POPULATION AND AGRICULTURAL CHANGE IN NIGERIAN HAUSALAND: THE INFIELD-OUTFIELD SYSTEM OF LAND USE IN SOBA DISTRICT, KADUNA STATE

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CHAPTER I

AGRARIAN CHANGE AND POPULATION GROWTH IN SOBA DISTRICT, 1950-1975: AN INTRODUCTION TO THE THESIS PROBLEM

The population of Soba District, an administrative area of some 800 square miles within Kaduna State in northern Nigeria, has increased significantly since mid-century. The number of its inhabitants is estimated to have grown from 40,000 in 1950 to nearly 80,000 in 1975.[1] Such population growth represents

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[1]Population figures for Nigeria have a long and notorious history of undependability. The 1952 Census lists 41,931 as the Soba District population at that time; although this census has in general been subject to charges of undercounting, this figure is obviously the best possible assessment of mid-century population. The census conducted in 1962 was repressed for political reasons. The widely disputed 1963 Census recorded 88,445 people in the district, which represents a highly implausible 7 percent rate of annual increase. Figures from the 1973 Census were not available at the time of this writing and have since been repressed.

A more complete discussion of the manner by which population figures used here were derived is contained in a subsequent chapter by way of explanation of a population density map of the district. It should be noted at the outset, however, that no attempt at formal demographic analysis was made in connection with this study; the data are simply not available. A general discussion of the problems of population data in Nigeria, including the questionable state totals released from the 1973 Census, can be found in R. Mansell Prothero, "Nigeria Loses Count," The Geographical Magazine (October 1974). The 1963 Census is discussed in I.I. Ekanem, The 1963 Nigerian Census: a critical appraisal (Benin City: Ethiope Publishing Co., 1972). The 1962 and 1963 censuses are examined in J.C. Caldwell and C. Okonjo, eds., Population in Tropical Africa (N.Y.: Columbia University Press, 1968).

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this relatively small number of individuals would very likely be involved in farming at least peripherally. This is not to suggest, however, that the remaining 99 percent of the district populace receive their entire livelihood from farming for, as will be explained in greater detail in a subsequent chapter, there exists a highly developed system of secondary and off-season occupations in this district as in the rest of Hausaland. Yet nearly all of the men in Soba District consider themselves to be first and foremost farmers. No heavy industry exists in the district, and almost nothing that is unrelated to agriculture is produced there.

The question emerges, then, as to what the relationship between this doubling of population and the primary economic activity of the district has been. Have the additional food and fibre requirements of the new farming families been met simply by an expansion of the cultivated acreage of the district? Has the additional populace been absorbed in the agricultural sector with little or no structural change in the agricultural system and with little or no stress on the environment? Since the population is obviously not evenly distributed over the district, is it possible to detect any differences between areas which have experienced greater growth and concentration of people and those which have remained sparsely settled? The theme that underlies this line of questioning is that of change and adaptation to change in traditional agrarian societies, and this theme is central to this investigation of Soba District.

The problem under study centers on the following question:

Is it possible to establish any connections between changes that have occurred in Soba District agriculture in recent decades and the increase in population that has taken place? After the nature and degree of population change in the district have been firmly established, a complete response to this question must proceed in two steps: First, it is necessary to specify precisely what changes in agricultural systems have taken place. This can be done directly, by comparing present findings with results from previous surveys, or indirectly, by substituting variation over space for variation over time. Secondly, the observed changes in agriculture must be related to demographic, cultural, economic, environmental, and spatial factors.

Agrarian Change in Soba District, 1950-1975

To the casual observer, it might seem somewhat curious to speak of change in agriculture in Soba District. If one were to disregard the relatively few and isolated examples of advances in agricultural techniques or adoption of innovations, it might seem far more appropriate to examine the static nature of Soba agriculture. Indeed, on the surface, there might appear to have been little change in the last twenty-five years. The types of agricultural land use and farming enterprises have been altered very little during this period. The family unit remains the primary source of agricultural labor; the hoe remains the fundamental agricultural implement. The crops are much the same as those one would have seen in 1950; Millet-sorghum combinations, frequently mixed with maize or with peanuts and black-eyed peas, have re-

mained the staple food crops. Cotton and tobacco are still much in evidence as crops grown for the market.

Similarly, this line of reasoning might continue, villages within the district display a remarkable degree of uniformity in their agricultural systems today. If one attempted to use contemporary variation in farming systems among villages of varying sizes in the district as an index of changes that have taken place over time resulting from population growth, very little differentiation could be established. Practically all villages and hamlets appear to be surrounded by a zone of land which is cultivated every year and to which dressings of organic materials are applied to maintain productive capacity. Outlying this zone is another within which fields are intermittently cultivated and fallowed. Farmers in all villages take advantage of lowlying fadama lands to cultivate small plots of sugar cane, rice, or vegetables. The fact that villages regardless of size seem to follow quite similar production techniques appears to suggest that the increase in numbers of people engaged in farming in the area has had little impact on the style of farming or upon the use of the district's land resources.

The dominant cultural impress on farming has, if anything, been strengthened and entrenched since 1950. Soba District remains a dominantly Hausa-Fulani and Islamic society. The total non-northern or non-Hausa population of the district has fluctuated during this time with the opening and closing of transportation routes and with the ethnic hostilities that preceded the Nigerian Civil War. Yet the proportion of the population that is

outfield plots which are fallowed for varying periods--are comparable to those of twenty-five years ago. No new categories of land use have come into existence.[1] Yet the relative extent of the major categories of land use within the domain of villages in the district has been altered. Such alteration has not been on a uniform basis throughout the district, and this, it will be argued, constitutes a significant trend in Soba agriculture.

The methods for the maintenance of the productivity of land resources--the resting of land for a period of years in order to allow natural processes to rejuvenate fertility or the application of fertilizers and manures from external sources--have not changed, although in the case of the latter method new commercial sources of such fertilizers have come into being. Yet, the relative proportion of land which is maintained in good heart by the two methods is not the same as it was in 1950, either at the village or the district scale. Changes in this respect, it will be demonstrated, do not bear a direct and linear relationship to the simple expansion of the farming population.

Other Aspects of Change in Soba District, 1950-1975

Of course, population growth has not occurred in the district during this period in isolation from external events. Sure-

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[1] Categories of land use obviously depend upon the classification scheme that is employed. This forms the topic for an extended discussion in a later chapter.

ly it would be a mistake at the outset to attribute all observed changes in agriculture to the impact of population growth alone.

In the first place, the administration and governance of Nigeria has changed from the status of British colony to parliamentary democracy to military regime over this period. Although the degree of penetration to the village level of the policies pursued by the respective administrations has varied, these shifts in central authority have certainly been reflected in the life of the district. The consistency with which, say, agricultural development policy has been pursued or the proximity of an administration to enforce or encourage such a policy, has been largely a function of these extra-district events.

Moreover, Soba District has during these years experienced the full impact of the events and processes which might be listed under the rubric of modernization. Two modernizing trends that are germane to this study might be cited here: The first is the increased commercialization of agricultural production in the district along with its general integration into the national economy. Extension services, marketing, pricing, and taxation policies along with the growth of urban demand for foodstuffs have all spurred district agriculture toward the production of commodities, food and non-food, for sale. As has been demonstrated elsewhere in Hausaland, the Soba District farmer appears to have responded to changes during this period in factor and product prices, along with other incentives, by increasing the proportion of his agricultural output destined for the market-

place.[1]

Secondly, the accessibility of the district, the transportation and communications linkages beyond and within its boundaries, has been increased enormously since 1950. The primary transportation artery in the area at mid-century was the Bauchi Light Railway; this was taken out of service in 1957, but the main Zaria to Pambeguwa road which bisects the district was improved and hard surfaced in the early 1960s. This road, which in 1952 was a poorly maintained, tortuous, gravel track subject to seasonal flooding, now carries a high volume of traffic including heavy trucking, public transportation, and private vehicles.[2] Moreover, in 1975 the transistor radio, the bicycle, and the motorcycle provide even the most remote hamlet in the district with ready linkage to the outside world. Other comparable infrastructural and amenity developments, many of them designed to foster the development of human resources such as the construction of a public television viewing pavilion, the establishment of two secondary schools in Soba Village, and the expansion of the primary school network in the district, have occurred during this same period.

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[1] Hogendorn's study of the expansion of peanut production in northern Nigeria provides a good illustration in this regard. C. Eicher and C. Liedholm, eds., Growth and Development of the Nigerian Economy (East Lansing: Michigan State Univ. Press, 1970). The importance of the traditional smallholder in the expansion of agricultural production in the nation is discussed in Chapter Three of G.K. Helleiner, Peasant Agriculture, Government, and Economic Growth in Nigeria (Homewood, Ill.: Richard D. Irwin, Inc., 1966).

[2] R. Mansell Prothero, personal communication.

Doubtless, these forces of modernization, commercialization, and integration have not left the agricultural systems of the district untouched. Hence, additional questions must be considered in this study. Is it possible, for example, to attribute a certain portion of the variation in land use to factors associated with economic development rather than to the impact of increasing densities of population? How have these external modernizing forces acted to accelerate or to retard, to diffuse or to concentrate, changes in agricultural practices? A major objective of the present study will be to disentangle, in so far as it is possible, the effects of such exogenous factors from those produced by the expansion of the district's population.

Nor has the growth of population in Soba District occurred in the abstract. It has taken place in time and space, meaning that it had a starting point and, more important for present purposes, a setting. More attention will be devoted to the ecological aspects and resource base of the district in a later descriptive chapter; however, it is useful to be reminded in setting out the thesis problem that questions about the environment in which the interaction between people and land resources takes place must be considered as well. Moreover, any of the villages in the district that one selects for analysis of changes in population and agriculture exists at a site relative to evacuation routes, markets, and urban centers. The extent to which these fundamentally locational considerations have shaped change and adaptation to change must also be considered.



Kaduna State
Nigeria

MAP 1

ZARIA, NIGERIA.

Agrarian Change in Hausaland

It is useful to visualize the changes that agriculture in Soba District has undergone in recent decades in the context of processes that have been observed at work in Hausaland at large.[1] In doing so, the approach and the emphasis of the present study can be brought into sharper focus.

Investigators who have posed questions similar to those already raised here with regard to other areas of Hausaland have suggested that responses to population pressure on land resources have been threefold.[2] Population pressure, in this case, is meant to suggest a point at which population of an area has increased such that income levels can no longer be sustained or improved by merely increasing cultivated area. Hence, there

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[1]The term "Hausaland" refers to that region of West Africa inhabited by Hausa speaking peoples or in which Hausa is the dominant language spoken. Although it obviously encompasses a broad territory and includes substantial variation in microclimate and topography, it has been argued that there are a sufficient number of unifying elements and underlying uniformities which allow Hausaland to properly be considered a region. Among these are: (1) the widespread dominance of the Hausa language, (2) the dominance of the Moslem faith and influence of Islamic law, (3) the existence of a long established and fairly sophisticated political structure based on the emirate, and (4) common cultural practices such as settlement type. Hence, the region referred to here is primarily a linguistic and cultural formulation.

[2]The discussion at this point draws heavily on the work of A.D. Goddard, M. J. Mortimore and D. W. Norman, "Some Social and Economic Implications of Population Growth in Rural Hausaland." Population Growth and Socioeconomic Change in West Africa, ed. J. C. Caldwell (New York: Columbia University Press, 1976).

comes into being a heightened competition for existing land resources. As this occurs, observers have found that Hausa farmers can be expected to (1) intensify their methods of production, (2) develop alternative means of earning a living or devote more time to non-farm and off-season activities, and (3) migrate to unaffected areas. These three types of response are not necessarily a hierarchically ordered series since some combination of them frequently exists in all of the more populous areas. The last strategy, migration, is not necessarily a "last resort" strategy.

The first of these responses, the intensification of agriculture by traditional techniques, has proceeded a long way in certain areas of Hausaland; the most widely cited example is that of the Kano Close-settled zone. By intensification is meant simply the addition of non-land inputs per unit of land, and in the case of Hausaland this has been accomplished largely by an increase in labor and fertilizer inputs rather than capital improvements. The result is the creation of a distinctive zone of land use on which plots are cultivated regularly every farming season, little non-utilitarian vegetation is allowed to become established, and a regular fertilization program is maintained. In the case of a densely settled region like the Kano environs, such land use constitutes approximately 85 percent of the surface.

It is this intensification strategy and the distinctive type of land use it creates that will be the primary focus of this investigation. The other two types of response to a rising

population will be given secondary consideration. In the case of Soba District, which as we have seen stands at a midway point along the population density range in Hausaland, the highly developed off-farm occupation structure probably represents a response to slack season as much as to the elimination of opportunity in agriculture. Nor does it appear that migration has been significant as a response to population increase in the district since it is probably a net importer rather than exporter of people.

Hence we are left with the process of intensification of agricultural production by smallholders, who employ the traditional means at their disposal, as the fundamental path that agrarian change in Soba District is most likely to have followed. The task remains, then, to specify in much greater detail just how this has taken place and, even more importantly, why. If agrarian change in the district over the past twenty-five years can be demonstrated to have been largely in the direction of increasing intensity of land use, the original questions concerning how this process relates to the stimulus of population growth and other non-demographic factors and whether this process has proceeded differentially among villages in the district can be explored with reference to variations in land use.

Summary of Objectives and Value of Study

The task to be undertaken in this study, in sum, is twofold: First, the effort will be to establish that significant variation exists among village agricultural systems in the district

both diachronically and synchronically. Agricultural land use will be the chief, but not the sole, criterion for such differentiation. Secondly, the aim will be to answer the question, how much of this variation among village agricultural systems can be attributed to the increase of population in the district and how much appears to be the result of other factors? The approach to the first of these undertakings is primarily descriptive in character while that of the second is more analytical.

The value of such a procedure lies in four areas. In the first place, a contribution is made by providing a test of certain aspects of a theory of agricultural change which has recently excited the interest of scholars in a variety of fields. A general and descriptive model of agrarian change under the pressure of population growth has been formulated by Ester Boserup in The Conditions of Agricultural Growth.[1] This model along with several attempts at revising it are presented in the following chapter, and the specific application of the model in this study is explained there. As will be shown, the objective of this investigation will not be to verify or to disprove a very complex and multi-faceted model by reference to a single case study. Nor is the intention here to lift out and isolate one element of her thesis in order to subject it to rigorous examination. Rather,

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[1] E. Boserup, The Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure (London: George Allen and Unwin Ltd., 1965).

the approach here will be to respond to the question, to what extent does the model provide a satisfactory explanation for observed changes that have taken place in the last twenty-five years in Soba agriculture as well as for contemporary variation in land use among villages?

The thesis problem presented here has a dual ancestry, and the second, inter-related purpose of this study pertains to a theoretical controversy that has arisen in the region under discussion. It concerns the correct interpretation of Hausa land use. Several observers with long experience in Hausaland have suggested that land use systems in the region are best seen in relation to the population density of the area in which they are practiced, an interpretation that is in accord with the Boserup model. But other, conflicting interpretations have been offered, and these arguments will be discussed in greater detail in Chapter III. The subsequent analysis, then, will attempt to test which of these several positions appears to best account for changes in Soba District land use.

A third objective, linked to the controversy concerning interpretation of land use, pertains to the clarification of terminology applied to Hausa agriculture. The aim here is to arrive at some satisfactory definition of several important terms for the sake of comparability of research results.

Finally, this study represents an extensive exploration of, and reporting on, a specific area, an exercise in micro-

geographic method.[1] In addition to its utility for the testing of existing hypotheses and for cumulative generalization into new theory, such a case study has value in its own right, purely as a precise account of a small area of the earth's surface over a given period. The usefulness of such close observation and detailed description from field research is particularly great in the case of most regions of Africa where the data base is extremely poor and contains substantial gaps.[2]

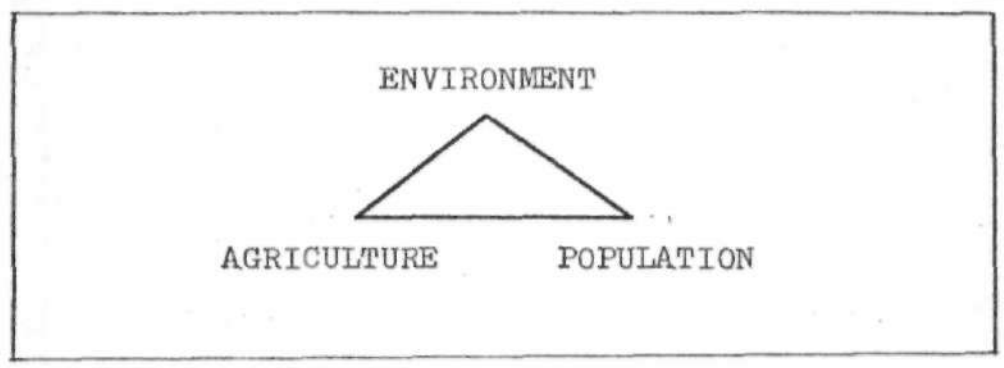
Operation at the village level provides the researcher with an extremely valuable information resource that is generally lost when a study is conducted at larger scales, namely, the wealth of data that can be tapped from local sources. A great deal of reliance is placed in this study upon linguistic distinctions, classifications, and traditional knowledge of Soba District farmers. It would appear that, at least in some cases, the mere translation of locally employed terminology provides insights into village agricultural systems and farming practices. In addition, investigation of the perceptions and behavior of individuals is most satisfactorily conducted at the micro-scale.

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[1] H.C. Brookfield presents the arguments in favor of such empirical, micro-geographic research in "Explaining or Understanding: the study of adaptation and change," Chapter 1 in The Pacific in Transition (New York: St. Martins Press, 1973).

[2] Some of the best examples of small scale case studies of traditional African agriculture, as well as of the rationale for engaging in this type of research, are contained in the series of monographs sponsored by O.R.S.T.O.M. (Musee de L'Homme, Sorbonne, Centre National de Recherche Geographique). The arguments in favor of detailed, in-depth studies of "terroirs" are well stated in these monographs by G. Sautter and R. Pelissier. Similar stress upon detailed local studies is found in Alfred Schwartz, "Un Terroir Forestier de l'Ouest Ivoirien: Ziombli Analyse Socio-economique," Etudes Rurales 37-39 (Jan.-Sept. 1970): 267.

that it is customary to take one or another of the vertices of the triangle as a starting point, to treat it as the independent variable in the discussion of agrarian change.



The way that the thesis problem was posed in Chapter I is by no means the only possibility for framing the question. An alternative, one which has frequently prevailed within the discipline of geography, for example, is to concentrate on the environmental aspects of the interconnections between these elements and to pose the question, how does a particular environment act to restrict or to permit population growth or change in agricultural practices?[1] The Malthusian perspective, as well as those of its successors in the form of many carrying capacity and land potential models, are frequently expressions of this sort. Another phrasing of the problem is to focus on changes in agri-

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[1]This statement entails the most blatant of oversimplifications and could well serve as the subject of a dissertation on the history of environmentalism in geography. Although the issues involved thread their way through this thesis, at least implicitly, it would be tangential to the objectives here to treat them at any length. Suffice it to say that the problem is a complex one and cannot be fully encompassed by a statement such as that above.

cultural techniques and to assess their impact upon an agrarian populace or, as has been the case more recently, upon the environment. One major theory of agricultural change, for example, emphasizes the autonomous nature of agricultural technology in relation to other variables. The third alternative, one which has been somewhat less prominent in the literature on agrarian change, is to treat population as the independent variable in the equation and to inquire as to its effects on agricultural practices and on the environment.

While it is not the intention here to extend this discussion at such a high level of generality--after all, it could be argued that the discovery of the exact nature of the relationships among these variables lies at the core of the entire geographical enterprise--it is useful to make these very broad distinctions by way of introduction to the problem at hand. The procedure of this study is to follow the third of these avenues of approach to the topic of agrarian change. This will be accomplished by first outlining the main features as well as some of the implications of a recent and noteworthy conceptualization of agrarian change, the Boserup model. Next this model will be applied to a specific region to test its explanatory power.

The Boserup Model[1]

A conceptualization of the processes at work in agrarian societies formulated by the Danish economist Ester Boserup has received widespread attention. Her conception of the relationship between population growth and agricultural development has excited the interest of scholars in a variety of fields not because it is entirely novel or singularly profound, but because it is an extremely coherent, insightful, and well-argued presentation of the third alternative noted above. Her principal thesis is that population growth should be treated as an autonomous or independent variable in any discussion of cultural and technological change in rural societies. The line of causation, in other words, is not from increased agricultural productivity to increased population as would be the case in the first two formulations above; rather, Boserup claims, the reverse is true. Gradual and sustained population growth, in so far as it results in pressure upon land resources, stimulates changes in agricultural practices which may in turn alter environmental capacities. Boserup develops this line of reasoning by extensive reference to

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[1]The term model is used here in its most loosely defined sense to signify nothing more than a conceptualization which implies a set of relationships among variables. Since she delineates her model primarily by reference to historical example, Boserup's scheme is essentially qualitative or historical-descriptive in nature. Nonetheless, the term Boserup Model will be employed in this dissertation as a shorthand label for her population-based theory of agricultural change. See Boserup, Conditions of Agricultural Growth.

the history of agriculture in the Western world as well as to examples from the contemporary underdeveloped world. Her objective, in sum, is to develop and substantiate a population-based and an evolutionary theory of agricultural history.

In doing so, Boserup specifically rejects three positions. She attacks, in the first place, what she terms the "static geographic theory of land use". Whether or not this is a fair designation for theories of land use advanced by geographers is not fully the issue here since her target lies in the "static" rather than the "geographic" element of this phrase.[1] Her intention is to discredit those theories of agricultural land use and land use classifications which are conceived in purely physical environmental terms. Boserup considers soil fertility, for example, less as a limiting factor or an initial condition for land use than as an internal variable within an agro-ecosystem, hence, equally subject to the dynamic conditions brought about by population change. She envisages the connection between "natural conditions" and agricultural systems, in other words, as a two-way interaction. Her emphasis then is upon the manner by which say, intensive methods of land utilization can alter the influence of environmental variables.

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[1] It appears that Boserup has in mind P. Gourou's formulation in The Tropical World that long fallow systems represent an adaptation to special conditions of soil and climate in the tropical zone. Yet, she also recognizes that other more dynamic geographical contributions exist and cites the geographical literature quite extensively. See for example the footnotes, Boserup, Conditions of Agricultural Growth, pp. 19-21.

Secondly, Boserup's argument is conceived as a challenge to fundamentalistic Malthusianism, as well as "Neo-Malthusianism". Population growth, for her, is not governed by an inelastic food supply. Indeed, in contrast to Malthus's original view, she asserts that food production is highly responsive to innovations stimulated by population pressure on land resources; hence, sustained and gradual population growth is frequently the cause of prosperity in agrarian societies rather than the reverse. This transposition of the Malthusian perspective also leads Boserup to the conclusion that the explanations for increases in the rate of population growth following the industrial revolution in the Western world which are stated in terms of increased agricultural productivity are not fully satisfactory. Regrettably, she does not choose to discuss the origins of such population increase at any length but prefers to concentrate on its effects.

