

FARMING, FOREST AND SAVANNA IN WESTERN NIGERIA *

With 2 figures, 4 photos and 1 table

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Zusammenfassung: Farmland, Wald und Savanne in Westnigeria

Die Studie zeigt das Zusammenwirken wirtschaftlicher und ökologischer Standortfaktoren auf die Landnutzung im Übergangsgebiet zwischen Wald und Savanne in Westnigeria. Für sich allein können weder die wirtschaftlichen noch die ökologischen Standortfaktoren die beobachteten Verhältnisse befriedigend erklären. Wahrscheinlich ist ein ähnliches Zusammenwirken für weite Teile dieser Zone in Westafrika charakteristisch. Wenn die biologischen Gegebenheiten dieser Zone wirksam genutzt werden sollen, dann sind weitere Studien in ähnlichen Gebieten anzustellen.

Die Ergebnisse zeigen, daß die einfache, aber gebräuchliche Unterscheidung von Wald- und Savannen-Landwirtschaft in diesem Gebiet keine Gültigkeit hat, obwohl die so begrifflich umschriebenen natürlichen Grundlagen der Landwirtschaft die wirtschaftlichen Faktoren in erheblichem Maße beeinflussen. Deren Wirkungsweise kann jedoch nur im Zusammenhang der betriebswirtschaftlichen und der allgemeinwirtschaftlichen Gegebenheiten des Gebietes verstanden werden, nicht zuletzt auch deshalb, weil sie durch das Vorhandensein großer Städte mit ihrem Bedarf von Nahrungsmitteln und Brennstoffen beeinflusst wird.

There is a general assumption in African environmental studies that a strong relationship exists between vegetation type on the one hand, and cropping, together with agricultural practice, on the other. This assumption is based in part on the importance of self-propagated plants in restoring the nutrient status of the soil during fallows, in part on the considerable difference in effort involved in clearing different types of vegetation, and also on the more questionable notion that vegetation is usually a reliable indicator of soil conditions, or even a key to the sum total of all the factors which might conceivably affect plant growth in a given location (ALLAN, 1965, pp. 3–19; PHILLIPS, 1959, pp. 36–38). There has been a tendency in describing crop distributions or agricultural practice to rely on simple vegetational models as adequate descriptions of spatial variability. In West Africa this tendency has led to the classification of agricultural space as areas of forest practice or areas of savanna practice, and of crops as forest crops (e. g.

yams and cocoyams) or savanna crops (e. g. guinea corn and bulrush millet) (BOATENG, 1966, chap. 6; HARRISON CHURCH, 1966, chap. 6; STAMP, 1964, chap. 6 and pp. 141/142, 222, 305 and 307; WRIGLEY, 1960). The extreme approach is well illustrated by the use made of "climax or bioclimatic regions" by JOHN PHILLIPS in classifying the chief potentialities and hazards for agricultural development in Africa. These climax regions are the areas occupied by the "biotic communities (which "may be considered to be plant communities", or for which the plant communities are "indicators"), which reflect "the form, structure and developmental integration of the master climatic factors, modified in varying degree by local characteristics of the soil" (PHILLIPS, 1959, p. 36).

This tendency to use the vegetation map as the basic guide to agricultural distributions is open to several objections. Firstly the view taken of vegetation by the African farmer is essentially different from that of the botanist whose concepts and classifications are used to make the map. The farmer is concerned with problems of clearance, with plants as weeds, or as a means of restoring productivity, or as problems in maintaining a cycle of agricultural operations. His interest lies in the evaluation of plants as a source of fruit, grass, timber, or medicine, or in vegetation as an environment for hunting. Plant groupings based on floristic or even physiognomic criteria, or combinations of them, are rarely of primary importance in this respect. Secondly, while it is possible and useful to generalise about the factors which influence the location of a particular group of plant species, it does not follow that the operative factors are the same for each species within the group considered individually. Crop plants, especially, owing to modification by the cultivator of the ecological conditions in which they grow, and the genetic variety and consequent variability in environmental tolerance which they commonly display, rarely have any distribution which coincides with those of other crop plants, or of self-propagated plants. Furthermore, agricultural practice, though not without important ecological implications, is usually conditioned at least as much by economic and social factors as by biological or physical 'controls'. Thirdly, although vegetation and agricultural practice have important relationships, these are essentially reciprocal in nature. An agricultural response to a given vegetation condition inevitably results in a modification of that condition, which may lead to a new agricultural response, and so to further modification. A cycle of agricultural operations is in effect composed of a

