a small trade at markets, particularly at Ishiara market, where buyers include visiting traders from Embu and even from the Central Province. This is a new phenomenon - market sales of firewood and thatching grass - that all we first observed in 1976. Sellers are all women, who also are the collectors of grass; nowadays men sometimes collect firewood, although they carry it on their shoulders, or suspended by a rope, never on their backs. Sales increase in famine periods, and prices rise in the rainy season. In some areas (about one-third of Mbere) there has, as yet, been no need to sell firewood or grass, as local supplies are still abundant. But land adjudication will probably bring changes in all divisions (see: Brokensha and Njeru, 1977)

(Brokensha and Njeru, 1977) Many people already report that they need the land-owners consent before collecting anything, and that sometimes a fee is demanded. In most cases people are allowed to collect without fee providing they:

- (i) are on good terms with the owner;
- (ii) ask permission;
- (iii) collect for their own use, not for resale.

Finally, here are a few observations about problems of collection of firewood and grass approximate length of average journey (there and back) to collect -

	grass	firewood
Less than 3kms.	11	9
3-6 kms.	20	15
6-10 "	17	17
More than 10 kms.	19	10
no data	33	50
Total	100	100

(If firewood is being collected for brewing beer, the distance is likely to be greater, as only certain trees have the requisite quality of, producing a strong steady heat for three days and three nights. Mu-nyua, Acacia senegal, is a favourite tree for this purpose)

In 1970 it was unthinkable that firewood and thatching-grass should be sold: There has been a radical change since then, in values as well as economics.

- (d) Other plants. Here we briefly summarise some other changes.
 - (i) Bee-keeping is dying out, due to modernisation and land-adjudication (see Brokensha, Mwaniki and Ritey, 1972) This means that the whole complex honey-culture is disappearing.
 - (ii) Medicinal Plants are now of minor importance, especially where people have access to a dispensary or health centre.
 - (iii) Entirely disappeared are such old uses of plants as ear-plugs, clothing and most vital uses.
 - (iv) Modern substitutes (all of which must be bought with cash) have replaced the following:

Dyes	Formerly made from, e.g., <u>mu-ruruku</u> , Terminalia brownii (bark and seed)	Modern substitute indian dyes
Soap	<u>ng'ong'oya</u> , cucurbitaceae (roots) <u>momordia</u>	Omo or Lifebouy, Palmolive, etc.
Pot-cleaner	<u>Miringa</u> , cordia uvalis (leaves)	Steel Wool
Fibres for ciondo (basket)	<u>mugaa</u> , Acacia tortilis (fibres on bark)	nylon
Perfume	<u>mi-taa</u> , compositae spp.	Lady Gay, snowfire
Agricultural Tools	<u>mu-ruti</u> , Grewia tembensis	Iron jembe

(c) The net effect of all the changes in uses is that plants no longer useful are no longer regarded with care; peoples' perceptions and knowledge change, too.

(e) Cultigens. We make very brief mention of a few changes.

(i) Subsistence crops

The main change here has been a shift, much accelerated in the last ten years, from millets to maize, with far-reaching consequences. Reasons for the shift include the fact that maize requires less labour, in weeding, especially in guarding against bird pests, and in preparing. Also, maize is considered by many local people to be a more appropriate food for "modern people", although most informed agricultural officials encourage the cultivation of millet. Millet is both more suitable to most areas of Mberere, as it can better survive the frequent shortage of rain, and it is also more nutritious. The Agricultural Research Station at Embu has organized several millet and sorghum tests in different parts of Mberere. Tentative recommendations for main food crops are

"High zone" Katumani maize and sorghum

"Medium zone" sorghum

"Lower zone" Millet. An improved type of bulrush millet.

SERERE 2A, is recommended as it is bird-resistant (it has bristles), though the resistance is lowered when there are many plots of this millet, and the birds cannot choose another easier crop to raid.