Thirdly, Boserup's approach stands in opposition to the classical economic theory of land rent in which population increase is seen to govern expansion in agriculture along an intensive/extensive margin. She sees this viewpoint as an oversimplified and unsuitable conception of the variation in modes of intensification and possibilities for expansion of production, a misconception which resulted largely from an ethnocentric focus. One can more accurately elaborate a general theory of agricultural development, she claims, by reference to current examples of preindustrial agriculture and by comparing these to the history of agriculture in Europe than by confining one's inquiry to the special conditions of the European agricultural system at a

particular time.

It has already been suggested that the thrust of Boserup's thesis is not entirely new; she would probably not try to make that claim. In so far as her model is evolutionary and posits a successive series of stages of change in agriculture, it embodies a fairly common assumption in cultural history, namely, that the development of agriculture has been a largely regular process whereby initial extensive types of farming slowly become intensified. The assumption is that swidden agriculture is intrinsically easier to invent than more permanent types.[1] Moreover, the notion that a dynamic interaction exists among the major components of a man-environment system is one which has been increasingly substantiated by scholars since the turn of the century. Yet Boserup builds on these general assumptions by adding a number of quite specific contentions. It is appropriate at this point to turn to a discussion of five prominent themes that are threaded through her presentation in order to satisfy two objections: a somewhat more detailed explication of her schema and an introduction to several important themes that will be treated in the following study of Soba District. The format of the following section will be first, to describe in brief each of five elements in the Boserup model, next, to take note of significant objections or criticisms of each element and finally, to indicate how each theme will be explored in succeeding chapters.

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[1] B. Bronson, "Farm Labor and the Evolution of Food Production," in B. Spooner, ed., Population Growth (Cambridge: MIT Press, 1972), p. 206.

Five Major Themes in the Boserup Model

Land Use Classification

At the heart of Boserup's argument stands the first element, a fivefold classification of land use based on a frequency-of-cropping criterion. Figure 1 portrays her five divisions of land use; each class along the spectrum represents a decrease in the ratio of length of time cultivated to length of time under fallow of a given unit of land. Such a classification continuum represents an attempt, on the one hand, to avoid

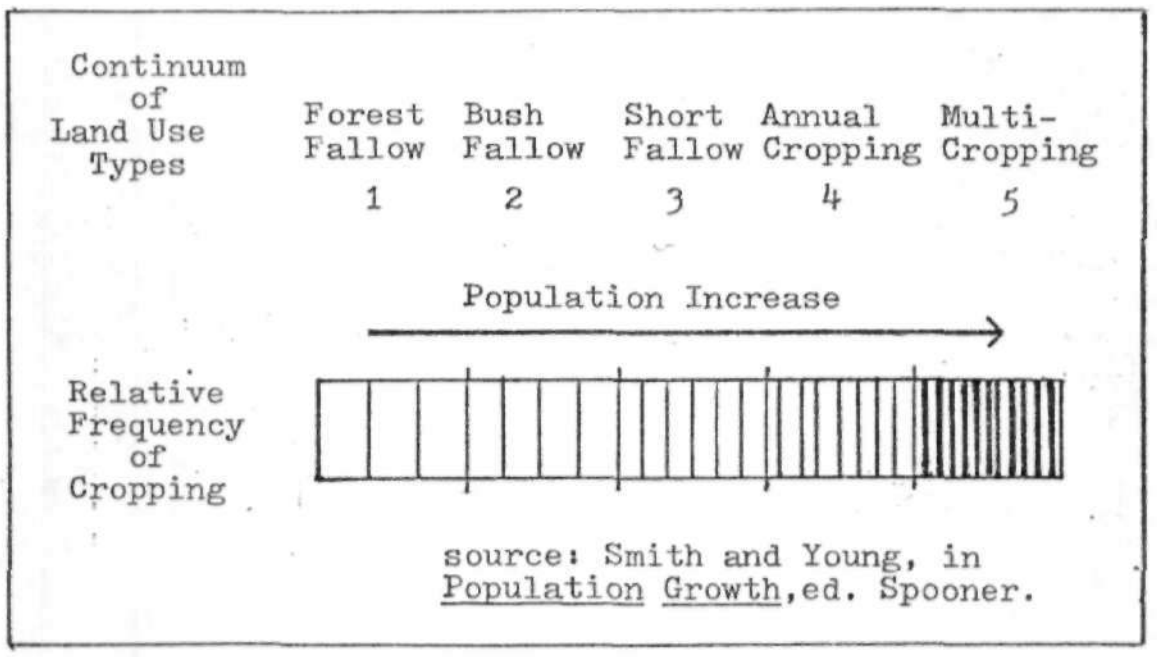


FIGURE 1 BOSERUP LAND USE CLASSIFICATION

the dualisms that have been a part of many discussions of agricultural land use, at least in economics, such as the distinction between cultivated and uncultivated land or that between intensive and extensive cultivation.

Furthermore, her intention is to introduce a time dimension

into calculations of "intensity" of land use. In order to emphasize the dynamic aspects of land utilization as well as to construct a scheme that is equally appropriate to non-Western societies, Boserup suggests that the addition of labor and capital inputs per unit of land are not the sole means of intensification. While a shortening of the interval between cultivation periods will usually result in an increase in the aggregate labor expenditure over any lengthy period, it does not necessarily constitute a substitution of other inputs for land. Nevertheless, it represents a form of intensification. Consequently, Boserup's version of the intensity equation would read as follows: intensity equals the non-land inputs per unit of land over time.

Boserup's typology of land use is not without precedent; nor is it as complex and comprehensive as others that have been formulated.[1] Moreover, Bronson has criticized her five-stage sequence as a purely synchronic taxonomy of cultivation systems; he observes that "the single criterion of cropping frequency not only makes some systems (for example tree farming) difficult to classify but also tends to give an overly simplistic picture of the enormous diversity of the world's farming methods."[2] To be fair it should be noted that Boserup recognized the necessarily

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[1] Compare Wolf (1966), Oberg (1965), and Watters (1960) for earlier or similar classifications as cited in P. Smith and T. C. Young, Jr., "The Evolution of Early Agriculture and Culture in Greater Mesopotamia: A Trial Model," Ibid., pp. 1-59.

[2] Bronson, "Farm Labor," p. 205.

arbitrary nature of her groupings and takes pains to point out that most agricultural systems are in fact hybrids, consisting of some combination of types along the classification continuum. Furthermore, she argues that, in practice, many traditional agricultural practices represent a "coexistence of land use systems" rather than a single "pure" type.

The adequacy of her single-standard land use classification scheme will not be fully discussed in succeeding chapters; yet the classification will be tested for its utility with reference to a specific region. Comparisons between it and alternative classifications that have been used in the study area will be made at the appropriate points. It can be said at the outset that, in general, the problems to be treated largely determine the suitability of any classification scheme. Since variation in the intensity with which land is farmed will be a central focus of the present study, a classification which accentuates such variation obviously has certain advantages.

Elastic Carrying Capacities

Boserup is convinced that there is considerable elasticity to the limits of the carrying capacity of any micro-environment. Her argument in support of this view is perhaps more sophisticated than but comparable to those of other observers who hold similarly optimistic views about the capacity of traditional agrarian systems to absorb additional inputs of labor, to undergo

intensification, and to increase their productivity.[1] Her position stands in distinct contrast to the notion that an upper limit is imposed upon the expansion of the capacities of simple agricultural systems either by environmental constraints or by rudimentary agricultural technologies.[2] Similarly, her viewpoint can be contrasted with many equilibrium models of land use that are in wide currency. More often than not, the carrying capacity concept embodies the notion of unchanging conditions: that is, a constant technology and static cropping patterns. In W. Allan's important and widely cited work, The African Husbandman, for example, the aim is to determine a critical population density that could be supported in a given region, but the calculations that he employs are based upon an existing system of long fallowing to maintain fertility.[3] His model makes little allowance for intensification of agricultural practices. Furthermore, the determination of some of the key factors in such models, such as optimum fallowing periods, is, as Street points out, an exceptionally difficult one to make with any degree of

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[1]Compare, C. Clark, Population Growth and Land Use (New York: St. Martin's Press, 1967).

[2]Jen-Hu Chang, "The Agricultural Potential of the Humid Tropics," Geographical Review 58 (1968).

[3]W. Allan, The African Husbandman (Edinburgh: Oliver and Boyd, 1965).

accuracy.[1] It would be a mistake, of course, to try to draw this distinction too far since Allan's purposes are clearly different from those of Boserup; his concern is with the environment and he seeks to ascertain those points at which environmental degradation can be expected to occur as a result of agricultural practices. Boserup, in contrast, stresses the adaptive and adjustment mechanisms which come into play at precisely the points of transition from low to high population density systems.

This notion of adaptive behavior, which is a corollary to the theme of elastic limits, has provoked considerable discussion among geographers in the recent past. Boserup's schema has held great appeal to human ecologists for precisely this reason.[2] In this study, the assumption of elastic limits to carrying capacity and the notion of adaptive mechanisms at work in village agro-ecosystems will be explored in the context of a specific region. One of its objectives, then, will be to examine in somewhat

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[1]The carrying capacity models of Conklin and Brookfield and Brown have been characterized as static. See H.C. Conklin, Hanunoo Agriculture (Rome: FAO, 1957) and H.C. Brookfield and P. Brown, Struggle for Land: Agriculture and Group Territories among the Chimbu of the New Guinea Highlands (Melbourne: Oxford University Press, 1963). A discussion of the problems involved can be found in J.M. Street, "An Evaluation of the Concept of Carrying Capacity," The Professional Geographer 21 (March 1969): pp.104-107. Another excellent presentation can be found in P.W. Porter, "The Concept of Environmental Potential as Exemplified by Tropical African Research," in Geography and a Crowding World, eds., W. Zelinsky; L.A. Kosinski; and R. Mansell Prothero (New York: Oxford University Press, 1970), pp. 187-217.

[2]Extensive references to the literature in geography on adaptive behavior are included in A.R. deSouza and P.W. Porter, The Under-Development and Modernization of the Third World (Washington: AAG Commission on College Geography, Resource Paper No. 28, 1974), pp. 73-75. For anthropological and archeological applications of the concept, see B. Spooner, Population Growth.

greater detail the manner in which population pressure on land resources operates to bring into being adaptive mechanisms in Soba District agricultural systems.

The Law of Least Effort

A third theme which forms an essential element in the Boserup thesis is the primacy of labor economy for the smallholder. At base, her model rests on the principle of "least effort" as a major determinant in agricultural land use decision-making. The fundamental motivation for the farmer is minimization of effort, and since each stage of agrarian change is less labor efficient than its predecessor, according to Boserup, a farming system naturally tends toward the most extensive possible. It would be intensified only under conditions of population pressure. Agrarian systems based on long fallowing and shifting cultivation, in other words, produce a higher crop yield per man-hour of labor expended than do those employing short-fallowing; similarly, the short fallow system would reward the farmer more for his efforts than would an intensive, annually cropped land use system. If considerations of labor economy govern his agricultural decision-making, then the traditional farmer is unlikely to intensify his use of land, which would be tantamount to reducing his labor efficiency, unless forced to do so by land shortage and declining yields. Hence, to borrow a felicitous phrase from deSouza and Porter, while "the engine which drives agricultural growth is population pressure, the fuel this engine

runs on is human labor."[1]

This essential component of the model has not gone without challenge; indeed, there are two aspects of this theme that have been contested. First, the claim that the law of least effort is the primary factor governing a farmer's land use planning has been assailed. Bronson, among others, has suggested that there are a range of factors--economic, political and cultural--that might influence a farmer's labor allocation and land use strategies. He goes on to observe that minimization of risk and other security imperatives may well be more important than minimization of work--assuming that the researcher even knows how non-Western farmer's perceive "effort"--in determining land use.[2]

An important task to be undertaken in the following chapters will be to ascertain, in so far as it is possible, what appear to be the dominant influences impinging upon the farmer's decision-making processes in the region under study. More specifically, does the concept of the primacy of labor economy satisfactorily explain the priorities of farming households, or would they be more suitably described by other categories such as security?

Secondly, the argument that extensive systems provide a higher output per unit of labor than do more intensive agricul-

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[1] deSouza and Porter, Underdevelopment and Modernization, p. 72.

[2] Bronson, "Farm Labor," pp. 200-203.

tural systems has been challenged. Again, Bronson has summed up the counter claims nicely. With reference to the scant quantitative information that is available--and it appears that his data must be handled somewhat cautiously to say the least--he finds that, contrary to Boserup's view, shifting cultivation is not always easier work than "permanent" farming.[1]

It is generally recognized that data on labor inputs to traditional agriculture are notoriously difficult to obtain with any degree of reliability and that the techniques for standardization into man-hours or their equivalent frequently mask as much information as they reveal. For this reason, no systematic attempt was made in the study to be described here to collect information on labor inputs. The question of the relative labor efficiency of extensive versus intensive land use is undoubtedly the key to a conclusive testing of this aspect of the Boserup model; however, this is not an issue that will be fully dealt with here. The observations about labor inputs which appear in the main body of this study are based on this researcher's qualitative judgments as well as a more comprehensive and long term study conducted by an economist in a neighboring region.[2]

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[1]Bronson, "Farm Labor," pp. 191-195.

[2]Data on labor inputs were obtained from D.W. Norman, An Economic Survey of Three Villages in Zaria Province: Input-Output Study (Zaria: Institute for Agricultural Research, Samaru Miscellaneous Paper 37, 1972), p. E 11.

Population Pressure as the Fundamental Stimulus to Change

A fourth element which underlies the Boserup model and which has been implicit in the presentation thus far deserves to be spelled out quite explicitly at this point since it is a major distinguishing feature of Boserup's conception of agrarian change, namely, the cause and effect relationship between population increase and agricultural intensification. Boserup is not merely making the somewhat commonplace assertion that more intensive agricultural systems can usually be found in more populous and densely settled regions. Although exceptions to this association have been reported, it constitutes a comparatively well established generalization that, at least at the global scale, appears to have remained valid. But Boserup posits a quite specific causal relationship between the two variables. Dense population is not only found in association with intensive systems; it actually causes them to come into being.

"Causation" obviously represents a different level of theorizing than does "association". This latter category, for example, allows a great deal of latitude for intervening elements to be masked by a more superficial and not necessarily causal relationship. Some of the attempts to refine the Boserup model have given considerable thought to the question of what factors might stimulate parallel processes which could be mis-interpreted as a causal relationship between population density and agricultural intensity.

An obvious objection to the Boserup model is that while she

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claims to have elaborated a cause-and-effect relationship, her appeal to historical example serves merely to demonstrate association between population density and the general intensity of agricultural land use. Furthermore, the endeavor to isolate a single cause as the primary determinant of a complex process has met with objection. Of course, the difficulties involved do not necessarily invalidate the epistemology, namely the attempt to determine which factor is most influential in stimulating agricultural advance and to see how far that factor can be used to explain the entire process.

In the present analysis, this epistemological problem has by no means been entirely resolved. Every effort is made here to exercise caution when dealing with the higher plane of explanation, namely "causation". As Bronson has observed, one way of proceeding in order to avoid the complicating cultural, economic, and political intervening variables is to examine a region in which both intensive and extensive systems can be found practiced by the same group. This is precisely the orientation of the present study. In order to minimize the opportunity for intervening variables to be hidden by a more obvious association between factors, a region in which a large number of factors can be held constant was selected for study.

Behavioral Aspects of Land Use

Finally, there is a distinctive behavioral aspect to the Boserup model that is related to notions of labor economy and will be treated at length in a subsequent chapter. Gradual and

sustained pressure of population on land resources not only stimulates innovation and intensification in agriculture, according to the model, it also teaches man the homely virtue of labor.[1] Although he may experience diminishing returns to his hours of agricultural labor as he is forced to intensify, the farmer gradually alters his work habits, becomes accustomed to working longer and possibly more regular hours in agriculture, and may well come to prefer his labor intensive system. It should be noted that there is an internal inconsistency in the model at this point: It is always presumed that the farmer is operating under the law of least effort and would readily return to the more extensive system should the opportunity present itself. Yet in this instance the intensive cultivator is portrayed as happily accustomed to his less labor efficient regime. Regardless of this minor inconsistency, however, the implication of the hypothesis of gradual adaptation to more difficult labor is that one could expect to find not only harder working farmers, but also farmers who have become accustomed to longer, more rigorous farm labor in densely settled, intensively cultivated regions.

There has been an increasing recognition among geographers of the importance of behavioral factors, such as a spatial actor's perception of his environment or his spatial preferences, as an influence on land use. In Blaikie's investigation of agri-

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[1] deSouza and Porter, Underdevelopment and Modernization, p.71.

culture in Indian villages, for example, he found that it was necessary to bring such factors into his purview in order to comprehend variation in land use at the household level.[1] The observation made by Harvey that "land use patterns are, after all..., the geographical expression of a large number of individual decisions made at different times for often very different reasons" is in evidence in much of the recent literature on the subject.[2] The call here is for an improvement in the classical economic models of agricultural location. Although her model similarly tends to emphasize the economic aspects of behavior, Boserup's insight is that there is a feedback relationship between necessary and preferred style of agricultural labor. This suggestion will be examined in subsequent chapters of this study along with the more general notion that the relationships among land shortage, agricultural practices, and the farmer's spatial preferences are reflected in his land use decision-making.

Implications of the Boserup Model

To the extent that she is correct in identifying population growth as the prime determinant of change in agrarian systems, Boserup's thesis results in a number of significant implications. Several of these bear mentioning at this point and should be

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[1] P. M. Blaikie, "Spatial Organization of Agriculture in Some North Indian Villages," Trans. Institute of British Geographers, 52-53 (March 1971, July 1971).

[2] D. W. Harvey, "Theoretical Concepts and The Analysis of Agricultural Land-Use Patterns in Geography," Annals of The Association of American Geographers (1966): 361-374.

borne in mind as the discussion proceeds.

Since her model is basically evolutionary in nature, it posits a series of successive stages, each with a distinctive set of attributes, through which an agricultural system can be expected to pass. These stages are illustrated in Figure 2, A Generalized Model of Agricultural Change. The suggestion arises that this successionary path is one which may well be telescoped but which cannot be circumvented; hence, this is not only an expected sequence of change but also a mandatory one. Therefore, Boserup would explain the fact that many intensive or sophisticated agricultural practices have not taken hold in underdeveloped areas, despite all the efforts of agricultural extension workers to foster their utilization, by noting that the rationale for more intensive techniques has simply not yet come into being in more sparsely populated regions. Consequently, a more fruitful strategy for agricultural planners in such regions would be to foster advance from one stage to the next rather than trying to circumvent the entire process of evolution by premature introduction of intensive practices.

A second and highly controversial implication of this model is that population growth is, in many cases, a good thing; it can be used to stimulate needed increases in agricultural productivity. On the surface, such a contention goes against the grain of all current notions of desirable population policy, yet Boserup would probably stress the need to be selective in applying a pro-natal approach. Boserup suggests that stagnant

SYSTEM ATTRIBUTES	Stage I (Low Densities)	Stage II (Mid Densities)	Stage III (High Densities)
1. Frequency of cropping	Rotational Bush Fallowing	Short Fallowing; some annual cult.	Annual cultivation dominant
2. Ratio: cultivated to uncultivated land	Cult./uncult. < 1	Cult./uncult. ≈ 1	Cult./uncult. > 1
3. Spatial Structure	Random Dispersed Plots	Zonation Pattern	Zonation breaks down
4. Use of Soils	Ecological Balance	Soil Mining: Exploitative	Conservative: Soil Improving
5. Land Tenure	Communal	Mixed: introduction of sales	Individualized
6. Holding Size and Structure	Large Holdings Size = f Choice	Increasing Fragmentation	Small holdings: Consolidation Size = f Wealth
7. Labor	Output per Man-hour = High	Output per Man-hour = Medium	Output per Man-hour = Low
8. Production Function	Labor = Limiting factor	Land = Limiting factor	Capital = Limiting factor

A GENERALIZED MODEL OF AGRICULTURAL CHANGE:
"DYNAMIC" THEORY OF AGRARIAN LAND USE

compiled from:
Boserup, Conditions of Agricultural Growth and
Gleave and White,
"Population and Agriculture".

Figure 2

rural economies can result in regions of sparse population density, referring to this phenomenon as the "vicious cycle of sparse population and primitive techniques". Strong opposition to this implication of Boserup's model has been voiced: the opposing contention has been that developing rural regions need not more people, but more of the other factors of production. Van de Valle agrees that top priority must be given to improving productivity in agriculture without increasing its burden. He views this implication of Boserup's model as its basic flaw, arguing that "population pressure and increase of densities seem a big price to pay for the intensification of agriculture if no other advantages result on the side of incomes and the level of living."[1] Boserup, of course, would probably be highly region-specific in her recommendations for population planning and would not necessarily advocate a blanket curbing of population growth as in every case the foremost priority for rural development.

Another interesting feature of her model is that it elucidates a two-way process, one which can be reversed. If population growth stimulates intensification, then population decline promotes extensification. "In cases where population density was reduced by wars or other catastrophes," Boserup notes, "there often seems to have been a relapse into more extensive systems of cultivation." A number of writers have des-

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[1] E. Van de Valle, "Implications of Increases in Rural Density," in Population Growth and Economic Development in Africa, eds., S.H. Ominde and C.N. Ejiogu (London: Heineman, 1972), p. 121.

cribed this reverse process, and at least one recent observer has taken note of this implication of the model and attempted to test it with respect to a specific region.[1]

Finally, it could be noted that Boserup's model implies that, in general, necessity is the mother of invention within pre-industrial societies. Serious shortages of resources are the dominant element in stimulating intensification of agriculture; hence, agricultural development is a way of coping with stress. Cowgill takes exception to this view labelling it the "strictly from hunger" view of developmental processes.[2] He argues that, in fact, populations undergoing stress are the least likely to innovate or to change accepted practices. Only in situations of surplus, presumably, are groups willing to experiment with new techniques. To be fair to Boserup, however, it should be recalled that she does not argue that land shortages or population stress give rise to agricultural innovations. Rather, they produce on the part of the populace a willingness to engage in less

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[1]This alternative is discussed in Boserup, Conditions of Agricultural Growth, p. 62. Geertz's work describing agricultural involution makes a similar point. C. Geertz, Agricultural Involution: The Process of Ecological Change in Indonesia (Berkeley: Univ. of California Press, 1963). Netting's study of the Kyofar people in Nigeria gives an account of this extensification process. R. McC. Netting, Hill Farmers of Nigeria: Cultural Ecology of the Kyofar of the Jos Plateau (Seattle: Univ. of Washington Press, 1968). Brookfield explores this possibility in New Guinea in H.C. Brookfield, "Intensification and Disintensification in Pacific Agriculture: a theoretical approach," Pacific Viewpoint 13 (May 1972).

[2]G.L. Cowgill, "On Causes and Consequences of Ancient and Modern Population Changes," The American Anthropologist 77 (Sept. 1975), pp. 505-525.

labor rewarding practices.

Parallel Versions and Revisions of Boserup Model

Boserup's line of reasoning has been paralleled by comparable, if less comprehensive, contributions from other sources. It is useful to consider several of these briefly as a part of this introductory, theoretical discussion since they provide alternative emphases which will be examined in the succeeding analysis.