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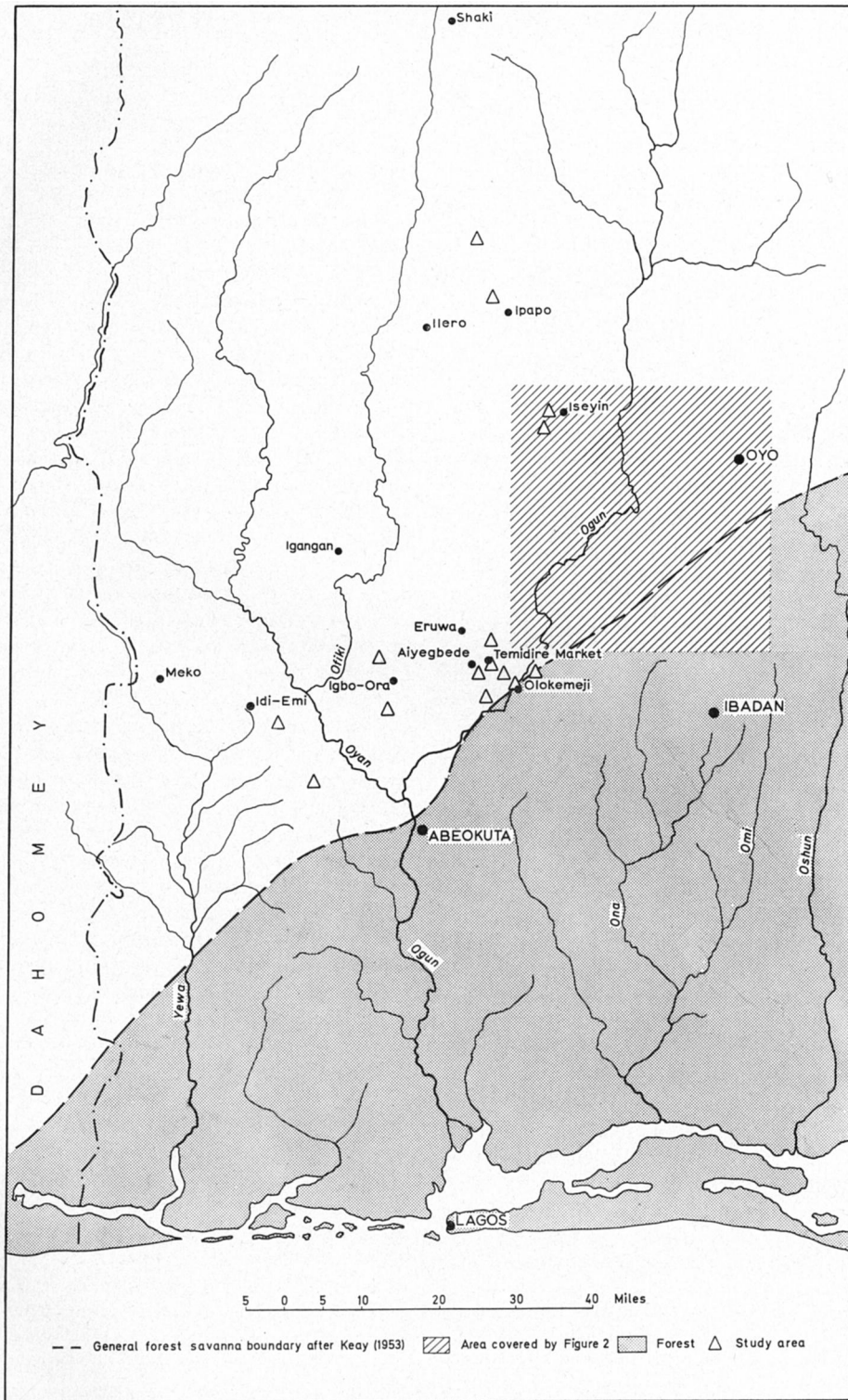


Fig. 1: Location of study area

chain of reciprocating relationships of this kind, which ends when no further useful agricultural response is possible. Self-propagated plants are then permitted to restore nutrient levels to a point at which the same, or another, chain of operations can begin again.

In order to study the relationship of crop and vegetation distribution in Western Nigeria a small survey of farm holdings in the forest-savanna contact zone was conducted by the authors in 1966. It was hoped that this would reveal some of the factors involved in the choice of crops, particularly on holdings which included both forest and savanna land. This survey formed an ancillary part of a general study of the forest-savanna boundary, involving its mapping from aerial photographs (*Canadian Aero Services*, 1961–1963, MORGAN and MOSS, 1965) and field studies. The 1966 survey was confined to the rough triangle between Shaki, Meko and Olokemeji (Fig. 1). Locations for detailed study were chosen from aerial photographs to obtain a variety of site conditions at points of reasonable access for the team of soil surveyors from the Western Nigeria Soil Survey Department and a plant collector from the Nigerian Forestry Department. The sample was therefore stratified by site. The fields and farms surveyed at each site were picked from as many holdings as farmers could be found willing to co-operate with the survey. The difficulties were unfortunately increased by an outbreak of major civil disturbance on the day the study began. A random survey would have been quite impossible to conduct since no map of farms was available and no means existed of ensuring that one could choose from amongst all the farmers in any village. The survey therefore made no attempt at any total statistical evaluation which would have been quite invalid, but concentrated instead on questioning farmers' motivations and their appreciation of the factors involved in their choice of crops.