(ii) Cash-crops

Watts provides a list of all the agricultural innovations in Embu District from 1925-1970. The list of new crops is extensive, but

most failed, some on several different occasions as some of the new development "experts" were reluctant to accept lessons from a colonial past. The most important cash crops today are cotton, green-grams, beans (especially Mexican -142) and, in a few areas, tobacco; mangoes are locally important in Nguthi sub-location, Evurori.

CONCLUSION

We have indicated how drastically Mbere vegetation has changed in recent years. This is bound to have wide reaching effects eventually on climate and rainfall, on soil and on economic development. It has also led to profound changes in Mbeere values: in 1970, nearly all trees - not only those weru, in the wilderness, - were regarded as commercial property, available to all. A few of the more valuable hardwood species were clan property, occasionally even individual property. Today, in many parts of Mbere, every plant has an owner who restricts its use by others. And a small but increasing number of people have rights to neither land nor plants.

Throughout this paper, we have been taking examples from Mbeere perceptions of their environment, stressing the value of trying to look at plants and other resources through local eyes, and illustrating the wealth of the local knowledge. Our main recommendation is that any development plan should take this knowledge into account. All too often planners impose their projects on the people, ignoring local beliefs and values, in a typical "development-from-above" syndrome. We do not claim that all local beliefs are "scientifically valid", yet we have been impressed by many aspects of their extremely detailed knowledge of plants and their properties. We do recognise that it is not easy to implement this recommendation: development planning requires some-one to make decisions. What we do say is that better decisions will be made if they are based in part on local knowledge. (for further argument on this topic see Barker et al 1977; Werner and Warren, forthcoming)

Second, there is an urgent need to enforce the existing Soil Conservation Rules regarding cultivation on hillsides and near river banks, to restore terracing and fire-controls and tree planting. The laws are there: The District Development Committee should see that they are enforced. It is probably true that individual land titles will lead to better care of the land, but the rules still need to be enforced.

REFERENCES:

1. Barker, David, Julius Oguntoyinbo and Paul Richards. The Utility of the Nigerian Peasant Farmer's Knowledge in the Monitoring of Agricultural Resources. MARC (Report No.4) University of London, London, 1977.
2. Brokensha, David, H.S.K. Mwaniki and Bernard W. Riley, "Bee-keeping in Embu District, Kenya" Bee World. 53 (3)1972,pp. 114-123
3. Brokensha, David and E.H.N. Njeru, Some consequences of Land Adjudication in Mpeere Division, Embu. Working Paper No. 320, Institute for Development Studies, University of Nairobi, 1977.
4. E.N.L.C.
Minutes of Embu Native Local Council
1925 - 1950.
5. Irvine, F.R. Woody Plants of Ghana, with Special reference to their uses. London, Oxford University Press, 1961.
6. Maher, Colin. Soil Erosion and Land Utilisation in the Embu Reserve, Parts I-II Nairobi, Development of Agriculture, (mimeographed), 1938.
7. Werner, Oswald and D.M. Warren (Editors). Studies in Applied Athmo-Science (forthcoming)
8. Williamson, Jessie. Useful Plants of Malawi. Zomba, government Printer, 1972.

REFERENCES:

1. Banker, David, John G. Campbell and Paul Richards.
The History of the Nigerian Forest Reserve System in
the Context of Agricultural Research. WRI Report No. 1.
University of London, London, 1977.
2. International Institute for Environment and Development.
"Reforestation in the Tropics: A World
Survey (1975), pp. 111-113
3. Banker, David and S.H.H. Hjern, Some consequences
of land allocation in forest reserves, paper
working paper No. 20, Institute for Development
Studies, University of Nairobi, 1977.
4. S.H.H.
Minister of Rural Native Land Councils
1975 - 1980.
5. James, R.A. Wood, Forest of Ghana, with special
reference to forest reserves, London, Oxford
University Press, 1967.
6. Waters, Colin, Soil erosion and land utilization in the
Forest Reserve, Forest Dept., Development of
Forestry, (Lagos), 1975.
7. Waters, Colin and S.H.H. Hjern (Editors).
Studies in Applied Agro-Science
(Lagos)
8. Williams, David, Forest Reserves of Nigeria,
Nigeria Government Printer, 1975.