Evolutionary Models

Firstly, there are general stage theories of agricultural change which are similar to the stance of Boserup in that they envision an evolutionary process of agricultural intensification. Illustrative of this general category is the contribution of J. Hutchinson; he suggests that there are three stages of agricultural advance each of which is related to the agriculturalist's treatment of his environment. During the first phase, exploitative agriculture, the farmer largely mines his land resource base. In the second, improving phase, systematic conservation of soil fertility is undertaken, and in the final industrialized agriculture phase, high agricultural productivity results from mechanization and use of commercial fertilizers. Jacks delineates a comparable evolutionary schema but adds a stage of ecological balance in agriculture which precedes Hutchinson's

first exploitative stage.[1] The significant aspect of these general stage models, for present purposes, is that like the Boserup model they are both successionary and cumulative. Each stage presumes the existence of a prior one, and each involves a characteristic form of land utilization and agricultural practices. Unlike the Boserup model, these theories are conceived primarily in environmental terms and they do not delineate so explicitly a causal relationship between population growth and advance from one stage to the next. Consideration of these models is useful in the present context, then, for their added ecological dimension, a factor that receives scant attention from Boserup.

The Gleave and White Model

An argument which very closely parallels that of Boserup, but which contains a number of significant variations, is that developed by M. B. Gleave and H. P. White.[2] They begin their analysis with a question similar to that of Boserup, namely, how do agricultural systems adjust to changing conditions of population? Their theory of the relationship between population density and agrarian systems is designed with specific reference to West Africa. Their model similarly stresses the impact of popu-

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[1] J. Hutchinson, "Land and Human Populations," Advancement of Science (Sept. 1966); G.V. Jacks, "The Influence of Man on Soil Fertility," Advancement of Science (1956).

[2] M.B. Gleave and H.P. White, "Population Density and Agricultural Systems in West Africa," in Environment and Land Use in Africa, eds. M.F. Thomas and O.W. Whittington (London: Methuen & Co. Ltd., 1969), pp. 273-300.

lation increase upon agricultural practices and includes a comparable classification of land use. Yet there are important differences, and these seem to be primarily related to Gleave and White's attempt to employ population density as an explanatory variable synchronically rather than diachronically as did Boserup.

Firstly, these authors make the observation that, at least in the West African context, the expansion of cash cropping produces "...consequences that are so similar to those of population growth that the two are inseparable as causative factors." For them, the stages of modification of traditional agricultural systems which result from the introduction of cash cropping replicate those stimulated by population pressure in terms of intensification of land use and a hastening of the development of "permanent" agriculture with no fallows. They point out that there is an obvious mutual interaction between the two factors, population growth and commercialization of agriculture, which complicates the problem of deciphering their effects. Whether or not it is possible to extricate the influences of an increasing density of population on the village level agro-ecosystem from those of the more general processes of integration into the national economy and commercialization of agricultural production is an issue which will be given attention in this study.

These writers take note of an additional factor which is linked to the process of modernization, namely, the accessibility of and linkages to a region. They suggest that increased accessibility also acts on agricultural systems in a manner similar to population growth. Obviously the inter-relationships among

increased accessibility, increased population, and accelerated intensification of agriculture become a complicating issue for the determination of the impact of population growth upon village agricultural systems.

Another feature of this presentation is an alternative that receives little attention from Boserup. There exists the possibility, say Gleave and White, of maladaptive behavior on the part of farmers. In response to population pressure, farmers might not adopt more intensive techniques; rather they might adjust traditional standards downwards such as using less demanding crop varieties or by outright depletion of soil resources to the point of calamitous shortfalls. While the primary aim of the present study is to explore successful adaptations to population increase, this alternative--that not all forms of agrarian change stimulated by population pressure represent satisfactory adaptation to stress--will also be considered. However, the final determination of answers to questions of environmental deterioration lead one to consider a time scale that is well beyond the scope of the present study.

The final point to be made in this section is that Gleave and White observe that the relationship between population growth and intensification is not in every case direct and linear. They suggest that factors found in the rural West African context such as part-time non-agricultural occupations, hired labor in agriculture, and seasonal migration of farmers all act as intervening variables to distort the relationship. The effect of such variables is not to obviate the fundamental relationship that they

and Boserup wish to substantiate; rather, the suggestion is that they modify the relationship, making it both more indirect and more complex. In the more specific consideration of Soba District to follow, it will be shown that such complicating factors are indeed present, and it will be necessary to establish their role with some precision in order to satisfactorily test the basic Boserup model.

The Brookfield Model

H. C. Brookfield has devoted considerable attention to the adaptive capacities of agricultural systems in the island Pacific and, taking his cue from Boserup, has attempted to devise a more general theory of agricultural intensification.[1] Like Gleave and White, he takes note of the cul-de-sac maladaptive alternative as one response to population growth that Boserup ignores. He also gives some consideration to the process of "disintensification", the process mentioned above whereby the reverse flow of the Boserup model takes place when population pressure is relieved. But his primary objective is to elaborate and refine the demographic model, and he makes several points in doing so.

First, Brookfield notes that at the points of transition, when an agrarian system is undergoing change from one stage to the next, structural resistance will be encountered and a lag in technological shift can be expected. While this principle is in many ways comparable to Boserup's observation that a number of

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[1] Brookfield, "Intensification in Pacific Agriculture".

types of land use systems will typically be found to co-exist in the same region, or to Gleave and White's suggestion that West African agricultural systems are in fact hybrids, Brookfield's intent, it seems, is to account for instances where little correlation can be found between agricultural intensity and population density. This he would presumably explain as a result of a lag in adaptation.

Porter, among others, similarly takes note of this frequent lag in adaptation to higher densities of population and raises the question: At what point does gradual and sustained population growth become excessive or traumatic? In circumstances of rapid population increase, is it possible for gradually harder working farmers to always keep abreast of food requirements? He argues that the less desirable alternative--that population may outrun the capacity of traditional agriculturalists to sustain themselves with little chance of ever catching up--should not be overlooked.[1]

Secondly, Brookfield tries to broaden the definition of what constitutes population pressure. Boserup's model relies on accepted definitions of population pressure as the circumstance whereby demand for food outruns the capacity of a system to produce it. To this definition Brookfield adds the need for social production. The stimulus for intensification comes not just from pressure on land resources but upon total resources. It comes not just from immediate subsistence needs of a populace

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[1]Porter, "Environmental Potential," p. 201.

but from "total" needs. Brookfield substitutes the pressure of needs for the pressure of population.

While Brookfield refers primarily to the farmer's needs for production to meet social obligations, another aspect of needs deserves attention. In the context of rising standards of living and commercialization of village agriculture, consumer goods such as watches, radios, or motorbikes are increasingly viewed as needs by smallholders and might similarly be subsumed under the rubric of population pressure, albeit more indirect.

There are obviously problems with expanding the concept of population pressure to encompass all pressures perceived by the village smallholder. Cowgill opposes Boserup, for example, on precisely this point.[1] He claims that she never satisfactorily distinguishes between deprivational stress and demand as stimuli to agricultural intensification. The former of these, stress, is related to localized population growth while demand is an economic variable related to accessibility and urban growth. In the following chapters Cowgill's argument will be taken up at several key points since it represents an important objection to the basic Boserup model of agrarian change.

Brookfield is not entirely pleased with Boserup's denial of environmental constraints to innovation and adoption of intensive practices. He deals with this inadequacy by suggesting that environmental considerations can be seen as constraints which affect threshold levels of intensity below which no

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[1]Cowgill, "Ancient and Modern Population Change," pp. 506-507.

continued cultivation is possible. Local ecological conditions operate to govern the rate at which an increasing population must pass upward in the hierarchy of successively more intensive land use systems.[1]

Brookfield's view by no means constitutes a return to the view that environmental considerations supercede demographic factors in their influence upon land use systems. Yet his is an important caveat which must be given consideration in the more detailed examination of Boserup's environment-free model which follows. Indeed, his notion of the existence of thresholds proves to be most useful and will be explored in the main body of this study.

Several geographers who have done research in Africa have called attention to this non-environmental aspect of Boserup's model as its most serious shortcoming.[2] They regard Boserup as altogether too optimistic in view of serious environmental constraints found in many regions of the underdeveloped world. There exist certain environments, for example, which will simply not support intensive farming beyond forest fallowing. In their view, this environment-free model fails to take account of the possibility of "rural involution", the maladaptive alternative

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[1]Brookfield, "Intensification in Pacific Agriculture",p.43.

[2]L. Berry and R.W. Kates, "Views on Environmental Problems in East Africa," The African Review 2 (1972): p. 307; Porter, "Environmental Potential," p. 201.

discussed above.

The Use of the Boserup Model and Its Revisions in this Study

One aim of this study is to test the interpretive potential and explanatory power of the Boserup model as applied in a specific manner to a specific region. Having outlined some prominent features of the model, it is appropriate to conclude this introductory chapter by delimiting more specifically just how the model is to be employed here.

Boserup's objective in developing her theory of agrarian change is a rather broad one; it was noted at the outset that she has attempted to construct a model which can be used to explain "the actual historical course of agriculture, including the development of patterns and techniques of cultivation as well as social structures of agrarian communities."[1] She operates, in other words, at the historical and at the global scale.

The scale of the present study, obviously, is much more limited. Here questions about the validity of Boserup's historical interpretation are not at issue; such problems are not fully germane to this study. Nor will the adequacy of her model to comprehend world-wide variation in agricultural systems be treated. Rather, the questions posed here are twofold: How adequate is her model to explain variation in agricultural land

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[1] Boserup, Conditions of Agricultural Growth, p. 12.

use over a comparatively short and recent time span? The time period under consideration here is only a twenty-five year interval, from 1950 to 1975, and involves the recent rather than the historical past. Secondly, how adequate is her model to explain variation over a comparatively small space? The region under study consists of an administrative district of about 800 square miles, and the units of investigation are villages and farming households within that district.

This consideration of the Boserup model and its successors will proceed in two steps: Following two additional introductory chapters, which will serve to introduce the reader to the study area as well as to another dimension of the thesis problem, the effort will be to establish that variation in land use does exist in the region under investigation both over time and over space along a population density gradient. The attempt here will be to establish an association between intensity of agricultural land use and density of population. In addition, it will be appropriate in these sections to flesh out the skeleton of the previous general presentation of the Boserup model by discussing other attributes of agrarian systems found in association at certain stages of growth. In the second step, the problem will be one of determining to what extent population growth operating via the vector of pressure on land resources and diminishing returns to labor as in the model, can be established as the stimulus for advance from one stage to the next. At this point, further consideration will be given to some of the parallel processes already mentioned which have been found by

some to affect agricultural land use in a manner similar to that of increasing population.

One final point pertaining to the use of Boserup's model can be made. As was explained above, Boserup never claims that her five categories of land use are necessarily found in "pure" forms in the actual agricultural practice of traditional villages. Rather, mixes of several types will be observed. Certainly such heterogeneity of land use is the case in the region under study here.

Building on this observation, then, it seems a fair assumption to make that proportions of land devoted to varying types of land use in any village can serve as an indicator of agricultural intensification for that village. A village with a large extent of annually cultivated land, for example, can be distinguished from one with largely bush fallowed farmland. According to the Boserup scheme, the former village's land use system reflects increased population pressures resulting from a growing population. In the following analysis, where none of the villages under study exhibits a single, "pure" type of land use, the proportions of land which fall into the various categories will serve as an important demarcator of differences in village agricultural systems.

CHAPTER III

LAND USE IN HAUSALAND: CONFLICTING INTERPRETATIONS AND CLASSIFICATIONS

The traditional agricultural systems and rural economies of Hausa villages in the northern states of Nigeria have been the subject of numerous investigations in recent decades. Consequently, references to Hausa agriculture and land use are quite common in the literature on African agriculture. The systems of land use and intensive practices found there have frequently been cited as the basis for the support of unusually high population agglomerations, and the view has been expressed that at least in some sub-regions of Hausaland these traditional systems represent an example of successful adaptation to the stress of population pressure on land resources which has not produced any appreciable degree of environmental deterioration. Reference is usually made to areas such as the Kano close-settled zone where land rotation has largely been replaced by annual cultivation based on more intensive techniques.

Several special features of Hausa land use systems are usually mentioned in this regard. Manuring is customarily noted as the means by which soils on regularly cultivated lands are kept in good heart, yield declines prevented, and "permanent"

agriculture supported.[1] Moreover, there is in wide currency a conception of a Hausa-Fulani symbiotic relationship by which settled Hausa farmers benefit from the droppings of the animals of semi-nomadic pastoralists. Most accounts of Hausa land use also take note of the system of rotational fallowing of non-fertilized land, and the extent of this is regarded by many as a function of population pressure. In addition to increasing the frequency with which land is cropped, and the consequent need to engage in fertilization, other intensive measures such as multiple-cropping during a single agricultural season or inter-cropping of a variety of plants in a single field are commonly practiced. While these intensive features are frequently cited as characteristic of Hausa land use, they are not to be regarded as unique to that case. The Wolof, the Serer, and the Songhay all have comparable attributes in their agricultural systems in West Africa, and there are examples of similar intensive techniques elsewhere on the continent. Conversely, the case is rarely made that the entirety of Hausaland exemplifies all of these conditions.

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[1] Although it is in wide usage, the term permanent agriculture is problematic in the Hausaland context. Permanent cultivation has been defined as "cultivation without fallow." W.B. Morgan and J.C. Pugh, West Africa (London: Methuen and Co., 1969): p.116. Benneh similarly utilizes it as an initial subdivision in his classification of agricultural systems in Africa. G. Benneh, "Systems of Agriculture in Tropical Africa," Economic Geography 48 (July 1972): p.245. The question remains, however, as to whether one means permanent over time--fields are kept in cultivation on a continuous basis--or permanent over space--the same plots are farmed repeatedly but not necessarily continuously throughout the year. Because of the confusion that exists, the term annually cultivated land seems preferable as well as more precise in terms of actual agricultural practices in Hausaland.

An inter-related aspect of land use which has been discussed in the literature on Hausaland is the notion of zonation. An example from a study carried out in Soba District has been widely cited in the geographic literature on land use.[1] In it, the case is made that variations in the ratio of intensively to extensively cultivated land have a distinctive patterning impact on the landscape forming concentric rings, or land use zones around villages. A fuller presentation of this aspect of land use is included in a subsequent section, but it could be noted at this point that correlations have been suggested between the degree of zonation and the density of population.[2]

The question as to just what forces have contributed to the patterning of land use in the region has been addressed in many of these studies, but there is not complete agreement about the answer. Several reasons why more intensively cultivated land may be found in some sub-regions than in others have been offered; a number of theories concerning the processes governing intensification have been suggested. Although one particular viewpoint

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[1] R. Mansell Prothero, "Land Use at Soba, Zaria Province, Northern Nigeria," Economic Geography 33 (1957): pp. 72-86. Among the numerous places this study is cited are: Morgan and Pugh, West Africa, p.124; H.P. White and M.B. Gleave, An Economic Geography of West Africa (London: G.Bell and Sons Ltd., 1971): pp. 83-84; M. Chisholm, Rural Settlement and Land Use (N.Y.: John Wiley and Sons, Inc., 1962): pp. 67-68; W.B. Morgan, "The Zoning of Land Use around Rural Settlements in Tropical Africa," in Environment and Land Use in Africa, eds. M.F. Thomas and G.W. Whittington (London: Methuen and Co. Ltd., 1969): pp. 303-305.

[2] A.T. Grove, "Population Densities and Agriculture in Northern Nigeria," Chapter 9 in Essays on African Population, eds. K.M. Barbour and R.M. Prothero (London: Routledge and Kegan Paul, 1961): pp. 115-136.

has gained wide acceptance, this view has not gone without challenge. This controversy concerning the proper interpretation of land use in Hausaland and the factors that have given impetus to intensification of traditional techniques forms the second half of the problem under consideration in this study. Hence, a more detailed discussion of the conflicting viewpoints, along with some of their implications, is appropriate here.

Interpretations of Hausa Land Use

The Demographic Interpretation

The orthodox opinion concerning Hausa land use views the intensity of use primarily as a function of population density. There is a basic accord between this view and the Boserup model, although writers who have made specific reference to Boserup's work have placed important caveats on their subscription to her theory. These reservations will be discussed below in connection with brief reports on each researcher's work. In general, this viewpoint stresses the fact that more intensive techniques are customarily found in the vicinities of larger towns or where rural densities of population exceed some critical level. There is an obvious association, they claim, between the two variables, *intensity of land use and density of population.*

This broad correlation between population density and intensity of cultivation in Hausaland was espoused quite early on by a group of British geographers several of whom worked in Nigeria. This group included K. M. Barbour, R. M. Prothero, and W. B. Morgan among others, and their viewpoint forms the central

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point of an essay by A. T. Grove on the subject. His argument is summed up by the statement, "greater numbers of people both require and allow farming to be more intensive." In this essay, Grove sought to demonstrate that changes in farming and fallowing practices result from a growing population, and he supports this view with references to studies from four areas of Hausaland: Fune-Damaturu in Bornu, Bindawa near Katsina, Soba-Anchau in Zaria Province, and Kano.[1]

Taking note of the highly uneven distribution of population in Hausaland, Buchanan and Pugh make a distinction between "medium density farming" and "low density farming". According to them,

> Continuous cultivation, based upon simple crop rotations and the use of manure on permanent and well-defined holdings is developed chiefly in the vicinity of the bigger towns of the Sudan zone, where the light, easy-working soils lend themselves to intensive cultivation, and where the absence of the tsetse fly makes possible the keeping of larger types of stock. Cultivation of this type, often with subsidiary irrigated cultivation along streams, is found around Sokoto, Zaria, Katsina, and Maiduguri and attains its highest degree of development in the Kano close-farmed zone.[2]

For the sake of later analysis, it is important to bear in mind that these observers link what they term "continuous cultivation" not only with large settlements, but also with the factors of

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[1]Grove, "Population Densities and Agriculture," pp. 118-134.

[2]K. M. Buchanan and J. C. Pugh, Land and People in Nigeria (London: University of London Press, 1955), pp. 111-112.

amenable soils and the absence of the tsetse fly hazard.

The most comprehensive and well-argued case for the formative impact of population growth upon agricultural land use in Hausaland has been made by a group of scholars who have been associated with Ahmadu Bello University in Zaria. M.J. Mortimore, whose work has focused on a number of villages in the densely settled zone near Kano, found that the pattern of land use there reflected the pressure of population in the virtual disappearance of fallow and the devotion of 85 percent of the farmland to annual cultivation. By comparing indicators of land use intensity from central villages with those from outlying villages in this zone, he concludes that, "there is much in Kano to support the idea of population density as a primary determinant of rural economic systems..."[1] While the features of rural economy which allow such high population densities are not necessarily unknown in other rural communities in northern Nigeria, "the stimulus of a growing population is required to bring them into use."[2]

Although Mortimore specifically mentions the basic

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[1] M.J. Mortimore, "Population Densities and Systems of Agricultural Land-Use in Northern Nigeria," The Nigerian Geographical Journal 14 (June 1971), p. 7. See also M.J. Mortimore, "Land and Population Pressure in the Kano Close-Settled Zone," Advancement of Science 23 (April 1967), pp. 677-686.

[2] M.J. Mortimore, "Population Densities and Rural Economies in Nigeria," in Geography and a Crowding World, eds. W. Zelinsky, L.A. Kosinski, and R.M. Prothero (London: Oxford University Press, 1970), p. 387.

A prime criterion employed in the selection of villages for investigation in his work was density of population, and Norman showed that there are significant correlations between this variable and others such as size of farm holding, family labor utilization in terms of man-hour input per cultivated acre, as well as the percentage of fallow land held by farming families. He suggests that the factor of population acts in the following manner:

> As population density increases land becomes more limiting in relation to labour... The main influence of an increase in population density is a decrease in the average size and relative variation in the size of holding... The increase in population logically accounts for the decrease in the size of holding. At the same time there is increasing pressure on those families with land under fallow to temporarily transfer the usufructuary rights to other families with land shortages. In other words, the opportunity cost of leaving land fallow becomes too great.[1]

Yet it is not only the size of holding and amount of land held in fallow that Norman found to be related to population density; the intensity with which land is farmed in these three villages, primarily in terms of the application of organic fertilizers, bore a strong relationship to density of population as well. A similar relationship was found to exist with total man-hours expended on village farms.

Norman admits that in the analysis of his data it was sometimes difficult to differentiate those differences attribu-

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[1] Goddard, Mortimore, and Norman, "Population Growth in Rural Hausaland," pp. 9-10.

table to the location and accessibility of a village from those due to its density of population. In his research area, the villages under study increased in density with ease of access to an urban center, and he observes that this is by no means an atypical situation. He attempts to overcome the problem of distinguishing the effects of accessibility from those of population growth by assuming that in most cases the two variables are positively and highly correlated anyway. Yet his problems in this regard point to a very critical dilemma in any attempt to test for the impact of population growth upon agriculture, especially if one has a recent time period under review. In recent decades in the northern states, it has been the case, as Norman suggests, that the opening and improving of transportation routes, the provision of services such as agricultural extension, and the opening of commodity buying stations has tended to occur, naturally enough, in the more densely settled regions. The problem presented by these interacting factors is by no means an easy one to settle.

A.D. Goddard carried out similar investigations in the central Sokoto close-settled zone and has also highlighted the impact of population on land usage. He found that the location of the study villages in an area of relatively high density contributed to several important features of the farming system: (1) over 80 percent of the accessible upland was cultivated annually; most of the remainder was unsuitable for cultivation; (2) bush or long fallowing rarely occurs; (3) "under the influence of increasing demand land has become a transfer-

able economic commodity and the tenurial rights held by the farmers approach those of freeholders in practice if not in law;" (4) farmers spend proportionately greater time in off-farm occupations; (5) farmers frequently resort to out-migration, while temporary migration in search of employment occurs with great regularity.[1]

With respect to the Sokoto close-settled region, it would appear that the most noteworthy impact of population increase has been to spur the two alternative avenues of response discussed in Chapter I of this thesis, namely the growth of alternative occupations and rise in out-migration. Although Goddard's report does not include data on labor and fertilizer inputs to agriculture, he leaves the suggestion that increased intensity of land use has been and will continue to be one way of providing for an increase in population. Nevertheless, the point is made in this connection that "cash crop farming, particularly of groundnuts and cotton, never developed in this densely populated zone which was only marginally suited climatically and edaphically to the new crops."[2] This investigation of Sokoto,

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[1] A.D. Goddard, J.C.Fine and D.W. Norman, A Socio-Economic Study of Three Villages in the Sokoto Close-Settled Zone, Vol. 1, Land and People (Zaria: Samaru Miscellaneous Paper no. 33, 1971), p. 39.

[2] F.A.O. report on Soil and Water Resources Survey of the Sokoto Valley, Nigeria, quoted in Goddard, Mortimore, and Norman, "Population Growth in Rural Hausaland," p. 15.

then, underscores two extremely significant points: first, intensification, while it has been a prominent and widespread response to population growth in Hausaland, is not the sole mechanism of adaptation and change. Second, it is very difficult to eliminate entirely the environmental component in any consideration of the process of agrarian change in this region.