Altogether 302 fields were measured and their crops recorded. Five complete holdings were surveyed, and farmers were questioned at 15 survey locations comprising eight miles of transects across the forest savanna boundary along which soil pits were dug, and plants, including crop plants, were recorded and collected. (Moss and Morgan, 1966).

Environmental characteristics of the area of study

Within the area of study there is considerable edaphic contrast. The 2000 square miles of dissected country in which the sample areas were located, range from 200 to 1200 feet above sea level, and are characterised by narrow valleys with convex sloping sides, and numerous residual hill features rising occasionally to 2000 feet. In the extreme south-west a dissected scarp slope of Cretaceous ferruginous sandstones is capped by extensive sheets of hard laterite ironstone, bounded by escarpments below which extensive colluvial slopes are developed. The most common rock

outcrop in the remainder of the area is coarse-grained quartzose granite gneiss, which weathers to a sandy and gravelly soil, with only a small clay content, usually associated with concretions, and frequently showing a distinct layer of accumulated broken ironstone fragments and angular stones. Such soils, generally very acid in reaction, are subjected to considerable and rapid changes in moisture status in response to fluctuations in atmospheric water supply. There appears to be a general association between vegetation dominated by grasses and the occurrence of such soils. Where laterite pavements are developed on cretaceous sandstones, they are associated with a distinctive vegetation type consisting of scattered trees and a discontinuous herb-grass layer dominated by the grass *Ctenium newtonii* (TAYLOR, BAKER, LEEFERS and DE ROSSAYRO, 1963). At the edges of the laterite this vegetation type is immediately replaced by thicket and secondary forest on deep colluvial soils.

More locally in the area of Basement Complex rocks, heavier, less gravelly, more base-rich soils occur, associated with the outcrops of finer grained, more felspathic rocks, often with significant proportions of ferromagnesian minerals. Diorite, for example, forms pronounced ridges in many locations, and weathers to soils of this type which frequently support healthy tree crops, and a rich self-propagated flora. On the other hand, the occasional outcrops of almost pure quartzite give rise to soils still more sandy and gravelly than those derived from the granite-gneiss.

Rainfall totals for the few observing stations in the area range from 45 to 53 inches. Some stations in savanna locations to the north receive as much or more rainfall as some of the stations in the forest. The relationship between rainfall and vegetation depends therefore not so much on annual totals, as on seasonal distribution. Plant growth is also affected by the spatial distribution of relative humidity which can be critical for seedlings during the dry season. Locally, however, there are marked microclimatic variations. The rainy season consists of two periods, one beginning in late February or March and lasting 4 to 4½ months, and the other beginning in August and lasting 3 to 3½ months. More northerly or savanna-ward locations tend to have a shorter rainy season with more intense precipitation and a shorter intervening relatively dry period in July-August. This short break in the rainy season interrupts growth. Such interruption is not too serious for well rooted plants, particularly well established root crops, but it can reduce yields of grain crops, and it is usual to treat the two portions of the rainy season as separate growing periods for grains, of which the first, being longer, is normally given to the main crop.

The forest-savanna contact zone

Most of the area is covered by a wide variety of differing physiognomic types of savanna vegetation,

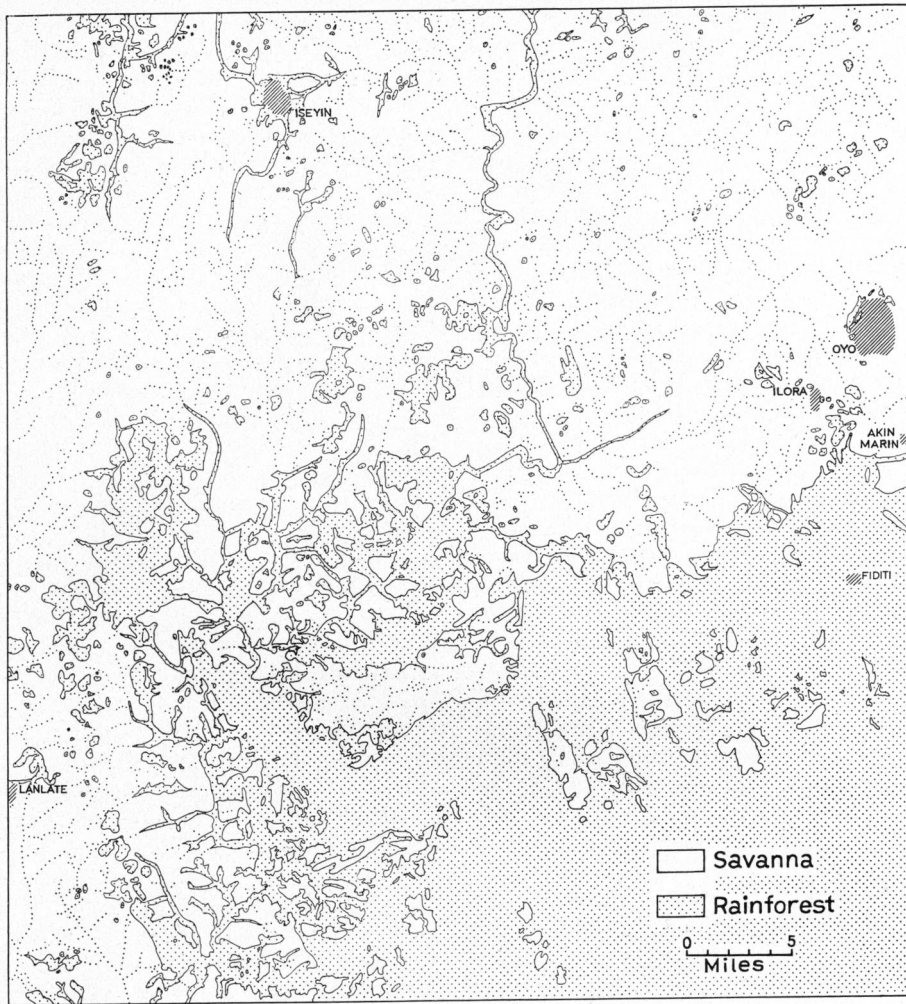


Fig. 2: Forest and savanna distribution in a portion of Western Nigeria, 1961–1963 (for location see Fig. 1)

ranging from grass with only a few small trees, through a well-developed grass-herb layer with numerous trees, to dense woodland with an almost closed canopy, a very poorly developed herb layer and frequent shrubs. A feature of all the forest islands examined was their association with deep clay soils including the diorite derived soils described above. This feature proved of considerable locational significance for agriculture. Continuous forest, with evergreen species, including some tall emergents, and with a closed canopy except where it is broken by cultivation, occurs in the south east of the area. Salients and islands of forest extend northwards into the savanna, with some islands as far as fifty miles from the northern limit of continuous forest. The marginal location of these islands and salients provides a unique opportunity for the study of the relationships between these two distinct communities of planted and self-propagated plants. Although the proportions of grass vary considerably grasses always colonise rapidly

where man clears the woody plants, whereas in the forest areas grasses rarely appear at all after clearing (photos 1 and 2).

The contact zone itself consists of a "mosaic of communities representative of each region", a complex pattern of islands, salients and enclaves of forest within savanna, and of savanna within forest (Moss and MORGAN, 1966). Figure 2 shows the first detailed map of a portion of the contact zone. It is a preliminary attempt based on a small scale aerial photograph mosaic. More accurate mapping on a 1:50,000 scale is proceeding. Locally the sharpness of the forest-savanna boundary is remarkable, making possible extremely detailed mapping from near vertical aerial photographs, and facilitating studies of differing agricultural practice in relation to different vegetation within very short distances. In many places the change from forest to savanna, or rather from a vegetation in which a self-propagated herb layer was more or less absent to one in which it was dominant,

and usually grassy, normally occurred within a yard, and there were few places where this change was not apparent within ten yards (photos 3 and 4). The change was always associated with an equally striking change in the floristic composition of the woody component of the vegetation.

Farm Locations

Generally farmers lived in one of three locations:

- a) In small villages with adjacent farmland, to which access was reasonably easy, and where all or most of the holding was situated.

Distance to furthest fields was of the order of one to three miles. Several of these were farm villages "belonging" to a nearby town. It was apparent, however, that close social linkage did not necessarily mean a regular migration between houses in town and village. For example, in one village, Oke Olowo, families had relatives in Eruwa town, but only stayed there for short periods. These Eruwa relatives had land in Oke Olowo, but did not farm there on the scale that the villagers did. So that although there were important connections, nevertheless there was a marked separation of activities between the townspeople and the village people. Similar features have been observed elsewhere in the Region (GODDARD, 1965).

- b) In small towns such as Eruwa or Igbo-Ora with fields extending around the town for some three to ten miles radius.