One final example of this demographic line of reasoning deserves mention, although it does not, strictly speaking, pertain to Hausaland. R.M. Netting carried out a study of the Kofyar people who reside on the southern escarpment of the Jos plateau in Benue-Plateau State.[1] He suggests that the complex, conservational, intensive system of agriculture employed by these people developed as a response to the extreme shortage of land available in the face of a growing population. The readiness with which these farmers adopted more extensive techniques of production after migrating to downhill, sparsely settled areas suggests that when population pressure is alleviated a return to less labor-intensive practices can be expected to occur. Obviously, this example fits well within the Boserup thesis and other similar cases of extensification are cited by her.[2]

An important point which is relevant to the present inquiry can be made regarding this orthodox interpretation of Hausa land use. As has been alluded to above, this view is

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[1]Obviously this example can not be used to substantiate the case for the demographic interpretation of Hausa land use. It is cited here simply because it pertains to northern Nigeria and because it accords with the interpretation under review. Netting, Hill Farmers.

[2]Boserup, Conditions of Agricultural Growth, p. 63.

generally consistent with the Boserup model of agrarian change, at least in terms of outcomes if not in terms of specific causal factors. These investigators, with certain reservations, view population growth as a stimulus to agricultural intensification in Hausaland just as Boserup has suggested. Of course, they do not necessarily provide comprehensive evidence to support Boserup's notion of the primacy of labor economy in the intensification process.

But an important divergence from the Boserup model is apparent in these studies. It concerns the possibility of failure to achieve successful transitions from one stage to the next in agricultural development. From the earliest reports on rural Hausaland up to these more recent inquiries, those who have held to the demographic viewpoint have usually taken note of the critical transition points at those times at which a farming system is stimulated to progress from one stage to the next -- from dominantly bush fallowing to short fallowing or annual cultivation, for example. They suggest that the threshold level beyond which intensification of agriculture must take place in order for a growing population to be supported at existing levels is of great consequence. At these points, they allow for the maladaptive possibility and are not as convinced as Boserup that the process of intensification is assured simply by the stimulus of population growth.

This less optimistic alternative appears in all of the studies noted above and is expressed quite clearly in the joint effort by three of the writers. After noting the form that

intensification of land use can be expected to take, they state that "if these fail to take place, serious deterioration of the land may ensue, especially in drier areas, and its capacity to support population may be permanently impaired." Furthermore, "it also appears that a critical situation may develop in the event that the resources of manure fall below the level necessary for the maintenance of soil fertility under annual cultivation of all land belonging to a community."[1] It should be recalled, of course, that this concept of critical transition points in rural population densities is one which recurs in much of the literature on African agriculture.

The Cultural Interpretation

The orthodox population-related view of Hausa land use has not gone unchallenged. Polly Hill, in her analysis of findings from the village of Batagarawa near Katsina, argues that the intensive aspects of land use found there and elsewhere in Hausaland are merely indicative of a "preferred agronomic system" and that they are not necessarily to be associated with land shortage or with density of population.[2] The

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[1] Goddard, Mortimore, and Norman, "Population Growth in Rural Hausaland," pp. 3-4.

[2] The view that is summarized here is presented in Polly Hill, "Farms and Farmers in a Hausa Village (Northern Nigeria)", Chapter 7 in Rural Capitalism in West Africa (Cambridge: Cambridge University Press, 1970), pp. 150-151; and in P. Hill, Rural Hausa: a village and a setting (Cambridge: Cambridge University Press, 1972), pp. 303-306.

intensity with which land is utilized, in her view, is a feature of cultural rather than demographic factors.

Hill claims that, contrary to popular belief, Hausa farmers "prefer to keep all their farms within a mile or two of their residences under continuous cultivation every rainy season, irrespective of the supply of land outside this zone." Hence, "in Nigerian Hausaland continuous (or permanent) cultivation is commonly the preferred system" except in areas where a high incidence of bovine trypanosomiasis prevents cattle rearing. Intensive cultivation, she argues, is not confined solely to regions of dense settlement. In support of this view, she makes the following four observations:

1. Intensive practices such as manuring have been in existence in Hausaland for centuries, an observation that is supported by archival sources. The manuring of plots has not evolved in recent times as a product of pressure on the land, but has been known and practiced by Hausa farmers for a considerable period of time. It is not a function of latter day increases in population.

2. A high proportion of farmland, even in areas of dispersed settlement, is annually cropped. Intensively cultivated land can be found adjacent to very nearly all Hausa villages and hamlets regardless of their size and irrespective of the amount of land available for rotational fallowing. These conclusions are derived from the inspection of air photographs covering large areas of Katsina emirate.

3. Farmers throughout Hausaland appreciate the manurial value of animal droppings and household wastes despite the fact that there is a persistent belief that African farmers are ignorant of the value of such fertilizers.

4. It has been largely a matter of chance that research into Hausa agriculture heretofore has been carried out in areas where the preference for manured farmland is less apparent or has simply been ignored by the investigator.

Clearly Hill's analysis conflicts with the model of agrarian change enunciated by Boserup. Although Hill does not fully discuss the origins and causes of intensive land use in Hausaland, the suggestion is quite clear that she does not view it as having been stimulated by the growth of population. But there are several additional points of controversy as well. For Boserup, the infield zone of more intensively cultivated land surrounding villages is best seen as a matter of convenience and adaptation to natural conditions.[1] It is possible, according to Boserup's schema, to regard this infield zone as a more recent type of land use and the outlying, fallowed fields as an older or prior form of use. For Hill, on the other hand, this zone can be explained as a cultural artifact; it results from a distinctive preference on the part of Hausa farmers. It is not necessarily to be seen as a comparatively recent evolution from an older, more extensive type of land use.

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[1]Boserup, Conditions of Agricultural Growth, p. 57.

In Boserup's scheme, Hausa farmers, like all other agriculturalists who rely primarily on traditional methods, aspire to a bush fallowing system, the most labor economical system available to them. Given the opportunity, they would employ extensive techniques. Hill takes the opposite view. She would argue that Hausa farmers aspire to intensive, annual cultivation as their primary farming method and, given the chance and the materials, would practice manuring on all their plots. Clearly these differences represent fundamental conflicts in the respective interpretations of agricultural land use and must be given due consideration in the following chapters.

The Spatial Interpretation

Although the difference of opinion outlined above provides the pivotal focus on which the present study will turn, two further alternative interpretations of Hausa land use will be considered in the analysis. While they are distinctive viewpoints, they represent a shift in emphasis rather than a conflicting theory of agrarian change; hence, they are somewhat less controversial in explaining existing land use in Hausaland.

The first of these subsidiary interpretations attributes variation in the intensity of land use, especially as it is reflected in patterns of zonation around villages, primarily to

locational factors.[1] Chisholm, in his commentary on the study carried out by Prothero in Soba District, sees the general arrangement of land use as arising from the problems posed by distance.[2] The variations in intensity of land use found in Hausaland he regards as comparable to those found in the rural settlement process in general. That infield plots receive greater inputs of labor and capital is merely a reflection of the costs in time and money of overcoming distance. Furthermore, there is a perimeter around the village beyond which it would simply be uneconomical to farm intensively. Beyond this limit, plots naturally receive a correspondingly lower rate of inputs per unit of land. The result is a zone of intensively cultivated land adjacent to the settlement with another extensively farmed zone outlying it, just as is the case in much of Hausaland.

In his discussion of the pattern of land use and the existence of "concentric rings" around African villages, W.B. Morgan's arguments contain an implicit interpretation of Hausa land use which is similarly locational in nature. He follows

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[1]With respect to this fundamentally locational interpretation of land use, it is important to note that few observers would apply classical agricultural location models directly to rural Hausaland. There is a very significant distinction to be made. Whatever "rings" or zones can be found to exist in Hausaland cannot be said to reflect marketing or consumption factors as in the classical models. Rather, they are based upon <u>production</u> factors, namely the inputs to land in the form of labor and fertilizer.

[2]Chisholm, <u>Rural Settlement</u>, p. 68.

space economy models in arguing that "a tendency for patterns of land use to be arranged in rings around rural settlements may arise from the basic economic principles governing the location of argicultural activities."[1] If this is the case in Hausaland--and Morgan quotes the same example from Soba District in support of his views--then land use there is best interpreted as a function of the space economy. Intensively cultivated land receives a higher level of inputs because of its comparative advantage with respect to cost of movement.

Morgan states quite explicitly that:

> Because the farther fields cost more to reach in terms of effort or wages, it follows that unless they have other special advantages of soil, moisture, or site, the costs or effort involved in production there will be correspondingly higher, and the returns for the total of the farmer's labour will be thereby reduced. The farmer thus finds it more difficult to achieve on the farther fields that level of intensity of effort which it is possible to achieve on the nearer fields. The factors governing the competition between various enterprises available for the use of land thus differ according to location in relation to the settlement.

It is interesting to observe that Morgan takes heed of two important mitigating factors which may alter the operation of the purely locational model. In the quotation just cited, he suggests that "special advantages" of soil or site may well intervene. In some cases, then, intensively cultivated land might not necessarily be located adjacent to the settlement.

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[1] This paragraph summarizes the arguments in Morgan, "Zoning of Land Use," pp. 301-305.

Secondly, he adds a behavioral element by noting that "the relationship of distance to the problems of manuring, choice of crop, and choice of agricultural activity may thus have differed considerably from one farmer to another." The suggestion is that variation in the decision-making processes of individual farmers may also complicate the working of the locational model.

Although Morgan cites Boserup's theory and agrees that such a population-based model is useful in explaining land use, he does not fully subscribe to the demographic interpretation. In the first place, he argues that a village showing a zonation pattern in intensity of land use might exist where population growth is nil or where densities have remained constant, simply because of the export of surplus production from the region. This objection recalls the parallel and duplicating operation of the commercialization process mentioned in Chapter II. Moreover, Morgan feels that it is "too simple a solution" to correlate zoning of intensity solely with population growth or with large, stable settlement units in Hausaland. There are simply too many complicating or site-specific factors.

It is noteworthy that the Prothero study of Soba village has been used so frequently by writers in this locational vein because it is a construction that Prothero himself does not explicitly place upon his findings. If anything, he chooses not to explain the land use patterns that he found in Soba but only to describe them. He does suggest, however, that the features he describes are characteristic of low to medium density regions of Hausaland, thus establishing a link to population

density. He also takes note of the range of distances from the settlement to the perimeters of the zones he describes, thus implying a distance relationship. Yet there is no unequivocal statement of interpretation of land use--spatial or otherwise--in Prothero's reports on his Soba investigations. Writers who use this study in that way place their own interpretations upon his work.

As was noted at the outset of this section, the use of spatial models to explain Hausa land use does not necessarily stand in contradiction to either of the two previous interpretations. Both Boserup and Hill, for example, make reference to "locational principles." For Boserup, an agricultural system in a state of transition will exhibit a variety of land use types; intensively cultivated land tends to be that in proximity to the settlement as well as that most hospitable to such practices. Similarly, Hill regards the infield location of intensively cultivated land as the logical site for a farmer's preferences to be expressed. Given the opportunity, Hill would continue, farmers would probably expand this zone to the limits of village territory.

Nevertheless, the spatial interpretation of land use does attempt to do more than answer the question of why land adjacent to the village is more likely to be intensively cultivated first. It also suggests an answer to the question of why land is intensively farmed at all. The location of a plot with respect to the sources of its agricultural inputs is seen as the dominant factor governing its use. When the distance between farm and

farmstead rises above a certain critical limit, it simply becomes uneconomical to cultivate the field intensively. Transportation costs, broadly interpreted, make it unprofitable. Land within these limits, however, receives a higher level of inputs per acre because it is profitable for the farmer to provide them--not because he prefers to farm in this fashion or because he has been forced to do so by pressures of land shortage.

The role of distance as a pre-eminent, if not exclusive, factor in governing the use of farm plots in Hausaland will be examined in the course of this study. Moreover, the possibility of setting critical limits of distance for intensive cultivation in the context of the constantly changing circumstances of rural Hausaland will be given attention.

The Environmental Interpretation

The final interpretation which has been given to Hausa land use that will be considered in this study is perhaps the most straightforward although it is by no means the easiest to test. Various observers--including some of those discussed above who have concluded in favor of population or location as the most influential factor--place a considerable degree of emphasis upon environmental attributes which influence land use in Hausaland. Rainfall and water regime act to set the outer limits for the types of land use suitable there, and, within these parameters, other environmental factors shape agrarian practices. Foremost among these latter is the variation in soils. Another frequently mentioned influence is the presence

of a readily tapped water table which serves as a prior condition for the establishment of large population agglomerations such as Kano. It has already been noted that many classifications of land use and of land use potentials are conceived in similar physical terms and that Boserup objects to these as "static geographical theories of land use."

The most obvious example in Hausaland in which physical features appear to govern land use is the category of fadama. This is a type of farming which is shaped almost entirely--crops, cultivation techniques, labor requirements, implements--by the micro-relief and water budget. Yet it should be recalled that while the manner of farming may be a function of environment, the extent of land so utilized is another matter. In the final analysis, even the use of fadama may result from a number of the factors under review here.

Observers have suggested that there may be a positive correlation between agricultural practices and soils in the upland category of farms as well. Mortimore, for example, found that if the boundaries of the great soil groups were superimposed on the pattern of population distribution around Kano, it appeared that the close-settled and intensively farmed zone was confined to one soil group.[1] Grove similarly linked population density and agricultural practices with soil types. He suggested that, while in areas of low density (below 200 per square mile) the

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[1]Mortimore, "Population Densities and Agricultural Land Use," p. 3.

pattern of land use may be unrelated to "inherent capabilities" of land resources, in more heavily settled regions, "there is a close relation of land use pattern to soil conditions."[1] Aside from these rather broad associations at the regional scale, however, no investigator has established definitive correlations between land use and soil type at the village level. In part, this is because such a procedure would require the researcher to construct his own soils map in most sub-regions of Hausaland. Even short of such an exhaustive study, however, the available evidence suggests that soils play a major role in shaping Hausa land use.

Furthermore, environmentally-oriented interpreters would argue, the pronounced seasonality of the rainfall in Hausaland vis-a-vis the limited labor pool available and the relative scarcity of mechanized cultivation governs the total acreage that can be cropped in any given season.[2] Since labor inputs to intensively cultivated land are subtracted from the total pool available during peak cultivation periods, the rainfall regime also indirectly governs the proportion of cropped land which can receive high labor inputs. Moreover, since forage

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[1] Grove, "Population Densities and Agriculture," pp. 125-126.

[2] A number of agricultural development schemes in Hausaland, notably the Sokoto Rice Scheme, were predicated on the conclusion that labor shortages at key periods in the agricultural season were the primary constraint imposed on the expansion of agricultural output.

and other vegetation is a result of environmental conditions, the animal manure supplies required for intensive cultivation are also ultimately related to the environment. In this same regard, numerous references in the literature pertain to the absence of the tsetse fly, which is in turn related to micro-ecological conditions, as a permissive factor for intensive, manure-dependent agriculture.

This thesis makes no attempt to treat the philosophical arguments related to the place of the environment in shaping culture. Nevertheless, an effort must be made to assess, in the specific case under study, whether environmental factors such as those listed above are so restrictive as to outweigh cultural, demographic, or spatial considerations in the use of land resources.

Historical and Economic Interpretations

If one takes the village level agro-ecosystem as the unit of study, then the four interpretations offered above can be taken to represent primarily endogenous forces. What about the impact upon land use of factors largely external to the village or even to the region? Several possibilities could be suggested in this regard.

An historical interpretation has been advanced which relates the types of land use found in Hausaland to political factors operative in the pre-colonial era. The need for security, for example, resulted in the growth of centers of power--the large walled settlements--and left large regions virtually unoccupied.

Hence, concentrations of large-scale intensive land use result from an historical imperative and do not represent say, an adjustment to local soils. While this historical interpretation may have merit when considering the evolution over a long period of uneven population distribution and consequent differences in agricultural practices, it will not be given further consideration in this study since the time period dealt with here is relatively recent and comparatively short.

Perhaps a more significant omission from the list of interpretive factors cited above is a specific consideration of purely economic forces as a determinant of land use. While exogenous economic forces such as the price incentives set by marketing boards are implicitly operative in the foregoing interpretations--most notably in the emphasis on space economy--they are not expressly viewed as paramount in any of the four. Yet it would be a drastic oversimplification to completely sever "economic forces" from the land use interpretations given above. Indeed, the prime rationale for excluding a separate and comprehensive examination of the economic aspects of agrarian change in this study is that such factors can be subsumed under the interpretations previously delineated.

Moreover, it should be born in mind that "intensification" of land use is the fundamental topic under investigation. The adoption of crops that are grown solely for the market or the increase in the proportion of land devoted to commercial production can both be distinguished from the more general intensification process. The former two categories both represent

aspects of the commercialization of agricultural production. Intensification of land use may result from the influence of these forces, but it generally is linked to other factors under consideration in this study.

No separate consideration of the "commercialization" of agricultural production is included in the present study. With the possible exception of several improved varieties, no new crops have been introduced to the study area during the time period under review. No new types of land use associated with specifically commercial crops have come into existence. Hence, variation in the intensity of land utilization rather than, say, presence or absence of an innovation stimulated by the market mechanism, serves as the more powerful indicator of agricultural change in Soba District.

The motive behind this review of interpretations of Hausa land use has not been to overdraw the lines among them or to manufacture false distinctions. Rather, the objective has been to delineate four primary factors, admittedly inter-related, with an eye to determining which has exerted the most powerful influence on land use in the area in recent times. The demographic interpretation, at least in its Boserupian form, can be regarded as largely non-environmental, aspatial, and transcultural. It, like the space economy models, is universalistic. The cultural interpretation, in contrast, is site-specific; it is not population dependent and, at least to some degree, operates independently of economic and locational forces.

Land Use Classifications

With the foregoing interpretations in mind, one final task remains before proceeding to a more detailed introduction to the study site and to the methodology and field techniques employed. With respect to each of the four main explanatory factors listed above, a classification scheme for land use is present, explicitly or in some cases implicitly, in the arguments of the investigators concerned. It is appropriate to conclude this chapter by examining these classification systems and by proposing a classification of land use that will be employed in this thesis. To distinguish among land use types, at least three criteria have been employed.

The Topographical Criterion

Utilization of a topographical criterion--which, as might be expected, is related to the micro-hydrological regime--renders a clear and distinct initial division of land into two categories: upland and lowland. Norman's studies rely almost exclusively on a topographical criterion to distinguish the two fundamental types of farming that he considers: upland farms, which he refers to as gona (pl. gonaki) and lowland or fadama farms. This is a distinction which, as Norman observes, Hausa smallholders readily make. Fadama farming, for example, is always considered as a distinctive style of farming with an associated set of practices.

Lowland Land Use

Lowland or fadama is defined by its relative geomorphological position which in turn influences its water budget. Fadama is usually seasonally inundated and may retain a high soil moisture content well beyond the end of the rainy season. It is customarily cropped all year long, not just during the prime agricultural months. Because it usually demands far greater labor inputs per acre and because of its relative scarcity, fadama plots tend to be considerably smaller than upland fields. Similarly, total acreage devoted to fadama cultivation in any particular village is invariably far less than upland.

This category of land use might well be subdivided. Although no further breakdown of fadama will be included in the classification scheme employed in this thesis, distinctions based on distance from settlement, local hydrological regimes, or fertilization procedures could readily be made. On the basis of location, for example, one could distinguish between fadama plots situated comparatively close to the farmer's residence (500 yards or less) and those located at much greater distances from the settlement (in some cases surpassing 3 miles).

An even more interesting delineation of subtypes could be made on the basis of a precise evaluation of localized hydrological regime. Many fadama areas consist of headwaters of streams and rivulets; others are merely depressions. Some are located on floodplains while others are adjacent to perennial

streams or stream channels.[1] Because of their variety, these fadama areas are occasionally subject to ambiguous definition in the minds of farmers. In the course of interviewing for the present study, for example, one farmer would occasionally call his plot fadama while his neighbor cultivating similar land regarded his as upland. However, such confusion was generally the exception. In at least one village under study farmers could draw a precise demarcation line between fadama and non-fadama land. Ultimately, local classifications of fadama tended to be based upon the field's capacity to support a fadama crop such as rice, sugar cane, or certain vegetables.

With respect to method of fertility maintenance, it is possible to distinguish those plots on which total reliance is placed upon hydrological fluctuations and flooding to replenish the nutritive status of soils, those to which organic fertilizers are added, and those which receive a dressing of commercial fertilizers. Interestingly enough, the fact that many of these plots receive subsidies of manures and fertilizers has largely been ignored in the literature on Hausa farming. However, subdivision on the basis of frequency of cropping would yield no great variation since most of these plots, once opened up, tend to be cultivated year after year. Rarely are they left fallow

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[1] The classification of fadama from which this section draws was conducted by Beryl Turner, "An Approach to the Classification of Fadamas," paper presented at Ahmadu Bello University Department of Geography seminar, Zaria, Nigeria, April, 1974.

for any length of time beyond that required for replanting or until another flood cycle has occurred.

Despite the fact that these subdivisions are valuable, they will largely be ignored in the following analysis for the sake of simplicity. A comprehensive classification of fadama is not fully germane to the issue under investigation here since, as will be shown, the labor requirements and "intensity status" of this type of land use are relatively constant. In the present study, fadama cultivation is treated as intensive land use.

Upland Land Use

The upland category, generally called tudu by Hausa farmers, forms the vast majority of surface area and the largest acreage of cultivated land in nearly all villages. These fields depend entirely on seasonal rainfall for their productivity. Beyond their similarities in topography and hydrology, however, fields within this category display a broad range in use and could be subdivided further. Subdivision of upland farms is somewhat more complex than that of fadama, but is obviously worthwhile for the analysis undertaken here. Two further criteria can be utilized to make distinctions within this category.

The Locational Criterion

Underlying Hill's investigation of Batagarawa agriculture is a twofold classification of land use. Since fadama cultivation was apparently of little consequence in this village, she generally disregards the topographic criterion and divides farms

according to a locational criterion. She distinguishes between gonar karkara (pl. gonakin karkara), which refers to fields located near a settled area, and gonar daji or bush farms, those located in outlying scrub-land areas. Although the Hausa terms that she uses to designate these two types of land use, which she found to be in common usage in this village, have an essentially locational reference, Hill links with each type a characteristic mode of fertility maintenance as well as a characteristic period of cultivation.

Interpretations of land use which emphasize the spatial relationships involved obviously stress the locational criterion in distinguishing among land use types. Reference is frequently made to "near" and "far" fields. In the present study, the terms infield and outfield are preferred.

Infield Land Use

The infield type of land use can be defined as cultivated fields which are adjacent to the settlement and which are contiguous or nearly contiguous with one another. Generally, such land forms a solidly cultivated zone which frequently forms a roughly concentric circle around settlements, although this can assuredly vary quite considerably according to local siting and population factors. This infield zone, which will be analyzed in greater detail in subsequent chapters, can not be defined by a a set distance criterion, say all land within a half mile radius of the village center. Its outer perimeter, as will be shown, varies greatly although its distance from the settlement appears

to bear a significant relationship to the primary factor under consideration here, population.