Accessibility has a market effect in some cases on the location of cultivated land in that the cropped area tended not to be circular, but star shaped, with higher proportions of fallow and uncultivated land in between the paths and roads radiating from the town and at the more distant locations.

- c) In some locations outside the area, often, but not always, in a large town such as Ibadan.

Some farmers were found who held land in widely separated locations. In one case the furthest pieces were over a 100 miles apart. Such farmers were highly commercial, employing others, often relatives, to work their farms.

General character of farming

The Yoruba in the study area produce crops both for market and to satisfy part of their own needs. Many of them employ hired labour. All the farmers interviewed emphasised the commercial nature of their cropping, and where surveys of holdings were made the commercial crops were found to be much more extensive than crops which appeared to be mainly for domestic consumption. Such commercial production of both food and industrial crops is wide-

spread in Western Nigeria (GALLETTI, BALDWIN and DINA, 1956). Hired labour appeared to be essential for food cropping on holdings of seven acres or more, for the planting season for such cropping was short if the farmer also attempted to plant and tend commercial tree crops. Informants suggested that labour was becoming scarce due to the tendency of young people to leave the area for the towns. Abeokuta and Ibadan dominate the life of the area and undoubtedly have attracted labour to their growing industries. Tared roads provide easy communication, so much so that bread was regularly delivered throughout much of the area from bakeries in Ibadan. The demand for education has also tended to remove children from farming activity for a large part of the working week, and reduced the labour formerly available for weeding and a number of minor tasks. Emphasis on labour reducing techniques is therefore growing, and since there appeared to be no shortage of land, savings in labour were effected even where they meant some reduction in yield.

Land is normally held by usufructuary right which may be inherited. Most of the land held in this way belongs to local people whose families have long been settled in the area. Few strangers own land outright, but a number have acquired land by lease, chiefly for the planting of cocoa. The demand for good cocoa land has resulted in considerable pressure on land resources in the older planting areas in the forest. So long as cocoa farmers depended on the Amelonado varieties which grew most satisfactorily in shady and moist conditions, the forest proper was preferred. Since the war the development of the Amazon varieties, requiring less shade, though still preferring relatively moist conditions, has brought an extension of cocoa planting into the forest islands of the savannas. Large numbers of young plantations were seen, some of them held or worked by immigrant farmers, usually Yorubas from elsewhere in Western Nigeria. The demand for forest land has been increasing more rapidly than for savanna, and this despite problems in hiring labour for its cultivation, as will be shown.

One of the holdings was large (37.5 acres). No doubt it was not typical, but its extent and the variety of its crops provided useful illustrations of many important features. The head of the family no longer worked on the holding. Cultivation was done by his three married sons, together with four to six hired Igbirra labourers from the Northern Region. 10.2 acres were in forest, 19.2 in savanna, and 8.1 acres consisted of fields on the forest-savanna boundary, of which 6.2 acres were mainly on the forest side (forest edge fields) and 1.9 acres were mainly on the savanna side (savanna edge fields). Crops were divided amongst these different kinds of land as follows (acres):



1



2



3



4

Photo 1: Well developed grass fallow with heavily cultivated forest island in the background

Photo 2: Fairly typical forest fallow fringing cultivation in the background

Photo 3: Forest-savanna boundary: an abrupt change from forest to grassland

Photo 4: Forest-savanna boundary: the change from forest cultivation (oil palms, bananas, cassava and pineapple with forest fallow in the background) to recent grass fallow

	Forest	Forest Edge	Savanna Edge	Savanna
Cocoa and food crops	2.0	—	—	—
Cocoa and rubber	5.0	—	—	—
Rubber sole and mixed	—	0.7	0.5	—
Other mixed tree crops	0.5	—	—	—
Timber	—	—	0.2	0.4
Banana and other food crops	2.7	—	—	—
Cassava sole	—	1.2	1.2	11.7
Cassava and other food crops	—	4.3	—	3.5
Other mixed food crops	—	—	—	2.4
Newly cleared	—	—	—	1.2
	10.2	6.2	1.9	19.2

Well over half the forest area supported cocoa, mixed with either rubber or food crops, and well over half the savanna area was devoted to cassava, mostly as a sole crop, and intended for preparation in the field into gariflour for subsequent sale. Other holdings in the district showed similar crop distributions between forest and savanna land. It was apparently normal for a farmer to possess lands in both the forest and savanna, even if he had to traverse considerable distances between the different parts of his holding, and normal to depend on two main commercial enterprises: cocoa and cassava, whilst experimenting with others, such as rubber and cashew amongst tree crops, and commercial yam cultivation amongst field crops. Timber, usually teak or cassia, could also be regarded as a crop, and was often planted in a mixed stand with food crops in much the same way as cocoa and rubber. Other important but more localised commercial crops included tobacco and rice, but these depended in part upon access to either a curing shed or to a mill. The dominance of cocoa

and cassava was even greater than statistical analysis of the cropping pattern would suggest, because much of the food cropping was not done just to provide food for the family or an additional crop for market, but

- i) to provide shade crops for young cocoa, this applied particularly to cocoyams and bananas with their large leaves;
- ii) to maximise the use of land which was expensive to clear and to weed;
- iii) to reduce the amount of weed competition by suppression through a more complete coverage of useful crops;
- iv) to maximise the labour used by spreading the demand.

Cropping systems

Holdings were logically planned as systems of energy exchange and labour use, responding to the demands of the market, even though such planning, in most cases, lacked adequate paper organisation or accountancy. Although the crops described were combined together in mixtures and rotations in an immense variety of ways there were important tendencies in the patterns which were in effect systems of crop combination and rotation. The aim of most cultivators was to create one or more of these systems on his holding according to location, certain soil characteristics and moisture relationships. These, in part described elsewhere (MOSS and MORGAN, 1966), may be summarised as:

1. A root crops – banana – tree crops system in which the aim was to establish tree crops, mainly cocoa, but to obtain some return from interplanted food crops before the trees came into bearing. This system was confined to the forest except where the establishment of cashew or of timber trees, mainly teak, was the ultimate object. Some of the larger leaved food crops such as banana and cocoyam, played an important role as shade plants for young seedlings. Trailing plants such as the egusi melon were also useful in providing a cover which helped to suppress weeds. Many adventitious plants occurred which were used for domestic consumption as foods or medicines (e. g. *Talinum triangulare*, a leaf plant; *Jatropha curcas*, pig nut, oil from seed used for medicine or soap manufacture; *Solenostemon ocyroides*, roots and leaves eaten; *Marantochloa flexuosa*, *M. ramosissima*, Gbodogi, leaves used as wrappers, more commonly found in the continuous forest zone).
2. A maize – root crops – small crops system, occurring in both forest and savanna, producing the three most important local food crops, cassava, maize and yams. The relative importance of these three crops in the system varied according to location factors described below.

3. A guinea corn – root crops system, limited to the savanna, in which guinea corn stalks played an important role as yam vine supporters.
4. A rice – other crops system, dependent on distance from rice mills and preferring moist locations in the forest or in the forest fringe (MABOGUNJE, 1959).
5. A tobacco – other crops system dependent on distance from tobacco curing sheds (COPPOCK, 1965).
6. A cassava dominant system, confined almost entirely to the savanna, with long periods of sole cassava cultivation, or with little attention to secondary crops.

The choice of system depended on a multiplicity of economic and biological factors. Some of these have already been indicated. The choice of system or of dominant crop will now be examined in relation to forest and savanna.

Forest and savanna as factors in crop location

The survey of 302 fields, 290 of which contained crops, (see Table) gave some indication of cropping patterns in the area in relation to forest and savanna, although it cannot be regarded as a representative sample, since proper sampling procedures were impossible. Fields are listed in the table as containing either mixed crops or sole crops. Mixed crops in each case also included other crops already in the list, so that the mixed crop totals overlap and cannot therefore be added together to produce a total of 290. Of the 290 cropped fields only 12 of the 72 in forest or forest edge locations contained crops grown sole, compared with 106 of the 218 fields in savanna or savanna edge locations. Of the latter 89 fields contained food crops, mainly cassava, grown sole for the local market. Of the 57 forest fields 35 contained tree crops and 13 of the remaining fields contained bananas, a long term crop (3 to 4 years), although unlike most of the tree crops, mainly for the domestic food supply. The remaining 13 forest fields in bananas (totalling 26 in the table) also contained tree crops. Thus the forest fields were mainly devoted to tree or long term crops in mixed stands and frequently intermixed with food crops. In some fields there were as many as 12 species of crop plants including up to 5 perennials. In the savanna by contrast there were very few tree crops, and most of the mixtures were of only two or three plant species.

These distinctions between forest and savanna may in part be directly attributed to the environmental needs for successful establishment and growth of the crops concerned. Thus cocoa thrived only on soils which provided an adequate moisture supply in time of atmospheric moisture stress, and which were also able to drain away excess water during the rains. Furthermore the nutrient requirements of the crop