Ultimately the final determination of infield land use depends on a linkage with an additional criterion: frequency of cropping. Cultivated land which meets the criteria of proximity and contiguity and which is intended to be farmed annually belongs to the infield zone. The intention on the part of the farmer to farm land annually means that steps will be taken to insure its continued productivity. In most cases, at least up to the present, this has entailed the addition of organic fertilizers to the plot. However, it may be misleading to speak of this zone as containing "manured farms," as does Hill. Not all farms in this infield zone are necessarily manured; certainly not all are fertilized every year. Not all farms outside this zone are unmanured.

The infield zone, then, is defined most adequately on the basis of the dual criteria of location and intended frequency of cropping. Although these plots do indeed display a characteristic technique for the maintenance of fertility, no further defining factors are required. The only complicating factor arises when plots are in a transitional state. Some farms have not been cultivated annually in the past, but it is the farmer's intention to do so in the future. Obviously, dealing with plots on maps or aerial photographs does not reveal an owner's intent for it. Systematic interviewing is required to pinpoint farms in such a transitional state. For the purpose of the present study, a dressing of organic fertilizers is taken as a reliable

indicator of such intent. Occasionally, a plot within this zone may be found in fallow, but this tends to result from exceptional circumstances such as the absence of an owner from the village or dispute over cultivation rights.

As we have seen, Hill refers to this infield zone as kar-kara. Unfortunately, this term does not appear to have wide currency among Hausa farmers and was not generally familiar to farmers in the study area as a common description for infield farms. Farms of this type are more typically referred to as gonar cikin gida (farms within the houses) or gonar bayan gari (farms near the town).

Outfield Land Use

The outfield category of land use is somewhat more complex. Nevertheless, the initial criteria of location and intention of the farmer as to cultivation period serve to delineate the class. A plot located at a relatively greater distance from the settlement from which it is farmed--anywhere from a few hundred yards up to three miles--and which is intended to be cropped for a period of successive years and then allowed to rest can be considered part of this zone. Fields within this zone are generally known as gonar daji (bush farms), but they may also be called gonar waje (an outside farm) or saura (the remaining or left-over land).

Types of farms that fall into this class are extremely varied. A traditional way of distinguishing further among them is by the length of the fallow period. Short or grass fallows

are regarded as those from two to three years in length which allow only the regrowth of short grasses and scrub. The ridges from previous cultivation periods are generally visible throughout the fallow on these plots, so that ground inspection can frequently distinguish farms of this type. Long fallowing is similarly a relative concept, but in Hausaland might be seen as any land which is rested more than four years. In Boserup's classification, land rested longer than ten years is considered "bushy" fallow.

The problem with subdivision by length of the fallow interval is that it depends to such a great extent on the observer's frame of reference. Given the relatively dynamic nature of current agricultural practices in Hausaland, only a limited degree of permanency in fallowing traditions exists. For example, there is only a minimal consistency among villages in the study area. A standard rotation of six years cultivation followed by six years fallow was probably once dominant, but this no longer appears to be the case. Changes in fallowing practices are undoubtedly an important aspect of agrarian change and will be discussed in connection with specific village studies in Chapters VIII and IX.

In general, most farms in the outfield category rely upon periodic fallowing to regenerate fertility. Many of them are also supplied with animal manures by the corralling of Fulani cattle and sheep on them during the dry season, in which case the cultivation period may be considerably longer. The boundaries of plots within the outfield zone may vary quite considerably

over time, in contrast to those of infield farms which are generally more stable. Depending on fallowing practices and the demand for land, an equal number of fields may go out of cultivation as are newly cleared each year, making for substantial changes in the outfield landscape.

The Cropping Regime and Renewal Criteria

In distinguishing between infield and outfield land use, more than just a locational criterion was employed. These categories actually reflect a frequency of cropping criterion and are linked to an associated mode of fertility maintenance. To link these three factors is not unusual in discussions of Hausa land use although the terms infield and outfield have not been widely utilized.

Mortimore, for example, begins his analysis of land use around Kano with the topographic categories, upland and lowland, but proceeds to distinguish between annual cultivation based on intensive techniques and shifting cultivation employing fallowing. This latter distinction is obviously grounded on a frequency of cropping criterion akin to that used by Boserup. Mortimore also attempts to clarify some of the terminology involved in land use distinctions. He regards the term annual cultivation as correctly applying to land which is cropped every rainy season year after year. Continuous or permanent cultivation, on the other hand, is better employed to refer to land which undergoes

a continuous cropping cycle such as fadama farming.[1] He views "permanent" agriculture, in other words, in temporal rather than spatial terms.

As has been noted, Hill similarly attempts to link plot location with cropping interval and fertilization practices. She generally uses the terms "manured farms," continuous cultivation, permanent cultivation, and annual cultivation interchangeably.

Several additional classifications of use could probably be made on the basis of cropping regime, although these are mentioned here largely for the sake of identification. Intercropped land consists of fields which hold more than one crop simultaneously; these crops are usually present on the field throughout the agricultural season although harvest time may differ by several months. Multi-cropped land is that which holds several crops in succession. An early crop of maize, for example, is usually harvested prior to the planting of tobacco in the same plot.

In the present study, a straightforward threefold classification of land use, which appears to lend itself to an analysis of the issues under investigation, has been selected. The topographic criterion is employed primarily with reference to fadama farms which form a quite distinctive category of land use and associated practices. Beyond this, a combination of

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[1] Mortimore, "Population Densities and Agricultural Land Use," p. 8.

classification standards is used to distinguish between two fundamental types of upland use: infield and outfield. As has been explained, the former of these classes is generally associated with annual cultivation and with regular application of fertilizers. However, the denotation "infield" is preferred because, as will be shown, variations in actual practices within this category can be quite substantial.[1] Similarly, outfield land use is associated with rotational fallowing. The term "outfield" is more suitable since practices pertaining to this class of land are also quite varied.

Ultimately, the categories of infield and outfield will be used in this study to establish a distinctive system of land use that is found in Soba District as well as elsewhere in Hausaland. It should be noted at the outset, however, that these divisions are not universally applicable to all sub-regions of Hausaland. The distinction between infield and outfield loses its clarity, for example, in the context of densely settled regions where "infield-type" farming has been expanded to the outer reaches of village territory. The topic of the adequacy of this classification scheme will be rejoined in later chapters.

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[1] The terms "compound land" and "town land" have also been used to refer to this zone of land use. Infield is the preferred terminology here since not all of these fields are near compounds and not all of the land that is farmed by a town is infield.

CHAPTER IV

SOBA DISTRICT AS STUDY SITE: THE PHYSICAL SETTING AND THE BACKGROUND OF THE INVESTIGATION

Soba District, located in Kaduna State (North Central) of Nigeria within the region generally known as Hausaland, was selected as a suitable site to address the issues raised and to test the Boserup model in the manner described in the preceding chapters. This is an administrative district of approximately 800 square miles--its boundaries are not precisely determined--situated between 10^{o} 45' and 11^{o} 15' north latitude and 7^{o} 15' and 8^{o} 15' east longitude within an ecological zone frequently referred to as Guinea Savanna (Map 1).

In order to set the stage for a detailed discussion and analysis of land use and agricultural change in the district, several pertinent topics will be presented in this chapter. In the first section, relevant aspects of the ecological setting are delineated. Secondly, the rationale underlying the selection of this district as an appropriate study site--which raises a number of issues that have an important bearing on the line of argument being developed in this thesis--is presented. Finally, several issues and terms which are necessary for a correct understanding of the subsequent analysis are clarified in a brief discussion of the conduct of the study in Soba District. A more complete presentation of the methodology used in this study is contained in

the Appendices.

The Physical Setting

All agricultural activity and agricultural land use in Soba District are profoundly influenced by the physical environment. While no exhaustive inventory of the environmental setting or analysis of the ecological features of the district will be attempted in this chapter, some introduction is necessary to serve as preface to the ensuing discussion of agrarian change as well as because of its obvious relevance to the topic of agricultural land use.[1] This is not to suggest, however, that the Boserup non-environmental model is being discarded before any serious testing of it gets underway. Rather, the brief presentation of physical aspects of the district in the first section of this chapter is intended to serve as a basis for later consideration of the alternative, environmental interpretation of land use. The assumption here--one which is subject to closer scrutiny in later chapters--is that it would be a mistake to discount entirely the role of such non-demographic factors as influences upon land use and land use change.

The following section focuses on four distinctive aspects of

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[1]A far more comprehensive presentation of the physical geography of the Zaria region, from which Soba District varies only in minor details, can be found in the following sources: P. N. Hore, "Weather and Climate," J.B. Wright, "Geology", H. Klinkenberg, "Soils," and G. Jackson, "Vegetation," all in Zaria and Its Region, ed. M.J. Mortimore (Zaria: Ahmadu Bello University Department of Geography, 1970).

the physical environment of Soba District: landforms and drainage, soils, micro-climate and rainfall regime, and natural vegetation. In each sub-section, the aim of the presentation is to relate the environmental feature to its bearing on agricultural land use. Considerable attention is devoted to the factor of soils in this section for three reasons: (1) this attribute of the local environment has figured largely in most analyses of Hausa land use; (2) Soba District smallholders give obvious high priority to variations in soil quality; and (3) soils apparently play a pivotal role in land use decision-making in certain distinctive sectors of the district as will be demonstrated in succeeding chapters.

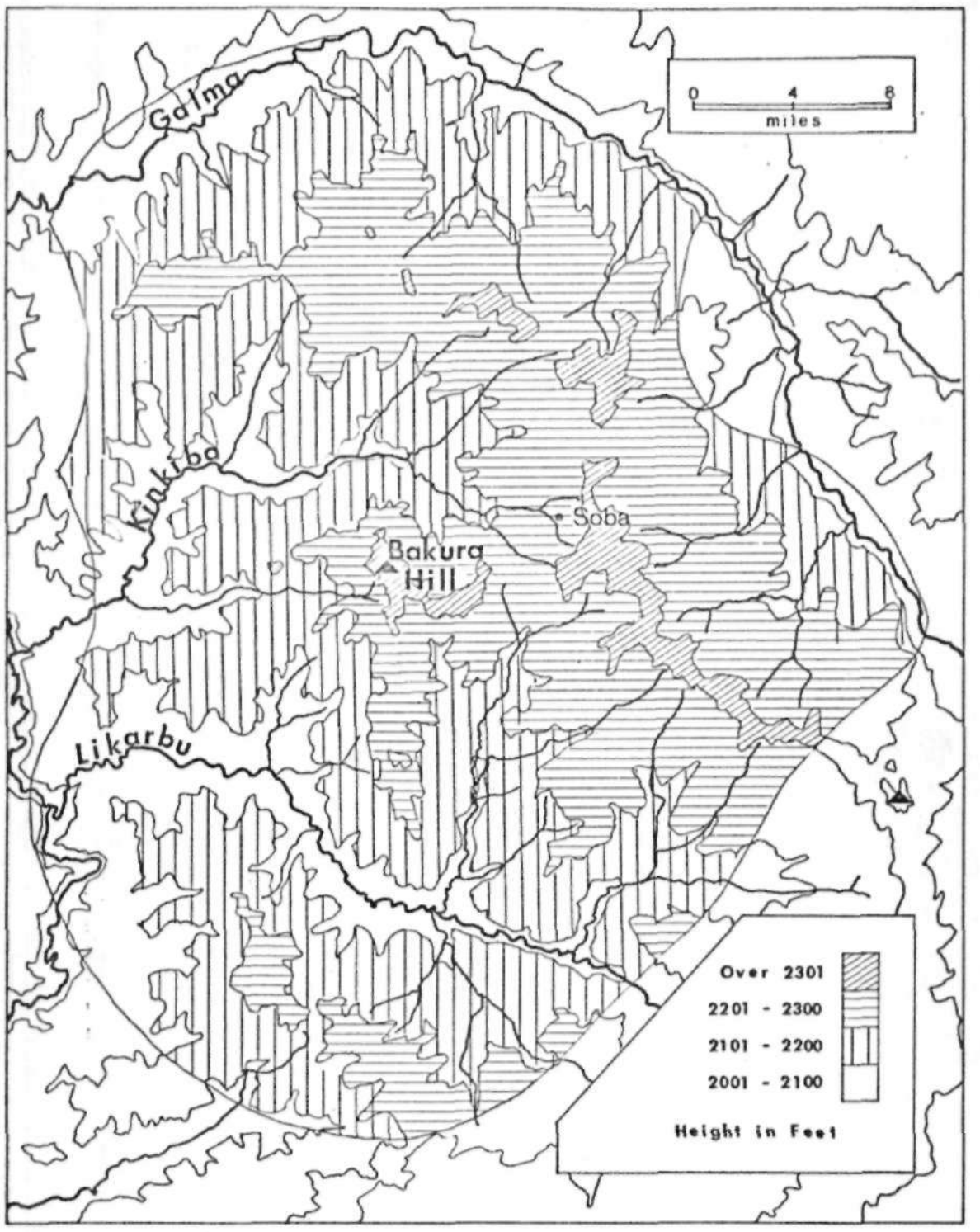
Landforms and Drainage

The gently undulating plains which constitute the basic landform of Soba District are a part of a vast, nearly even peneplain, formed on crystalline metamorphic rocks of the Nigerian Basement Complex, which extends across practically the whole of northern Nigeria. The variation in altitude in the district is not great; most of the surface ranges from 2,100 to 2,300 feet above sea level. Some relief is provided by lateritic-ironstone-capped outcroppings which are scattered across the landscape; the highest of these, Bakura Hill, rises to 2,427 feet and is situated squarely in the center of the district. (Refer to Map 2.) None of the distinctive inselbergs for which this region of Hausaland is noted are found within the district, although a massive rock formation is located at Dutsen Wai, just three miles from its eastern boundary.

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Soba District Relief

MAP 2

As can be seen on Map 2, slightly higher altitudes prevail in the northeastern quadrant of the district and form a watershed which traverses the northern sector. To the south of this watershed, the Likarbu and the Kinkiba Rivers drain the district, both flowing in a southwesterly direction. To the north of the watershed, streams flow into the Galma River, a year-round watercourse which forms most of the northern boundary of Soba District, and--true to its name meaning Hausa hoe--it curves 90 degrees to the south to serve as a portion of the district's western border as well.

Because of their comparatively low gradients, the valleys of the numerous meandering streams and watercourses that drain the district tend to be wide and shallow. Only a few more deeply incised stream beds or lengthy gullied channels are found. The result is that a quite significant acreage of marshy floodplains which can sustain year-round cultivation exists in the district. Even along the moderately incised streams, such as those found in the vicinity of Soba village, former floodplains are typically waterlogged during the rainy season, and moisture remains in the soil until late in the dry season. Since nearly all major villages and hamlets in the district are sited within one-half mile or less of a watercourse, local perennial and intermittent (wet season) streams form an important component of village agro-ecosystems.

Soils

It is not only in these fadama areas that the geomorphology of the district exerts an influence on agricultural land use. A

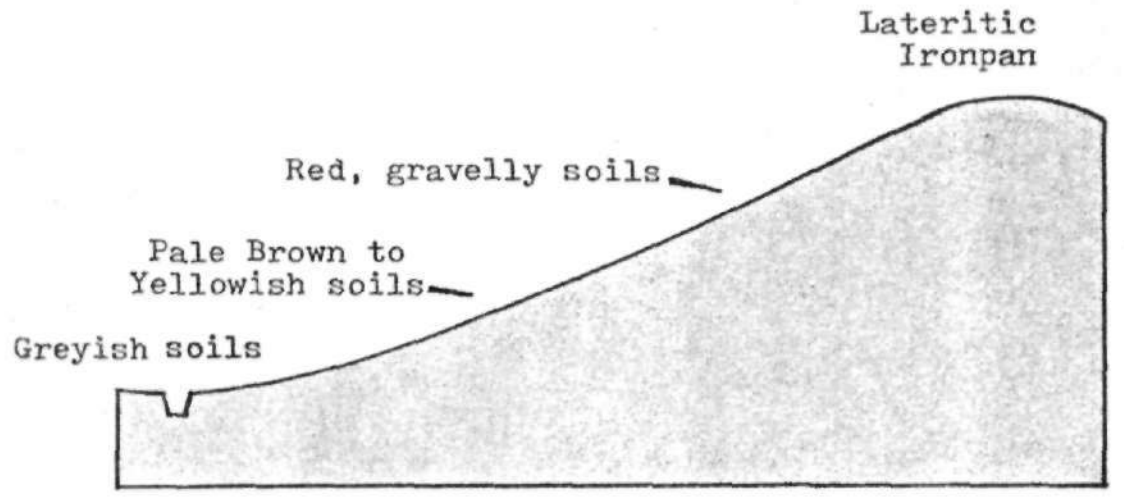
related and equally significant factor in village land use is local variation in soils. Most of the soils found in the district belong to the class of Leached Ferruginous Tropical Soils developed under conditions of appreciable but highly seasonal rainfall. Fadama soils, of course, are Hydromorphic soils. However, micro-variations in slope combined with local hydrological regimes result in agriculturally significant variations.

Two very common geomorphological formations found within the district, which are illustrated in Figure 3, give rise to a number of distinctive soil categories. To a great extent, the color and texture of soils in the district can be predicted by slope position. Upslope soils tend to be reddish, frequently with iron pan at the highest point. Lower down the slope, soils change progressively to pale brown and then to shades of yellow. Lowlying alluvial soils of the fadama are grayish to white. For the most part, these soils are derived from the underlying gneissic rocks, frequently with a thick mantle of aeolian drift materials. The crests of the hills are usually exposed remnants of old lateritic erosion surfaces.

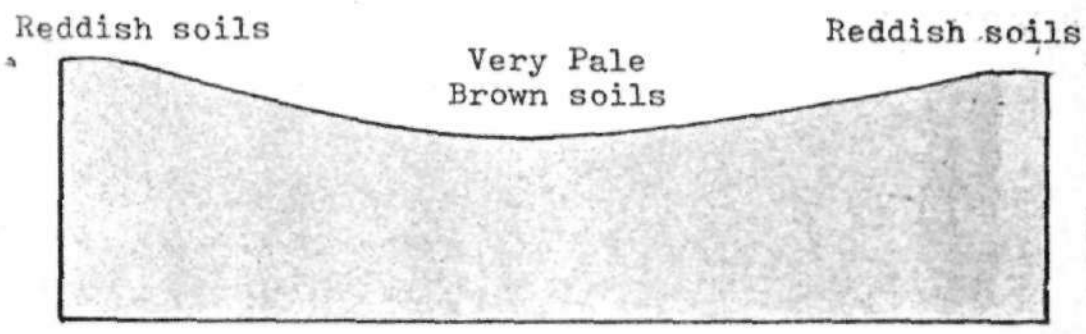
In general, the Ferruginous Tropical soils in the district are inherently rather poor in fertility and cannot sustain intensive agriculture over long periods without the use of fertilizers. Most of these soils show a marked differentiation of horizons, commonly with 30 to 40 percent clay content in the upper layers and with free iron oxides deposited as mottles or concretions in the profile. It is difficult to generalize about the structure of these soils since this factor changes so conspicuously with moisture

FIGURE 3

COMMON GEOMORPHOLOGICAL FORMATIONS,
SOBA DISTRICT



Type 1



Type 2

content; structureless material frequently takes on a radically altered character when wet. An additional common property of many of these soils, which will be shown to have an important bearing on village land use, is their propensity to form a surface cap under the impact of heavy rains. Because of a slightly higher silt and fine sand content in the upper horizons, or in some cases because of the absence of organic matter, some soils form a surface crust which gives rise to rapid runoff, has a low infiltration rate, and becomes significantly more difficult to work with simple farm implements.

The most important point that can be made in this regard is that Soba District farmers show evidence of a very sophisticated appreciation of differences in properties and capabilities of soils. Table 1 records a land classification scheme that was developed in the present study to differentiate among classes of agriculturally relevant soils. An attempt was made to match properties delineated by soil scientists with locally familiar terms. A telling observation can be made about the results of this effort: obviously, Hausa farmers' terms for differing types of soils do not in every case coincide with "scientific" classifications. The Hausa smallholder is primarily interested in an agricultural evaluation of soil; his differentiation tends to be confined to surface horizons; and there is frequently some ambiguity concerning soil type and soil treatment. The highly desirable bakar kasa (black soil), for example, may be developed from several types of soils which have been organically fertilized over a long period of time. Nevertheless, it cannot be emphasized too strongly that, in addition

Land Use	Topography	Soil Characteristics: Depth	Color (Surface)	Texture	Ease of Working	Drainage	Soil Type: Local Name	Type
Upland (tudu)	High	Extremely Shallow	Red	Rocky	Impossible	Rapid Runoff	marmara	Lateritic Ironpan
	Up-slope	Shallow	Reddish	Gravelly Clay Loam	Easy	Good	tsakuwa jar kasa gargagi	Leached Ferruginous Tropical Soils
	mid-slope	Very Deep	Pale Brown to Yellow	Sandy	Very Difficult Light	Slightly Impeded Rapid Runoff Excellent	bakar kasa (tawai) fara kasa jigawa turba	
Lowland (fadama)	down slope	Deep	Grey to White	Clay/ Clay Loam	Difficult	Water-logged Flooded	daboro tabo	Hydromorphic

TABLE 1 SOILS AND SOIL CHARACTERISTICS, SOBA DISTRICT

to "fertility", agricultural properties of soils such as drainage or susceptibility to capping are generally known by farmers and have an impact on land use decision-making.

The comment of a soil surveyor with long experience in the Zaria region is instructive concerning farmers' knowledge of soils. "You simply do not need to tell local farmers much about their soils; they already know where to go and where not to go..." As will be shown in subsequent chapters, this familiarity with the agricultural potentials of local soils is not inconsequential with respect to the proper interpretation of land use patterns found in the district.

Vegetation Landscapes

In this summary of certain aspects of the physical environment of Soba District, it is appropriate to take note that several boundaries of ecological significance exist between this area and the remainder of Hausaland to the north. Its soils, for example, display significant contrasts with the lighter and generally more sandy soils to the north. Furthermore, Soba District lies in the northern reaches of the ecological zone known as Guinea Savanna.

The vegetation in the Guinea Savanna zone has been greatly altered by the impact of agricultural practices, particularly burning, and characteristic vegetation landscapes vary quite considerably with micro-conditions as well as with season. Uncultivated "bush" land varies from scattered "Doka" woodlands, dominated by the Isoberlina Doka and I. tomentosa trees, to tall grass and scrub lands. During the rainy season, non-cropped land

is covered with rapidly growing fibrous grasses. In the dry season, these die back and are usually burned, giving the landscape a characteristic open appearance. The only thickly forested area of any size in the district lies within the confines of the Kona Forest Reserve, although other small expanses of woodlands exist in the southern sparsely populated sector of the district. (See Map 3.) In terms of their agricultural utilization, these scattered wood and scrub lands do not represent any serious obstacle to clearing and plowing.