Table : Number of fields observed containing most commonly occurring crops

	Forest	Forest edge	Savanna edge	Savanna	Total
Fields with crops	57	15	29	189	290
Cassava mixed	35	11	8	76	130
Cassava sole	3	3	4	44	54
Cassava total	38	14	12	120	184
Maize mixed	19	6	7	56	88
Maize sole	—	—	3	21	24
Maize total	19	6	10	77	112
Yams mixed	9	4	8	33	54
Yams sole	—	—	2	10	12
Yams total	9	4	10	43	66
Bananas mixed	26	3	3	4	36
Cocoa mixed	19	2	—	1	22
Cocoa sole	4	—	—	—	4
Cocoa total	23	2	—	1	26
Oil palm mixed	11	3	3	6	23
Oil palm sole	1	—	—	2	3
Oil palm total	12	3	3	8	26
Cocoyam mixed	16	5	—	—	21
Cocoyam sole	1	—	—	—	1
Cocoyam total	17	5	—	—	22
Guinea corn mixed	—	—	4	9	13
Guinea corn sole	—	—	—	5	5
Guinea corn total	—	—	4	14	18
Teak mixed	2	—	2	1	5
Teak sole	—	—	4	8	12
Teak total	2	—	6	9	17
Cashew mixed	2	1	—	10	13
Cashew sole	—	—	—	3	3
Cashew total	2	1	—	13	16

were better met on soils derived from more basic rocks, such as diorite. Thus cocoa grew well on the uniform clay soils which were found universally associated with the forest islands, a feature observed also in Ghana (BRAMMER, 1963). The more humid microclimate found within the forest islands was also a favourable factor in the complex. Bananas likewise preferred a humid forest environment, although a few plantings occurred in more humid savanna locations, whilst cocoyams showed a complete preference for forest moisture and shade. Guinea corn on the other hand only appeared in savanna or savanna edge fields, mainly because the plant was affected by fungus disease under the more humid forest conditions. However, maize, many varieties of which can be highly productive in forest, and yams, which are frequently described as a forest crop, here failed to show any forest preference, occurring more frequently as savanna crops and being confined to the savanna as sole crops. Both maize and yams, which like cassava are important as domestic staples and as commercial

food crops for sale in urban markets, appeared here as important savanna crops because of land and labour controls. The smaller the proportion of forest land in a holding, the more important it was to confine food cropping to the larger savanna portion even if yields were lower. This applied to several holdings near the general forest-savanna boundary where the farmers concerned had only small proportions of forest land, but otherwise was more apparent in locations further out into the savanna away from the general boundary and where the forest islands were smaller and fewer. The larger the proportion of forest land in a holding the more mixed was the cropping pattern on forest land, and the greater the tendency to plant food crops there (apart from the special shade crops, cocoyams and bananas, associated with the early stages of cocoa cultivation). Therefore cropping distinctions between forest and savanna generally became more marked in the small isolated forest islands than near the general boundary itself, for in these "island" locations economic pressures

produced sharper distinctions in distribution with apparently clearer environmental correlations. Thus one forest island near Ipapo, 42 miles from the general boundary, contained only tree crops such as oil palms and mangoes together with timber trees, whilst bananas and yams were all planted in adjoining savanna fields. Other forest islands near Iseyin, some 28 miles from the general boundary, contained chiefly mangoes, cocoa, oil palms, citrus, banana, papaya, and some cocoyam and pineapple with a little cassava. Forest islands at Igbo-ora, some 12 miles out into the savanna, produced some cassava, but for the most part were limited to cocoa and citrus. By contrast, in the main body of the forest, crops such as yams, maize and cassava were widely grown, and a great deal of land was devoted solely to food crops. Thus the presence of forest met a different response according to location and proportion of forest land in a holding.

Of the major elements of production labour, both in its quantity and its timing was markedly affected by whether the available land was in forest or savanna, and the quantity and timing of labour available in turn helped to determine the choice of crop. Forest land clearance was generally done in the November to February period when the rainfall in every month was less than three inches. Some clearance, usually of regrowth, could be effected in August, but the "little dry" season was generally too short and too moist for effective cutting and burning of forest trees. Although the planting and weeding of cocoa plantations were important, the most labour-demanding portion of cocoa farming was undoubtedly clearance. In some villages the work was done by Tiv labourers who were available as late as December or even January. These were experienced in cultivating a great variety of crops and could be used for duties on both forest and savanna lands. For the most part, however, the labourers were Igbirras, skilled mainly in weeding and planting cassava and grain crops, and available chiefly from February to November. In consequence in many villages the greater part of the cocoa planting and forest work was done by the villagers themselves, whilst savanna food crops were in large part planted and weeded by hired labour. There was a marked tendency for the forest land, which was proportionally the smaller area and highly valued for its productivity, to be devoted mainly to tree crops with supplementary food crops, worked by family labour, whilst most food crops were planted in savanna, often by hired labour, especially if grown for commercial purposes. In the latter case they were either planted sole or appeared sole in the latter half of the year after earlier elements in the mixture had been harvested. Because such labour frequently arrived late in the dry season, clearing of savanna fields had to be done quickly and planting likewise was often done equally quickly after the

rains had begun. Methods of cultivation were thus somewhat extensive even though hand labour was employed. In many cases this speed, plus the necessity to economise in labour even at the expense of yield, led to such practices as allowing yam vines to trail on the ground, instead of providing them with poles or the support of either guinea corn stalks or cassava stems from a previous year's crop.