Another typical vegetation landscape found in the district is the cultivation parkland. Where natural vegetation has been cleared or suppressed, certain trees of known value have been carefully preserved. Trees of economic value such as the Shea Butter (Butyrospermum parkii) and the West African Locust Bean (Parkia oliveri) are perhaps the most common in such landscapes, but the mango (Mangifera indica), the tamarind (Tamarindus indica), the silk cotton (Ceiba pentandra), and the baobab (Adansonia digitata) are also frequently planted and/or protected. Cultivation parkland is typically found in the vicinity of settlements, especially the older villages in the northern sector of the district.

The infield zone of land use is usually composed, at least in part, by parkland landscape. In most cases, an effort is made by villagers to keep fields within this zone relatively clear of undergrowth during the off-season. The outfield zone, in contrast, tends to be interspersed with large areas of Doka savanna. Hence, clearing operations within the latter zone, especially on

newly opened plots, obviously consume large amounts of labor.

The only other vegetation landscape of any extent are the fringing forests associated with stream courses and fadama. Taller tree species and denser undergrowth are characteristic of these micro-zones; useful trees such as the palm (Raphia sudanica), citrus varieties, or banana are frequently encountered here.

An important skill in land evaluation, required by both the farmer and the academic researcher, is related to the variation within upland vegetation landscapes. The knowledgeable farmer relies on certain key species of grasses and shrubs as indicators of the recovery rate or of the potential of various soils. Similarly, estimates of the length of fallows on village fields are based primarily upon observed vegetation stands. The height and density of shrubs and trees that have re-established themselves since cultivation ceased on a plot, for example, are a comparatively reliable gauge of fallowing intervals. Hence, distinctions between "long fallowed" and "short fallowed" land use rely primarily on such assessments.

Climate and Rainfall

A final point concerns the extreme seasonality of the climate characteristic of Soba District. A rainfall regime, which is largely governed by the north-south migration of the Inter-Tropical Convergence Zone and the consequent alternating effects of dry continental and moist maritime air masses, enforces a distinctive seasonality. Although it is customary to refer to only two such seasons, a wet and a dry, the Soba District farmer

actually distinguishes among at least four, and sometimes six, separate seasons. (See Table 2.)

Temperatures within the district are generally quite high throughout the year with a peak of 95° F mean daily maximum in April. The lowest value mean daily temperature, 56° F, falls in January during the Dari season.[1]

Total annual rainfall, which can actually vary quite considerably from village to village within the district, tends to be slightly higher than that received by Hausaland sub-regions to the north. The mean annual rainfall for the period 1931-1965 at nearby Zaria was approximately 43 inches; that recorded within the district at Maigana Agricultural Station for a more recent period (1968-1973) was slightly less, 38.5 inches (refer to Table 3). Of course, this latter figure reflects the lengthy drought that prevailed in the region during that time. Rainfall is concentrated within a distinct wet season, roughly April to September. Some rain may fall in March or in October, but the remaining four months are almost always rainless. Such a rainfall regime is suited to the production of annual crops--the mainstay of Soba District agriculture--with most land out of production during the severe water-deficit months.

The extreme variability, discontinuity, and selectivity of rainfall contribute to its most significant implication for the

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[1]These figures are actually median values of mean daily screen temperatures over the period 1958-1968 recorded at nearby Samaru, Zaria, Mortimore, Zaria, p.51.

TABLE 2

RECOGNIZED SEASONS IN SOBA DISTRICT

Approximate Months	Season	Description
Dec.-Jan.	Dari	"Harmattan", cooler, windy, dry
Nov.-April	Rani	Dry Season
April	Bazara	Mini-hot season preceding rains
May-Sept.	Damuna	Rainy Season
Oct.-Dec.	Kaka	Harvest Season
November	Agazari	Mini-hot season following rains

Year	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Total
1968				3.92	6.71	5.59	11.07	9.90	6.19				43.38
1969				.81	4.77	8.23	6.65	14.86	6.40	2.35			42.07
1970					3.07	4.28	6.25	15.12	7.07	.40			36.19
1971		.21	1.93	4.68	3.48	4.46	13.96	7.06	1.51				37.29
1972			.87	5.22	4.11	6.84	16.79	4.44	1.34				39.61
1973		.90	.47	3.19	4.01	6.48	9.57	8.04	.15				32.81
1974		.02	2.20	2.80	5.36	n.a.	n.a.	n.a.					n.a.
Average		.16	1.46	4.35	5.01	6.96	13.37	6.53	.96				38.56

TABLE 3

RAINFALL RECEIPTS AT MAIGANA AGRICULTURAL STATION, SOBA DISTRICT 1968-1974

purposes of this study. In the first place, these characteristics mean that rainfall records, even those recorded at a station within the district, are only suggestive of the actual amount of rain received by widely scattered villages and farmlands. A distance of as little as 500 yards can mean a noticeable fluctuation in rainfall received. Hence, any survey designed to utilize crop yield data, for example, would require rainfall gauges in nearly all villages sampled if the effect of variation in rainfall were to be controlled.

The variation of rainfall over space is simply a fact of life for the Soba smallholder; there is little he can do to influence it other than be aware that the constant danger of water shortage exists. Dispersion of his fields in an attempt to neutralize the impact of localized water deficits does not appear to be a widespread strategy; in any case, its effect would probably be minimal. Its variation over time, in contrast, is accorded considerable thought by the Soba farmer in his land use decision-making. The timing of rainfall is continually a critical matter. The crucial nature of the timing of farm operations will show itself repeatedly in the following analysis. The amount of land of various types that the smallholder can plow and plant early in the season is governed to a great extent by rainfall distribution vis-à-vis labor resources; the outer limits for maximum utilization of family labor during peak periods are fairly narrowly defined.

Rationale for Selection of the Study Site

In addition to the obvious advantages of the researcher's familiarity with the region and its primary language, as well as the necessity not to interfere with or duplicate existing research programs, the criteria used in the selection of this district as a study area were fourfold:

Setting within Hausaland

The district lies within the region of Hausaland. Not only does there exist a substantial body of literature on agriculture and rural economies of the region useful for comparative purposes, but also, as has been illustrated, an ongoing debate concerning interpretation of land use pertains to this area. The issues in this debate were summarized in Chapter III. Moreover, some of the evidence cited by Boserup, by Gleave and White, and by others to substantiate their models of agrarian change is drawn from Hausaland. Further consideration of this evidence in the light of findings from yet another sub-region of Hausaland is certainly appropriate.

Base Line Study

A second consideration pertains to the fact that an earlier land use study was conducted in Soba village by R. M.

Prothero in the 1952 farming season.[1] Hence, baseline information is available for a village in this district for comparison with the current study, a rarity in the African context. The nearly twenty-five-year interval between these two studies, during which time the district underwent a comparatively high rate of population growth, provides a sufficient span over which changes in land use induced by population increase should be detectable.

Uniform Impact of Exogenous Variables

Another criterion used for selection of this district as study area relates to the need to hold some variables constant while testing for the influences on variation in intensity of land use. Without seeking to gloss over the quite significant variation among villages within the district--which after all forms a central focus of this study--it is possible to make several observations about such constants. First, although there do exist some minority non-Hausa, non-Fulani groups, which will be discussed in a subsequent chapter, by far the dominant cultural tradition within the district is Hausa and Islamic. Secondly, although variation in connectivity with the nearest central place (Zaria) certainly exists, there is no village so remote or for which such a low degree of communication and interaction exists that it

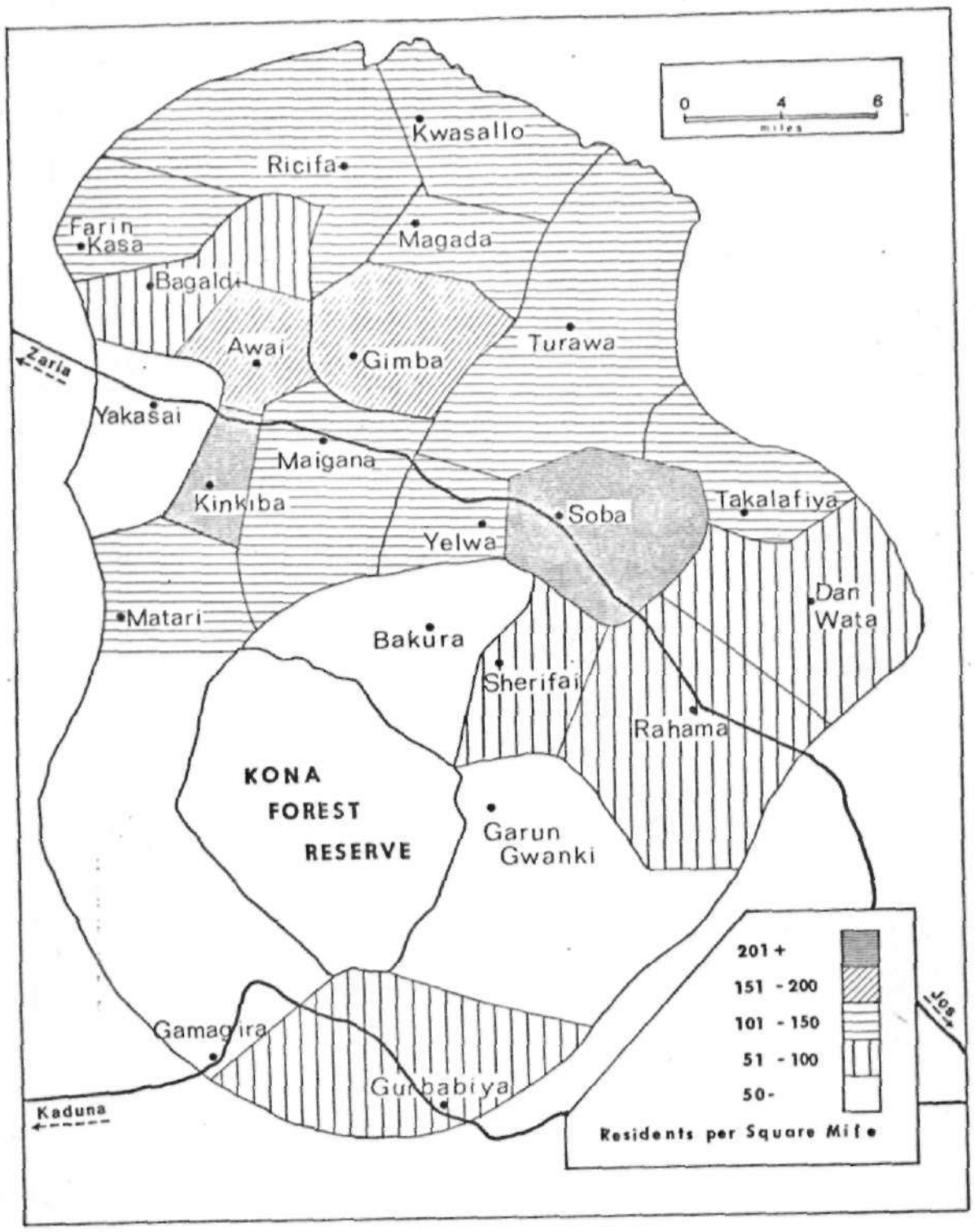
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[1] R.M. Prothero, "Land Use at Soba", pp. 72-86. The findings from this study are also reported by the same author in, "Land Use, Land Holdings and Land Tenure at Soba, Zaria Province, Northern Nigeria," Bulletin de l'I.F.A.N., T. XIX, ser.B, no.3-4 (1957), pp. 558-563.

poses a barrier to nearly complete diffusion of information about agricultural practices. Hence, diffusion of innovation in agriculture can be regarded as a constant for the purposes of this study. Thirdly, micro-topographical and micro-climatic variation is, as has been indicated, comparatively great. Nevertheless, the impact of the variation in macro-environmental variables on the farming practices of village households is equally random, hence, constant for present purposes. No village or sub-district in the region, in other words, is possessed of any overwhelmingly salutory or constraining climatic conditions.

Variation in Population Density

Some variation in population densities is obviously critical to any satisfactory testing of the models of change under review here. Initial preliminary analysis of a map constructed by R. M. Prothero on the basis of the 1952 Nigerian census suggested that such variation could be found within Soba District. The compilation of Map 3, based upon data from the present field research, demonstrated that a suitable range of density of population can indeed be shown to exist in the district. Since this population-density variable is central to the argument presented in this thesis, and since population figures for Nigeria have such a disputatious history, a few words about the construction of this Soba District population density map are in order at this point. After all, the case for variation in density within the district rests on information represented by this map.



Soba District Population Density

MAP 3

Areal Data

Population density calculations require both areal and demographic information. Within Soba District, neither of these figures is straightforward and readily obtainable. As was suggested above, the boundaries of this district have not been surveyed and mapped; nevertheless, there exists a generally accepted notion of its limits. Such boundaries appear on several maps, but more importantly, are known to district level officials. Village area boundaries are similarly indeterminate, but each village head has a conception of the extent of the territory under his jurisdiction and is aware of natural and man-made boundary markers. From interviews with practically all village heads in the district, and with some extrapolation where there was incomplete agreement about village territories, it was possible to delineate approximate village areas.

Although this procedure was useful for the purpose of differentiating population densities within the district, the concept of "village area" is problematic, to say the least. Few researchers trouble to define with any degree of precision their use of the term. Within Soba District, to cite an example of potential confusion, village administrative areas were consolidated in 1972. All village heads with fewer than 200 taxpayers under their aegis were eliminated; village headships were reduced from 32 to 22. Hence, some village territories--meaning the area over which a sarki (chief) is responsible for collection of taxes, for allocation of land resources, and for adjudication of minor

disputes--changed quite considerably at that time.

The "village area" concept is frequently used to suggest the territory that is cultivated, actually or potentially, by farmers residing in the central village. Since the administrative area usually includes quite a number of outlying hamlets and medium-sized villages, the entire village area is rarely under the total control of farmers residing in the village head's place of residence, or central village. Within Soba village territory, for example, few Soba resident farmers cultivated land farther than one and one-half miles from the settlement; the extent of the administrative village area obviously went well beyond this, stretching to three miles in some directions. Within such comparatively densely settled zones, a concept such as 5,000 most accessible acres--meaning those 5,000 acres under the control of the village head which are most likely to be cultivated by resident farmers--may well be more useful than the more general "village area" concept. As will be demonstrated in a subsequent chapter, such an "accessible area" concept is less useful in sparsely populated remote villages where farmers range over a much greater territory.

Population Data

Population figures within the district are similarly troublesome. The general absence of reliability and consistency

in population data in Nigeria has already been pointed out.[1] An apparently well conducted population enumeration was carried out in September, 1973 in the district as part of the Nigerian National Census. Unfortunately, the figures from this count were quickly embroiled in national political considerations, and it is unlikely that any disaggregated information from this 1973 census will ever be publicly available. Hence, the researcher is thrown back on his own resources for population information.

Since the present project was never intended to be a purely demographic exercise, a multi-faceted approach to approximation of population data utilizing a variety of convenient sources and techniques was adopted. For two villages within the district, reliable and comprehensive population information was collected in two ways. To arrive at a reasonable estimate for Soba village, air photo interpretation of 1973 1:10,000 air photo coverage was utilized in combination with an enumeration of nearly 25 percent of village households. In Garun Gwanki village, a complete enumeration of households was conducted. Sample enumerations were carried out in several additional villages and hamlets in order to obtain information on occupants per compound and per hut. For the remainder of the villages in the district, the following steps were

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[1]That the shadow of doubt that is usually cast on population data from the district may be justified is well illustrated by the following inconsistent population totals for Soba village drawn from several sources: 1952 National Census, 4,124; 1963 National Census, 10,124 (in this census, Soba village was actually divided into four separate reporting areas).;1970 Soba District Tax Register, 30,298 (A dubious village population total of unknown origin.); 1974 estimate from the present study, 8,000.

followed:

1. A reasonable estimate based on a 2.8 percent rate of annual increase from the 1952 figures was calculated.

2. This figure was compared with tax registers from the years 1968-1974 to check for under-enumeration of households. Since no villages would contain fewer adult males than were reported in the taxpayer population, registers can at least be used as a source for base line data. As most investigators have noted, tax registers have not in the main been a very dependable source of information; they tend to be a product of the wiles of village heads and the perspicacity of district collectors. Yet analysis of these registers from Soba District did provide information which, while not totally reliable as a primary source, could serve as a check on alternate sources. Outside of Soba village itself--the residence of the District Head and consequently a village with a high percentage of taxable citizens actually paying taxes--the annual rate of increase in taxpayers from 1969 to 1974 is remarkably consistent (mean rate of increase = 3 percent). Few villages increased at a rate under 2.5 percent and few over 4 percent in taxpaying population. This comparatively high rate of increase probably reflects several factors in addition to the relatively high rate of natural population increase that pertains in the district: It reflects an increasing incentive and imperative for village heads to collect taxes from all eligible villagers under their jurisdiction, and it suggests a continuing trend of in-migration to most villages.

Another method of securing population data from these tax registers gave results consistent with previous methods. Utilizing the tax records from 1973-74, a collection period with which this researcher was familiar and which was evidently one during which pressures upon village heads to record their entire taxpaying population were considerable, a village population figure can be ascertained by employing the assumption that this recorded taxpayer population represented 18 percent of the total village population.

3. The 1963 census figures were then used as an upper estimate of mid-period population. Close scrutiny of this census for villages in Soba District tended to confirm the generally accepted view that it represents a quite considerable over-counting. The rate of annual increase between census periods varied from an unlikely 4.5 percent to an implausible 11 percent among district villages. In order to reach the population recorded in these villages in 1963, the district population would have had to maintain a 9 percent rate of annual increase.

4. All of these estimates were compared for reasonableness and consistency with the researcher's thorough familiarity with all villages in the district. A rank scale was established on the basis of censuses, tax registers, and subjective assessments as to size (refer to Table 4). In this way reasonable upper and lower limits as well as a rank ordering of village populations was determined.

Although he reports population density figures based on

TABLE 4

POPULATION AND SERVICES OF
SOBA DISTRICT VILLAGES

Rank	Village	Est. 1974 Popula-tion	1974 Tax-payers	Primary School	Periodic Market	All Season Road	Guest House	Mosques	Churches	Dispensary	Cotton Market	Concrete Wells	Walls
1	Soba	7,900	1,569	1	1	1	1	1	2	1	1	12	1
2	Turawa	7,400	1,388	1	1		1	1	1		1	4	1
3	Gimba	6,200	1,125	1	1		1	1				3	1
4	Ricifa	6,100	1,177	1			1	1		1		7	1
5	Kinkiba	4,200	833	1	1			1				5	1
6	Awai	3,800	730	1				1				5	1
7	Maigana	3,600	580	1		1	1	1	1		1	9	1
8	Kwasallo	3,500	716	1				1				1	1
9	Rahama	3,500	655	1		1	1	1	1			2	
10	Garun Gwanki	3,400	623					1			1		1
11	Matari	3,350	625		1			1			1	4	
12	Dan Wata	2,700	526	1	1		1	1				1	1
13	Sherifin Tsinta	2,500	493					1				3	
14	Yelwa	2,400	368	1		1			1			3	
15	Takalafiya	2,200	365	1				1				1	
16	Bagaldi	2,000	390				1	1	1			4	1
17	Farin Kasa	2,000	379					1				1	1
18	Marwa/ Yakasai	1,900	314					1				4	1
19	Magadda	1,800	308									6	
20	Gamagira	1,800	328		1	1		1			1	1	
21	Gurbabiya	1,700	302			1						2	
22	Bakura	1,600	282									4	
	Total	75,550	14,076	12	7	6	8	18	7	2	6	82	13

Native Authority estimates for his three study villages in Zaria province, D. W. Norman tries to circumvent many of the problems recorded here by placing reliance in his analysis on a "land-per-resident" ratio statistic. Presumably, this calculation is based on an enumeration of farming families and a survey of farmlands available to them. Hence, it is a far more reliable estimate of "population pressure" than crude and somewhat dubious population density figures. Even so, calculation of actual acreage available to farming families resident in any given village is not without its problems. In the present study, a population density figure based on the procedures outlined above was deemed to be adequate to reflect the variations that exist within the district in terms of availability and proximity of suitable farmland to village smallholders.

Methodology and Conduct of the Study

The field research upon which this thesis is based was carried out during 1973 and 1974, including actual residence in Soba District from August 1973 until August 1974. During this time a variety of techniques were employed and a range of methods utilized with a view to collecting both qualitative and quantitative information relating to the problem at hand. A more comprehensive discussion of the field techniques employed and the methods used in analysis of the data is included in the Appendices nevertheless, it is appropriate to raise several points in this regard for the sake of clarity in the succeeding chapters.

Data were collected in conjunction with five distinct sub-

divisions of the research program. The first three of these subdivisions entails a nested hierarchy in terms of detail and comprehensiveness of information. The latter two were distinct single-theme oriented studies.

1. A broad-based interviewing program was carried out in which nearly 650 heads of farming households in 15 different villages and hamlets were questioned about their farms and farming activities. Data from this series of interviews are quite comprehensive in breadth if not in depth. For all villages for which no further studies were made, information about items such as plot sizes or distances from farm to farmstead was necessarily imprecise. Actual measurements pertaining to all of these farming households and all of their farms was obviously impossible. Hence, reliance was largely upon the report of the farmer.

2. In selected villages, periodic visits for follow-up interviewing of farmers, frequently in groups rather than individually, were made and farm plots were inspected on a random basis at random intervals to check on the accuracy of survey information.

3. In two villages representing the extremes of population density in the district, Soba and Garun Gwanki, much more comprehensive information was collected spanning the entire research period. Heads of farming households were interviewed an average of three times each, at least one of which was conducted on the site of one of the farmer's plots. This more complete survey series was carried out among a nearly 50 percent sample in the larger village and a complete enumeration within the smaller.

Maps were compiled for both villages.[1]

For these villages locational and areal data is of a much higher quality than that for villages for which no maps were constructed. Regular, frequent, and systematic inspections were made of village lands, cultivated and uncultivated, infields and outfields, and individual interviews were supplemented by group interviews on a more casual basis for purposes of cross-checking information.

In addition, considerable effort was made to obtain historical information pertaining to land use in these two villages. In the case of Soba village, this consisted largely of reliance on the earlier work of Prothero as well as interviewing of older residents. For the smaller village, such information came from interpretation of earlier air photography and interviewing of village officials.

4. One aspect of the research program was directed quite narrowly towards an examination of fertilization practices on the annually cultivated farmlands of selected villages. The objective in this case was to determine the extent to which such practices could be related to the primary variables under consideration, particularly density of population. More about the manner in which this study was conducted is included in the analysis of its

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[1]The Soba village map of farmlands was constructed utilizing 1973 aerial photographs supplemented by comprehensive surveys on the ground of cropping patterns and land use. The map of Garun Gwanki, for which recent aerial photography was not available, was constructed on the basis of a plane table survey of village infield farms.

results in Chapter VI.

5. Finally, a separate study was conducted to deal with a quite narrowly focused behavioral issue that arises out of the debate presented in Chapter III. This study consisted of a survey of farmers, for the most part questioned individually but in some cases in groups, in a variety of villages and frequently in conjunction with other interviews. It forms the basis for a following chapter relating to spatial preferences of Soba District farmers.

Timing of the Study

It might be noted that this research program was conducted during a time when environmental conditions in the Sahel zone to the north of the study area were abnormal; a prolonged drought had quite severe impact on the agricultural practices and land use of that area. The study area, Soba District, was similarly subject during this time to diminished and less predictable rainfall as well as a range of secondary effects of the drought--an influx of migrant labor, an upsurge in the Fulani pastoralist population, a quite considerable rise in commodity prices, to name several of the more significant such effects.

Undoubtedly such drought-related influences were reflected to some extent in the land use observed during the study period; reference will be made to this fact at appropriate points in the

succeeding analysis.[1] Nevertheless, these influences were not so great as to obviate the conclusions that may be drawn from a comparison between this agricultural season and others in the study area. Indeed, the argument could be made that although the study year was in some ways an abnormal one, it could not be considered an aberrant time period since unpredictability and extreme fluctuation in environmental conditions are in themselves the normal condition of farming in Soba District. Such normality of "abnormality" is probably reflected in the long-term land use practices found there.

Field Identification and Measurement

The problem of precision and consistency in terminology has been raised in connection with the discussion of the "village area" concept above. Another loosely employed term is "farm". The Hausa smallholder uses the word gona (pl. gonaki), which is translated as farm, to refer to the lands he has under cultivation. But use of the word "farm" in this case gives rise to confusion for readers unfamiliar with African agricultural practice. In fact, the smallholder's "farms" usually consist of several small (frequently under one acre in the infield zone) and widely scattered

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[1] The reader who is interested in a fuller discussion of the impact of the drought, particularly in a region where its influence was quite severe, on local demography and agriculture are referred to R.H.Faulkingham and P.F. Thorbahn, "Population Dynamics and Drought: A Village in Niger," Population Studies 29 (1975), pp. 001-015.

holdings (from 200 yards to 2 miles apart). The terms "plot" or "field" convey to the non-African a better image of actual land use. Hence, in this study the term farm is used only when referring to total holding, which usually includes a number of dispersed fields. Plot and field are employed to signify a certain location or use. The former usually denotes a smaller area and the latter term a somewhat larger one or a combination of plots.

A further ambiguity pertains to the delineation of "plot" or "field" boundaries, and consequently to the measurement and tabulation of farm areas. Hausa farmers do not follow a consistent practice in this regard. In general, the farmer is aware of the boundaries of his gona although these may not always be entirely self-evident in the landscape. In the case of a field planted to the same combination of crops and surrounded by uncultivated land, no confusion exists in definition of gona. If it is held and worked by one farmer, it is considered as one field and can be located and measured fairly readily. A field on which a variety of crop combinations is growing or which is contiguous with other similar plots presents more formidable difficulties for the interviewer and the surveyor. Many Hausa farmers distinguish among their gonaki by crop combination; hence, they may consider a large field with five combinations to be five "farms" and would report the ownership of five gonaki to the interviewer. Another farmer might consider the same multi-cropped field as one gona since all are in one location and held by the same family.

In this study, contiguity is used as the primary criterion to distinguish among individual fields. Every effort is made to

assign the status of gona on the basis of contiguous holdings of a single household rather than say, crop combination. Within one field, one might expect to observe one or more intercropped combinations of plantings.

Few farmers within Soba District appear to regard land in fallow as gona unless or until the land is turned or a crop planted. Nevertheless, such land is generally considered by farmers and by village officials as a part of household farm holdings. There are obviously considerable difficulties involved in accurate measurement of fallow lands by farming households.[1] More will be made of this point in a subsequent discussion of land tenure in Soba District, but it is useful to take note of the problems presented by fallow land in farm measurement. Because of the obstacles involved, namely, the extreme difficulty in determining who holds rights over which portions of uncultivated land and where boundaries among holdings are located, fallow land outside the infield zone is specifically excluded from calculations of acreages of farm holdings in this study. The only minor exception to this practice is in the case of land which might have been fallow at the time of survey but which was known to have been cultivated later in the agricultural season.

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[1] A complete discussion of problems involved in the definition of the farm-holding unit and of the inclusion in average holding figures of fallow land is found in Hill, Rural Hausa, pp. 235-239.

CHAPTER V

POPULATION, RURAL ECONOMY, AND AGRICULTURAL SYSTEMS OF SOBA DISTRICT

In Chapter I, a range of significant features pertaining to Soba District population, rural economy, and agricultural systems was summarized by way of introduction to the thesis problem. In order to proceed with a differentiation among village land use systems in the district and to gauge the relative impact of the set of influences under consideration, a more comprehensive discussion of several of these features is in order.

The first two sections of this chapter, which deal with certain aspects of the human geography of the district and with the smallholder mode of production, are primarily intended to express the commonalities in village agricultural systems. The concluding sections, on the other hand, initiate the attempt to delineate significant differences among village systems.

Aspects of Human Geography

Ethnic Composition

The population of Soba District consists overwhelmingly of individuals who identify themselves as Hausa. In the district-wide sample of farming households, only 2 percent of the respon-

dents identified themselves as belonging to a group other than Hausa. It could be noted that because of the nature of this study, namely that it was confined to farming households, the largest portion of these non-Hausa individuals consisted of recent agricultural in-migrants from the Jos Plateau region. These and other non-Islamic or non-northern groups appear to reside primarily in the large villages situated near the main road, and are frequently associated with the presence of an institution whose origins are outside the district such as the agricultural station at Maigana. Table 4 reveals that with only two exceptions, the villages of Turawa and Bagaldi, the few Christian churches in the district--entirely the result of in-migrants rather than local conversion--are located in these highly accessible roadside villages. The other segment of this non-Hausa population, northern and Islamic individuals, are not particularly concentrated in a small number of enclaves; small numbers of Kanuri and Sayawa people, for example, can be found in scattered locations in the district.

The most highly visible non-agricultural and non-Hausa group in the district consists of Fulani and Bororo pastoralists whose livelihood comes from livestock and livestock products. Even approximate figures for the population of these migratory pastoralist groups are difficult to calculate. The 1952 census, for example, recorded 285 "cattle Fulani" in Soba District, a figure which probably represents little more than a guess. Prothero reported the presence of Fulani herders in the district at the time of his study but implies that their number was not

great because of the restrictive influence of the tsetse fly.

All indications point to a quite sizeable increase since mid-century in the numbers of Fulani pastoralists present at one time of the year or another in Soba District. This was especially true in the period 1970-1975 because of the drought conditions in more northerly regions. The number of cattle taxed in the district (the Jangali) increased from 2,643 in 1972 to 7,323 in 1973, an increase by a factor of three.[1] Furthermore, a senior veterinary officer from Samaru estimated that the Fulani population in the Zaria region had doubled during 1973 alone. Close to 1,000 adult Fulani were counted at a single peak season meeting of the Soba village periodic market in 1974. Although many of these are seasonally absent from the district, doubtless their numbers and influence has dramatically increased since mid-century.

Population and In-migration

The figure of 80,000 inhabitants was given in Chapter I as the approximate total population of the district. The suggestion was made there that at least some portion of the increase

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[1] These figures for the district cattle population are considered by no one to be an accurate tally, a nearly impossible undertaking. That they are a drastic underestimate is readily admitted by all concerned, tax collectors and taxed alike. Cattle are never actually enumerated; rather an acceptable figure is reached through estimation and bargaining. These figures are used here merely to suggest a relative increase in numbers although even the size of this increase may have been inflated somewhat because a more energetic and zealous tax collector carried out the Jangali in 1973.

in population numbers since 1950 results from in-migration to the district. The exceptional mobility of Hausas has long been recognized as an important factor in any demographic analysis of Hausaland. No precise rates of movement were established from this study, but recent arrivals, seasonal migrants, and households with origins outside the bounds of the district were frequently encountered even in the most cursory examination of villages in Soba District.

The amount of movement of people is suggested by Table 5 which records the length of time farmers in the district-wide sample claimed to have been resident in their present village. Twenty-two percent of this sample reported that they were not life-long residents of their present villages, and 17 percent had arrived within the last 20 years. This relatively high rate of movement does not necessarily imply that all of these individuals are in-migrants, however, since movement within the district--from outlying hamlets to central villages as well as in the opposite direction--is not at all uncommon.

More detailed information about several classes of in-migrants is contained in Chapters VIII and IX, but it seems evident from this survey that four types of migrants can be distinguished within the district.

1. Permanently settled agricultural in-migrants, whose number includes most of the peoples of Plateau origin noted above as well as numerous Hausas from as far away as Kano and Katsina, are present in practically all villages of any size. Except for the non-Hausa groups, their agricultural practices are generally

indistinguishable from those of long time residents. Characteristically, the impetus for the migration of these individuals comes from population pressure in the source areas, and a common pattern can be seen in the method of migration. Typically, a leading farmer will have engaged in seasonal migration for farm labor or off-season employment prior to the actual move and settlement of his family and other individuals from his home village.

2. In recent years, permanent non-agricultural settlers, typically non-Hausa in origin, have been much in evidence especially in the larger, more diversified villages. In most cases, these individuals have established small-scale businesses and shops, and it appears that many of them have come to Soba District from Zaria rather than directly from their original source areas. Chapter IX discusses this group in more detail.

3. Seasonal and temporary migrants are of widely varying types. A significant number of this group are farmers from nearby areas who have managed to lease or borrow land within the district for their own use during the agricultural season. A typical example is a farmer from Ikara, a more densely settled village area to the north of Soba District, who has holdings there as well as in the vicinity of Soba village and who returns to his home village each dry season. Others in this category of migrants are present in the district only during the dry season and consist largely of itinerent traders and craftsmen who seek to cin rani, or earn a living by an alternate means during the slack season. The group

of clay pot manufacturers from Kano who have been arriving in Soba village every dry season in recent memory are another example of this category. Finally, a large number of the pastoralists, but by no means all of them, could be considered as part of the seasonal in-migrant class. The evidence suggests that most of the Fulani are absent from the district at least for short periods of the year.

4. Drought-related migrants, which include cases of all of the above types, were the most prominent category of new residents in the district in 1973-74. Hundreds of families from the Sokoto and Katsina regions, as well as from the Niger Republic, sought refuge in the district. Many of these individuals secured farmland or, in at least one instance, established pioneer villages.

Although many Soba District inhabitants similarly engage in seasonal migrations or are drawn to nearby urban areas in search of non-agricultural means of livelihood, it appears that the district is still a net importer of people. No effort was made in this study to calculate precisely the numbers of residents who had migrated to urban areas. Certainly their number is quite substantial, but no such thing as a rural exodus could be said to exist in the district. Quite the contrary is true. The fact that the district appears to be a reception area suggests that district and village level authorities, who in nearly all cases welcomed in-migrants and made it possible for them to acquire land, did not perceive any degree of population pressure on resources in the district. Certainly important local varia-

TABLE 5

MIGRATION STATUS OF
SOBA DISTRICT FARMERS

Category	Frequency	Percent	
Lifelong Resident	507	78	
In-migrant (more than 20 years ago)	32	5	22
In-migrant (6-19 years ago)	52	8	
Recent Arrival (5 years)	59	9	
Total	650	100	

TABLE 6

ESTIMATED DISTRIBUTION OF POPULATION
BY SETTLEMENT TYPE, SOBA DISTRICT

Type of Settlement	Number in District	Estimated Population	Percent
Gari	13	23,000	30
Large Village (over 1,000)	23	14,000	19
Unguwa	62	31,000	41
Kauye (hamlet)	148	7,550	10
Total		75,550	100

tions in this respect do exist; indeed, this forms a central focus of subsequent chapters. Yet no village in the district has shown any evidence of a desire to reduce the rate of flow or numbers of in-migrants.

Type and Distribution of Settlements

The dominant pattern and type of settlement within the district is related to cultural and historical factors, namely a preference for and imperative to cluster dwellings in defensible positions. As elsewhere in Hausaland, nucleated villages composed of dense clusters of family compounds, each of which contains individual huts or rooms enclosed by a wall, are the rule. As is also the case elsewhere, some measure of dispersion appears to have taken place in recent decades, and isolated groupings of a few compounds under the dominance of a single patriarch (dispersed hamlets) are not at all uncommon. Usually only non-Hausa families can be found to reside in the comparatively few isolated, dispersed farmsteads that exist in the district.

There are four types of settlements that can be distinguished, and the relative importance of each type is indicated on Table 6. All but one of the thirteen old walled villages or gari (pl. garuruwa) are located in the northern sector of the district and many of these are within a fifteen mile radius of Zaria. With only two exceptions, Garun Gwanki and Yakasai, all of these gari are large villages with in excess of 1,000 inhabitants; at least five of these probably surpass 2,000 in popula-

tion. Nearly 30 percent of the district's inhabitants reside in these old towns, and another 19 percent inhabit the 23 other large villages in the district. Hence, nearly half of the district's inhabitants are concentrated in its 33 large villages.

Interestingly enough, Table 6 indicates that the next largest proportion of the district's population resides in smaller hamlets of less than 1,000 residents each. These numerous unguwa are typically peripheral hamlets under the administration of a central village head. They are well dispersed throughout the district although there is a comparably greater concentration of unguwa in the northern sector. As Table 7 is intended to illustrate, the range in size among these satellite hamlets can be quite broad (from fewer than 100 to over 500 inhabitants), but many appear to have been of relatively recent origin and have experienced rapid growth since mid-century. Moreover, it is common for an unguwa to serve a specialized function--as a religious center, a craft center, or a slaughtering station--or to be the result of the personality of a single influential individual.

It is estimated that close to 90 percent of the district's populace, then, live in clustered settlements most of which are fairly sizeable. Only 10 percent live in isolated, dispersed dwellings or in clusters of fewer than four compounds. The latter small settlements (kauye) are also well distributed throughout the district. There is contradictory evidence pertaining to the question of whether or not their number is increasing. Examples of the abandonment of isolated compounds and movement toward larger settlements occur as do comparable examples of the opposite

TABLE 7

POPULATION AND ORIGIN OF SELECTED HAMLETS, SOBA DISTRICT

Hamlet[1]	Estimated Population	Estimated Date of Establishment	Origin
Unguwan Pumpu	150	1945	Site of former watering point for railway
Unguwan Limam Yelwa	100	1940	Hamlet head migrated from site of forest reserve
Unguwar Mallam Dogo	400	1910	In-migration of influential religious leader
Unguwar Darho Mahauta	50	1950	Out-migration from Soba village; specialized function: butchering
Unguwan Madaki	300	n.a.	Out-migration from Soba village; specialized function: blacksmithing

[1]A hamlet or village near a town is designated an Unguwa. The variety in endings in this list is related to masculine and feminine forms.

character, namely the establishment of new kauye especially in the vicinity of the main road. While it might be speculated that an increasing level of amenities and services found in larger villages would spur an exodus from remote, dispersed kauye, it appears to be equally true that a commensurate increase in the ease of access to remote sectors of the district makes the abundant farmlands available there all the more attractive to enterprising farmers.

Two observations relating to village agricultural land use can be made concerning this predominant mode of settlement in Soba District. In the first place, it is apparent that the initial siting decision of these nucleated settlements in relation to micro-topography shapes future land utilization to a very great degree. Characteristically, non-roadside settlements are sited at a mid-slope location within a mile or so of a stream and its associated fadama. Such a siting provides for maximum utilization of and expansion onto favorable mid-and down-slope soils in the immediate village environs. A more detailed examination of this siting factor in relation to land use is taken up with the case presented in Chapter VIII.

Secondly, the clustered nature of the dwellings provides maximum opportunity for the accumulation and temporary storage of rubbish and organic materials. A highly dispersed settlement pattern would not foster such collection of potential fertilizer materials. This point will be taken up in the following chapter.

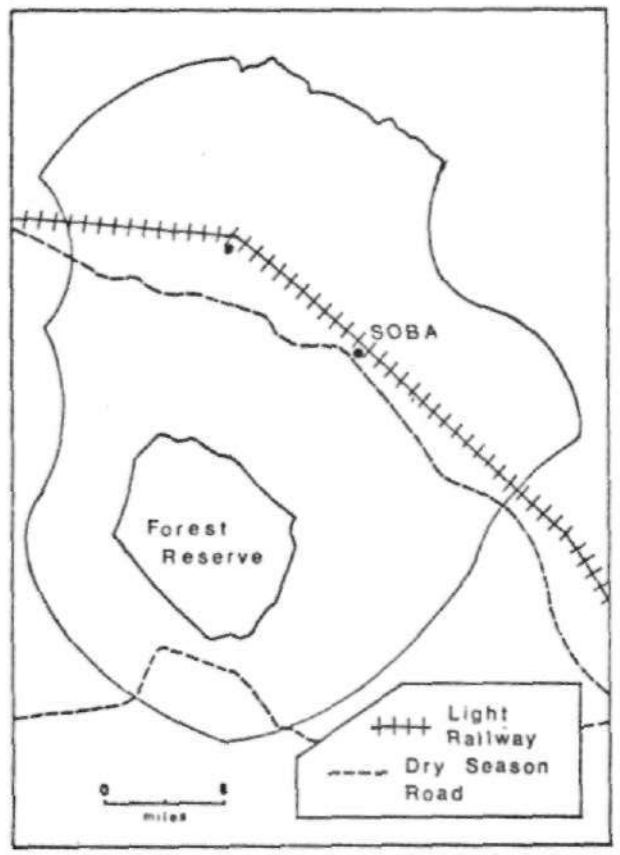
The Transportation Network

Several references have been made to changes in the transportation network within the district since 1950, notably the supplanting of the light railway by a graded, hard-surfaced roadway as the primary transportation artery. An additional improvement in connectivity among villages and hamlets during this same period is worthy of note. As the contrasting Maps 4 and 5 indicate, numerous motorable links have been established with outlying villages in recent years, and a true network, rather than merely a single linear pathway, is beginning to emerge. The extremely complex network of footpaths that covers the whole of the district has long been used by bicycles, and more recently by motorcycles, but the tracks indicated on Map 5 have been upgraded for use during the dry season by heavy vehicles. The consequent increase in accessibility of outlying villages has been not inconsiderable; in most cases, several trucks or mini-buses ply these tracks daily as long as they are passable.

Smallholder Agricultural Production

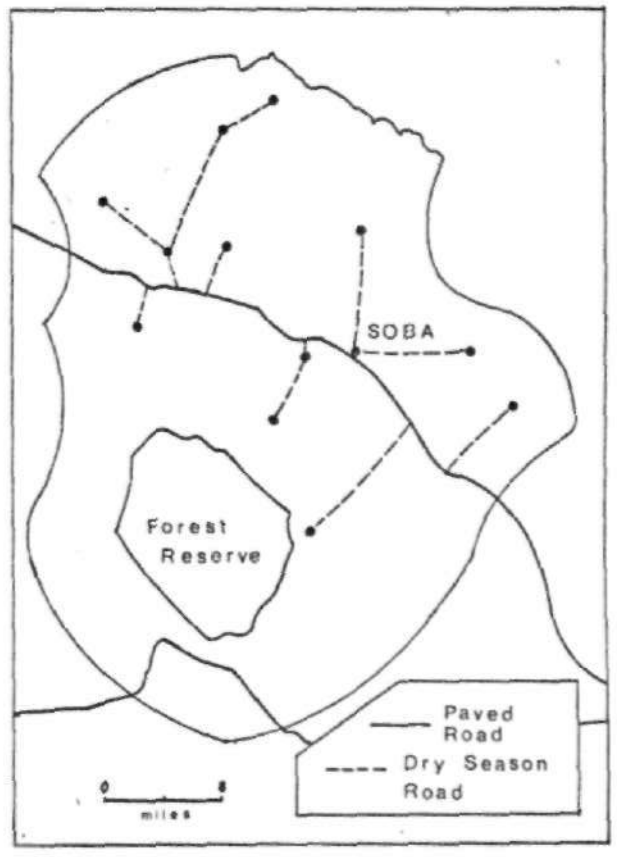
As is typically the case in traditional agricultural systems, the smallholder mode of production dominates in Soba District. Although there are a number of large absentee landholders within the district who depend on hired labor and occasionally employ tractors or cattle-drawn plows for cultivation, the techniques of production used on these large holdings do not,

SOBA DISTRICT TRANSPORTATION NETWORK



1950

Map 4



1975

Map 5

for the most part, vary from those used by the majority smallholder population. The dramatic upsurge in mechanized farming of large fields by entreprenurial farmers that was in evidence in the sector of the district in proximity to Zaria probably betokens a coming trend in agricultural production. Nevertheless, at present and for the foreseable future such large scale farm organization is the exception in the private sector.

Hill has made a strong case to demonstrate that a considerable degree of heterogeneity exists among smallholders in Batagarawa. Although no comparable analysis was made in this study area, it appears that her arguments apply equally in Soba District. Therefore, any attempt to construct a typical smallholder profile is bound to conceal the quite significant variation that occurs among farming households. In Chapter IX, for example, one special category of smallholder, the managerial farmer, is singled out for further scrutiny. Nevertheless, it is useful to present several mean figures pertaining to Soba District smallholders in order to characterize more fully the type of farming population under investigation.

Tables 8 and 9 record the estimated ages and educational levels of smallholders from the district-wide sample. The median reported age of a male household head was 35 years; 62 percent of the respondents considered themselves to be between the ages of 21 and 40. Very few of these smallholders had had any primary education or beyond; 91 percent had at least several years of Koranic schooling, a figure that is not surprising in view of the large number of Koranic teachers and schools in the district.

TABLE 8

REPORTED AGE OF SOBA
DISTRICT FARMERS (N=650)

Age Range	Percentage	
15-20	5	
21-30	32	
31-40	30	
41-50	17	mean = 39
51-60	10	median = 35
61-70	4	mode = 30
71-80	2	
Total	100	

TABLE 9

FORMAL EDUCATION OF SOBA
DISTRICT FARMERS (N=650)

Education	Percentage
No Formal Education	4
Koranic Schooling	91
Adult Education	3
Some Primary Education	1
Primary Completed/ Secondary Education	1
Total	100

land are occasionally encountered.

Other farm implements commonly employed are the maigirbi, a small version of the fartanya used primarily for harvesting, the lauje, a small-handled sickle with a 6-8 inch blade, and the gatari, or ax.[1] The blades for these implements are fashioned and repaired locally by blacksmiths from scrap sheet metal. Their wooden handles are usually carved by local craftsmen or farmers in search of extra income.

The cultivation practices of smallholders reflect the reliance on these simple hand tools. With the exception of several crop-specific cultivation techniques such as those used for tobacco or yam production, the most widespread field preparation method is ridge and furrow cultivation. Cultivation is accomplished by two primary methods, each of which is associated with--but by no means exclusively practiced on--the respective types of upland land use, infield and outfield. In the case of a field which has been in use for several years, a time saving method is frequently used. Scoops of earth from the previous year's ridges are removed and deposited in the previous year's furrows; seeds are then planted in this loose pile of earth. After the seeds have germinated and reached a height of 4 to 6 inches, the old

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[1] An interesting discussion of these farm implements as durable capital goods can be found in Norman, Economic Survey in Zaria Province, pp. 42-47. See also the section on farm tools in Hill, Rural Hausa, p. 242.

ridges are broken down and new ones built up around the young plants. The other cultivation technique, initially more laborious, is used on newly opened ground as well as on older plots. In this case, a garma is used to construct substantial size ridges, in an operation known as bangaje, ideally but not always where the previous year's furrows were located. Seeds are then sown directly in the new ridges.[1]

Crop Enterprises

The agricultural calendar shown in Figure 4 gives an indication of the variety of farming operations that must be carried out by the smallholder during the year. As is implied by this calendar, labor allocation, in the light of the time limits imposed by rainfall distribution and the moisture requirements of his crops, is a critical matter for the small farmer.[2] Diversification of his production--thus spreading out the demands on his labor supply as well as minimizing chances for major loss--appears

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[1] The assets and liabilities of ridge and furrow cultivation methods are discussed in J. Kowal and K. Stockinger, "Usefulness of Ridge Cultivation in Nigerian Agriculture," The Journal of Soil and Water Conservation 28 (May-June 1973), pp. 136-137.