Other location factors

Location with respect to markets and population centres introduces an important variable into the relationship between crops and the forest-savanna boundary. The most important single factor in the farm economy of the area is the existence of the great cocoa and food marketing complex for export and for the supply of the cities of Ibadan, Abeokuta and Lagos. The city of Ibadan with its three quarter of a million population is the largest single market for food in Nigeria, being supplied with rice, yams, cassava and bananas from well beyond the area of study. Cassava is almost certainly the most important single food crop consumed in Ibadan. The crop is very easily grown, indeed more labour is spent in its preparation than its cultivation. Moreover, it needs no special storage facilities, for it may simply be left in the ground until required. In consequence there are many producers, and only a slight seasonal rhythm in prices, partly due to the seasonal fluctuations in the production of and demand for alternative foods (GALETTI, BALDWIN and DINA, 1956). Interest in the crop is therefore widespread and has undoubtedly tended to increase in recent years as food prices have risen, and until just before the period of study cocoa prices had tended to drop. The main areas of production therefore were near Ibadan, either on forest land less suited for tree crops, or more commonly in the savanna.

Approximately 63% of the fields observed contained cassava. The table suggests that the forest proportion was about the same as that of the savanna, but more savanna fields contained cassava as a sole crop or as a major crop. Yams were the most important alternative food crop. Although in the table yams occupied only a little more than half the fields occupied by maize, yam yields per unit area were so much greater that these fewer fields provided a far greater food production either by weight or in calorific terms. Yam cultivation required considerable skill and effort. Whereas on many farms in the area studied most or all of the cassava cultivation was done by hired labour, a great deal of the yam cultivation was done by the local farmers and thus competed with tree crops in labour demand. The farther to the north or northwest of Ibadan a farm was located, the farther it was away from the main food market and from the general forest-savanna boundary. Thus its location

tended to combine both smaller proportions of potential tree crop land and greater distances to market. In consequence yams which could command high prices, including high profits which could pay for considerable transport charges, tended to become more important as a major commercial foodstuff further out into the savannas. In such locations most relatively moist sites near the settlements were occupied by a mixed cultivation dominated by yams, particularly the moist fringes of the forest islands where the proportion of clay in the soil was still high and heterogeneity in the soil profile not very marked. Nearer Ibadan yams were grown less for their commercial importance and more for domestic supply, the main commercial crop being cocoa, whilst cassava appeared to increase in importance on sites which elsewhere would be regarded as favourable for yams. It was not any supposed difference in transportability as such which produced these contrasts in location, for whilst yam roots might be transported whole, cassava was normally prepared in the fields, and the resultant gari flour achieved a considerable weight saving.

A lesser but not unimportant location effect was the distance of the holding, not from the market, but from the farmer's dwelling. Analysis of the relation between yams, cassava, maize and distance along three transects from Eruwa town indicated a tendency for yams to be more common on the nearer fields, and cassava to dominate on the more distant fields (MORGAN, 1969).

Many farmers expressed a preference for living as near their more highly valued tree crops as possible, to keep a constant watch against pests and, in some cases, robbery. Location near forest islands had the additional advantage that many such islands occurred on clays suitable for building. The fragmentation of holdings characteristic of Yoruba farming made distance an important consideration for most farmers. Even in the smaller villages portions of the holding might be 2 to 3 miles away and visits to the more distant fields tended to be less frequent, and, in some cases, consisted of a few periods of stay in temporary huts. The tendency in such locations was therefore to grow crops such as cassava, which needed less attention, particularly with regard to weeding. This tendency of villages to be located near forest islands, reinforced the dominance of cassava in distant savanna fields, often in continuous cultivation for several years, followed by long periods of fallow.

Conclusion

The study shows something of the interaction in locational influence between economic and ecological factors in relation to cropping in the forest-savanna

contact zone of Western Nigeria. The observed patterns cannot be satisfactorily explained in terms of either one group or the other. It is likely that similar interactions are characteristic of much of the zone in other parts of West Africa, and if the biological resources of this zone are to be effectively utilised it is necessary that other studies be attempted in similar areas.

The results suggest that the simple distinction usually made between forest and savanna agriculture does not occur in this area although the different agricultural environments implied by these terms do exercise a considerable influence upon the operation of economic factors in the agricultural economy. These effects can be understood, however, only in the context of both the internal farm economy and the general agricultural economy of the region, especially as it is influenced by the presence of large cities, with their demand for food and fuel.

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