[2] A large body of literature pertaining to the topic of labor allocation strategies of traditional agriculturalists can be found. One example relating to Hausa farmers contains an analysis of monthly labor distributions as well as of the critical June-July "bottleneck" period. See D.W. Norman, "Labor Inputs of Farmers: a case study of the Zaria Province of the North Central State of Nigeria," The Nigerian Journal of Economic and Social Studies 10-11 (1968-69), pp. 8-10.

While there is admittedly great variation in economic levels among district smallholders, these figures indicate that educational levels do not vary sharply.

Agricultural Practices

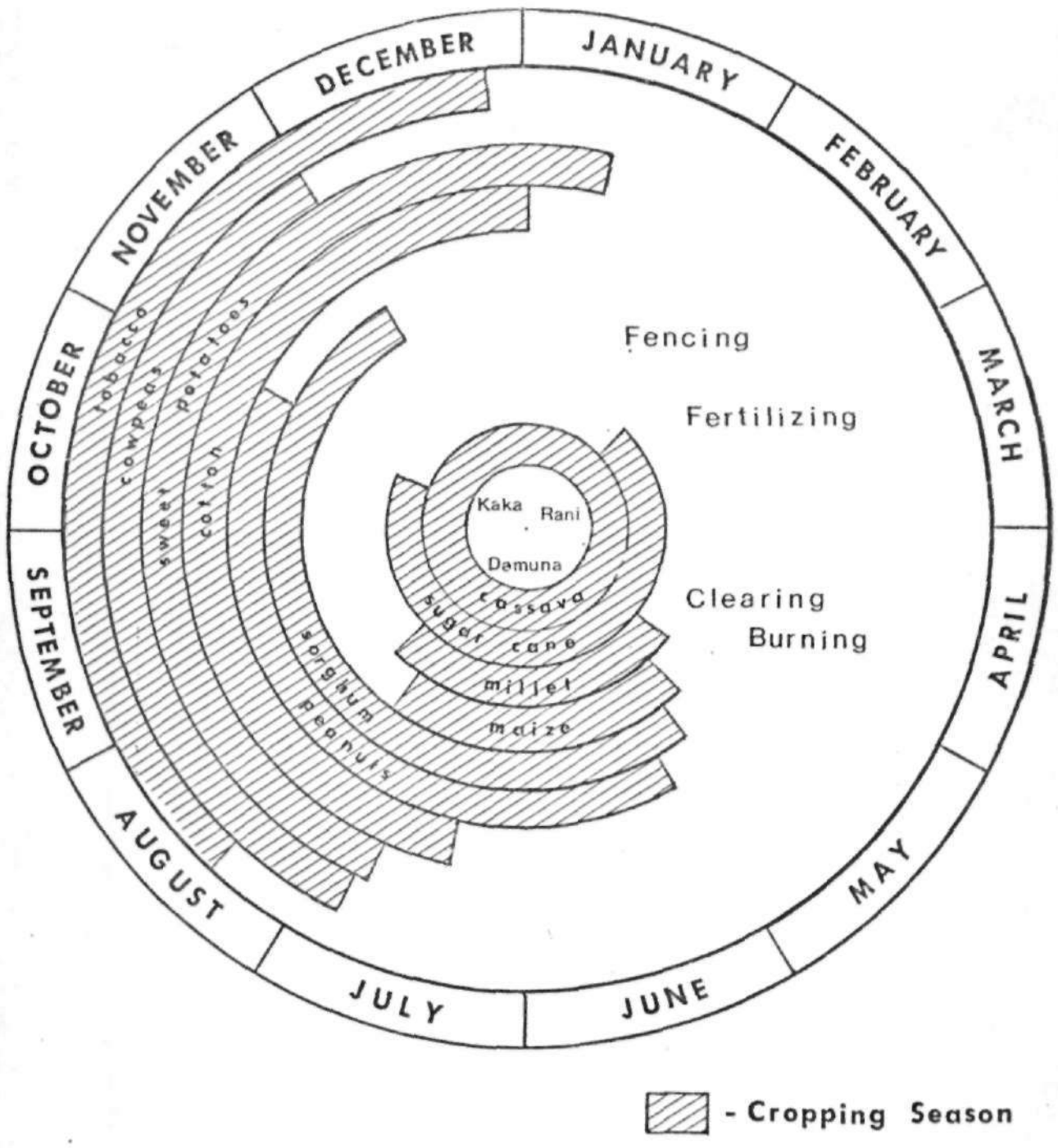
The deceptively simple cultivation techniques and practices followed by farmers in the district, which actually represent decades of refinement and adjustment to local conditions, are based almost entirely on human labor and short-handled hoes. The incidence of mechanized farming outside the bounds of the agricultural station at Maigana is small and largely confined to the non-smallholder realm. Only one example of the use of an ox-drawn plow, which has been received with much success elsewhere in Hausaland, was found in the district.

Practically all farming households possess two basic types of hoes, the fundamental farm implements. The garma (galma) is a heavy, long-curved-bladed hoe used for initial plowing or ridging operations. The fartanya, with a flat triangular blade that varies in size and shape depending on the specific purpose for which it is intended, is a multipurpose short-handled hoe employed for weeding, planting, or harvesting peanuts. Only 0.5 percent of the sampled households claimed not to have immediate access to both of these tools in their own compound.

A point to note in relation to these tools is that the varieties in construction and shape are related to variations in soils. While the two types described above dominate in Soba District, other varieties originating in other sub-regions of Hausa-

FIGURE 4

AGRICULTURAL CALENDAR
SOBA DISTRICT



to be a widespread response to such constraints. There is also the suggestion in this calendar that few farmers specialize in any single type of crop production. A small number of individuals specialize in the production of minor crops such as vegetables, but almost all smallholders grow all of the major staple crops. Farmers who produce tobacco, onions or yams, for example, also grow a variety of cereals as well.

The varieties of non-tree crops found in Soba District are listed on Table 10. It should be recalled that few of these crops are ever planted in sole stands. The technique known as inter-cropping, in which standard mixtures of from two to six varieties are grown in a single field concurrently, is widely practiced. Examples of common mixtures are included in later chapters.[1] Multiple cropping, in which two or more crops are grown in succession on a single plot during the same season, is another intensive technique frequently employed.

Cereals

The office of the Soba District Head estimated that 55 percent of the cultivated acreage of the district was devoted to the production of staple cereal food crops, especially millet and sorghum. Obviously the present study included no effort to reach a comprehensive breakdown of district-wide food production, but

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[1] Intercropping is discussed at length in D.W. Norman, Crop Mixtures under Indigenous Conditions in the Northern Part of Nigeria (Zaria: Institute for Agricultural Research, Samaru Research Bulletin 205, 1974).

Table 10

CROP VARIETIES IN SOBA DISTRICT

Class	Varieties	
Cereals	Early millet Late millet Sorghum	Maize (corn) Rice Ibaru
Legumes	Peanuts (groundnuts) Black-eyed peas (cowpeas)	Bambara nuts
Starchy roots and tubers	Cassava Yams Cocoyams	Sweet Potatoes (Hausa potatoes)
Vegetables	Okra Peppers Onions Tomatoes	Garden Eggs Pumpkins Squash
Sugar	Sugar cane	
Non-food and fibre	Tobacco Cotton Deccan Hemp	Henna Gourds Loofa vines
Fruit tree crops	Citrus (lemon, orange, lime) Mango	Banana Paw-paw

partial information from the several villages studied more closely suggests that the District Head's estimate may be fairly close to the mark, although the total may actually reach as high as 60 to 65 percent.

There seems to be no doubt that production of millet and sorghum--and increasingly of maize--is the foremost priority of the smallholder; with few exceptions, all other aspects of his production are secondary. To focus on non-food or export crops in an analysis of Hausa farming, as has so frequently been done in the past, gives a distorted view of smallholder production. In Soba District, for example, cotton is generally planted later than would be maximally productive simply because the farmer prefers to tend to his food crops first. As will be seen, non-staple agricultural production may have never surpassed the production of locally consumed foodstuffs in the district as a whole and, given the increasingly favorable comparative advantage of food crops, probably never will in this area.

Cotton

The Zaria region has long been a major cotton-producing sector of northern Nigeria. It occupies an estimated 20 percent of the cultivated acreage of the district, second only to the major food grains. As Figure 6 shows, however, cotton purchases from Soba District have fallen off in recent years. Reasons for this relative decline in production will be suggested in the following village studies.

Tobacco

Figure 5 illustrates a quite dramatic upturn in tobacco production in the district that has occurred since 1970, largely due to the extension efforts of the tobacco companies with headquarters in nearby Zaria. By 1975, nearly 75 percent of the tobacco production of North Central State was grown in Soba District. Additional explanations for the growth of tobacco production are included in subsequent sections of this study.

Crop Storage and Marketing

The distinction between "subsistence" and "commercial" production is not one which is given particular attention in this study of Soba District.[1] The question of what proportion of the smallholder's production is for his own use and what share enters the market is not at issue here. It seems clear that there are extremely few smallholders in the district who do not sell at least a portion of their output, food and non-food crops alike. Beyond this, however, the variation in practices is great--from farmers who sell only to meet emergency needs to farmers whose entire output enters the marketplace. Hence, conclusions about "the degree of commercialization" of villages are not easy to reach. The simplest way of viewing the problem is to realize, as Hill points out, that everything in a Hausa village has a cash value.

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[1] Hill's arguments pertaining to the merits of the "cash" and "subsistence" dichotomy are persuasive and apply equally well in Soba District. She suggests that the distinction has little meaning in contemporary Hausaland and is not a particularly useful way of approaching rural economies. Hill, Rural Hausa, pp. 26-31.

FIGURE 5
TOBACCO PURCHASES, SOBA DISTRICT

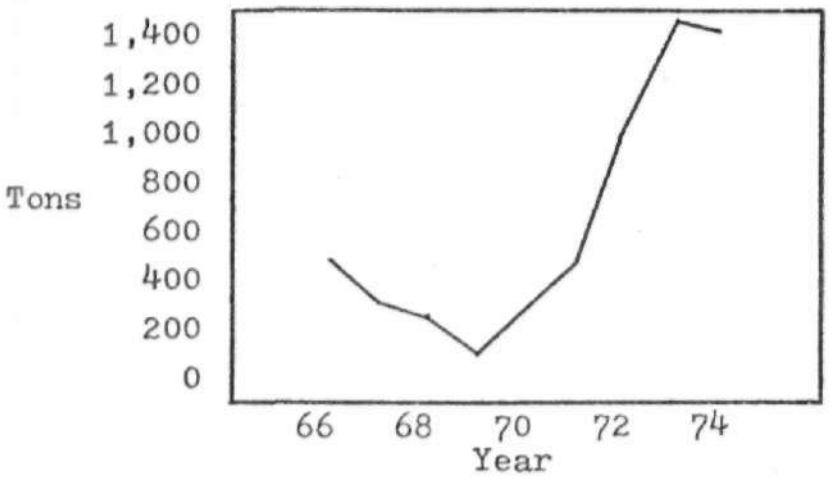


FIGURE 6
COTTON PURCHASES, SOBA DISTRICT

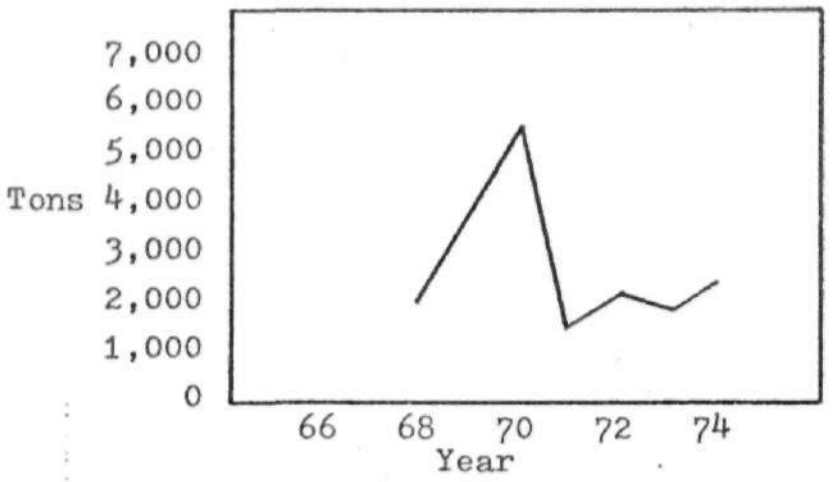
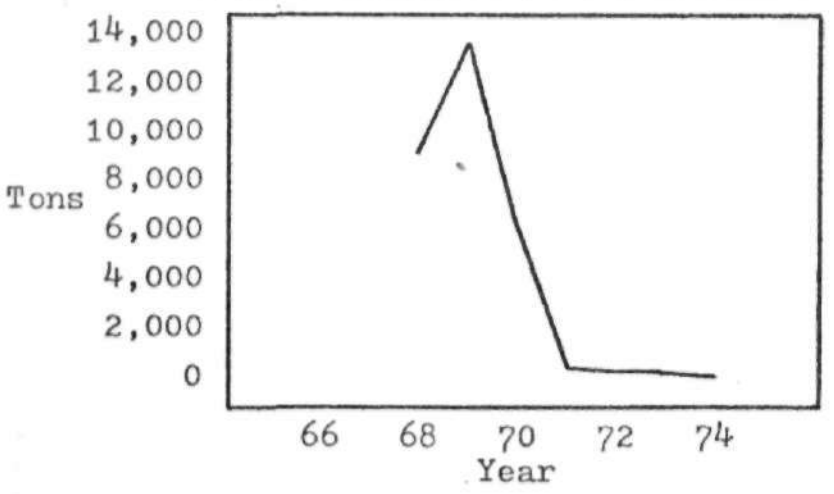


FIGURE 7
PEANUT PURCHASES, SOBA DISTRICT



Grain production is customarily stored after harvest as unthreshed bundles in specially designed mud and thatch granaries (rumbu, pl. rumbuna). These rumbuna are a prominent feature of most older compounds; newer dwellings frequently include a special room for storage purposes. Millet and sorghum are frequently threshed in the field at the harvest and immediately bagged for sale. Maize is usually dried and stored in bags as loose kernels. The most important point regarding storage to be made here is that the smallholder is largely responsible, not only for the production, but also for the storage, processing, marketing, and distribution of most food supplied in Soba District.

Agricultural commodities such as cotton and peanuts, on the other hand, are marketed via governmental agencies, in this case the Northern States Marketing Board. With respect to cotton, seven seasonal buying stations are established each year in the district following the harvest in January. Farmers transport large sacks of cotton (350-400 lbs.) via donkey to these semi-permanent structures to be graded, weighed, and purchased by authorized buying agents. These agents in turn standardize the bag weights and transport the cotton to Zaria for ginning. A small portion of the production is retained in villages for local spinning and weaving industries.

Peanut production is similarly purchased from smallholders by licenced buying agents. As Figure 7 illustrates, problems have arisen in this regard when posted prices for a commodity fall below levels in local markets. As is revealed in this graph, the official purchase of peanuts from Soba District fell from 13,000

tons in 1968 to almost none in 1974 simply because the smallholder could get double the return in local markets. The Northern States Marketing Board took steps in 1975 to correct this discrepancy and to deal with farmers' complaints behind low cotton production figures by raising producer prices for these two commodities.[1] Nevertheless, the comparative advantage and profitability of food grain and tobacco production remained formative.

Livestock

Large scale livestock rearing does not form a major component in most smallholder's production systems. Nearly half of the sampled farm households reported that no livestock other than chickens or fowl were present in their compound (see Table 11). Another 40 percent, however, claimed ownership of a small number of sheep and/or goats. As is suggested by this same table, donkey ownership appears to be confined to a relatively small number of households since, in many cases, it represents a specialized occupation. Cattle and horse ownership, in contrast to holding small livestock, is not at all widespread and is typically asso-

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[1] N.S.M.B. prices for peanuts were raised from 94.25 naira (U.S. $141.38) per ton to 165.00 naira (U.S. $247.50) per ton in 1975. Grade I cotton purchase prices were similarly increased from 134.50 naira (U.S. $201.75) per ton to 201.60 naira (U.S. $302.10) per ton. Nevertheless, at 1975 prices and production levels, a farmer could expect a return of approximately 14.00 naira (U.S. $21.00) per acre from sorghum as opposed to only 6.00 naira (U.S. $9.00) per acre from cotton.

TABLE 11

LIVESTOCK OWNERSHIP, SOBA DISTRICT

Type of Animal	Percentage	Average Per Household
No livestock or fowl only	49	--
Small livestock (sheep, goats)	40	4
Donkeys or Horses	4	1
Cattle	7	n.a.
Total	100	--

TABLE 12

COMPOSITION OF FARM HOLDINGS BY LAND USE TYPE, SOBA DISTRICT

Land Use Type	Number of separate fields 0	1	2	3	4	5	6	7	8	9	(Percentage) Total
Infield	15	26	33	15	5	4	1	.5	.5	0	100
Outfield	14	24	42	14	3	2	.5	0	0	.5	100
Fadama	53	27	11	4	4	.5	.5	0	0	0	100

ciated with wealthy or prestigious farmers.

Village Agricultural Systems

Thus far, the introductory presentation of Soba District has focused on the smallholder as the basic unit of production in agriculture. For the sake of the argument to be pursued in this study, it is appropriate at this point to transpose the terms of the discussion somewhat and to consider smallholder production in the context of the village within which the farmer resides. In this way, certain telling differences among smallholder production systems and land use begin to emerge. A number of important characteristics of Soba District land use remain to be presented, but these will be aggregated into village level units in order to be discussed in the light of land use interpretations presented in Chapter III. Certain key indicators of variation among village systems will be presented in this section with some attempt at relating these to demographic factors. The emphasis in this section, in contrast to the one preceding it, is on dissimilarities among village agricultural systems.

Land Use and Land Holdings

The three types of land delineated in Chapter III form the basic elements of Soba District village agricultural systems: upland infield, upland outfield, and fadama. All villages and hamlets visited in the district, regardless of location or population size, maintained farmland in each of the first two categories, and nearly all of these settlements cultivated fadama as

well.[1]

Among the sampled households, the modal farmer held two fields within the infield zone, two in the outfield zone, but no fadama plots. Nonetheless, 53 percent of these respondents did engage in fadama farming. This latter observation is suggestive of the fact that variations in the composition of farm holdings can be quite significant. As Table 12 indicates, the composition of household holdings ranged from 0 to 9 fields of each type. Since these figures pertain to the number of separate fields, not to the acreage involved, it is difficult to make judgements from this table about the relative importance of each type in each village sampled. Nonetheless, an association between the composition of farm holdings--in terms of proportions of infield to outfield farms--and density of settlement of the farmer's village area seemed to be indicated in these findings, an association which will be explored more fully in later chapters.

While all three types of land use can be found in nearly all district villages, the relative proportion of each can vary considerably from village to village. Hence, it is not merely the presence or absence of infield land use which is important; its relative extent in comparison to outfield acreage frequently reveals striking differences among village agro-ecosystems.

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[1] As was observed in Chapter III, Hill makes much of the observation, supported by this study of Soba District, that infield farming is typically found in all Hausa villages regardless of size or population density. She interprets this as showing a distinct preference for infield farming, a suggestion which will be taken up in succeeding chapters.

Again, the indications are that differences in population densities account, at least in part, for differences in relative proportions of each type. The extent to which fadama cultivation is practiced, it must be added, appears to be similarly associated with population variables, but is obviously not exclusively a function of non-environmental factors.

The following four chapters will further examine the proposition that, at least in part, variation among district agricultural systems is best viewed in the light of differences in population density. It is possible to distinguish certain features of village farming systems which are characteristic of low density areas and others which are typical of more densely settled village areas. Before proceeding to this analysis, however, several additional characteristics remain to be presented, and a number of obvious exceptions to the general rule need to be discussed.

Domestic Organization and Farm Labor

As is generally the case in predominantly agricultural societies, the family has remained the primary unit of organization for agricultural activity. Goddard reports that:

> The nucleus of most rural Hausa households is the conjugal family (iyali, pl. iyalai) comprising a man, his wife or wives, and children. Residence is virilocal, and it is common for more than one conjugal family to inhabit a compound, together with other dependents. The family unit, which is the significant economic group, does not necessarily inhabit one compound. Persons within one compound may comprise

> separate farming units, while those living in separate compounds may still combine together [for agricultural activities].[1]

The mean size of a farming household in the sample from Soba District was calculated to be 7.8 while the modal class for this measure was 5. This average family size accords well with those observed elsewhere in Hausaland and is close to that reported by Norman for the Zaria region.[2] It also supports the widespread suggestion that large family groups are on the decline in rural Hausaland.

There are two types of family farming units that can be distinguished in the district as elsewhere in Hausaland. In simple farming units, usually comprised by a single iyali, family fields are held by a male adult who performs most of the agricultural labor by himself with or without the help of minors or hired laborers. Complex farming units, called gandu (pl. gandaye), generally include two or more iyali and represent an old institution for domestic organization in Hausaland. Buntjer defines the gandu as "an economic work unit in which two or more male adults, usually married, cooperate to secure an income, normally from a farm." Hill adds that the gandu is a "voluntary, mutually advantageous agreement" in which a son normally works in a subordinate

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[1] A.D. Goddard, Changing Family Structures among the Rural Hausa (Zaria: Institute for Agricultural Research, Samaru Research Bulletin 196, 1973), p. 207.

[2] Farming household was defined by a measure used successfully, it appears, by researchers at the Institute for Agricultural Research, Zaria, namely "suna ci daga tukunya daya" or those who eat from the same pot. See Norman, Economic Survey of Zaria Province, p. 19.

capacity on his father's farms for a great variety of benefits including a share in the food supplies.[1]

Within the gandu, which may be either paternal or fraternal depending on the relationship of its members, certain well specified rights and obligations accrue to each member. In general, the decision-making function resides in the senior member. Other members work in cooperation on common farms in return for which they are provided with dwellings, a certain amount of food, taxes, marriage and childbirth expenses, as well as agricultural supplies. Subordinate members usually have personal farmland as well and are alloted specific times of the week to work on them. The relationships within the gandu can be quite complex, especially in the now relatively rare instances where three generations are involved.

As was noted above, the evidence from Soba District is consistent with findings from other regions of Hausaland which suggest that large and complex family farming units so common in the past are now the exception. The most numerous production unit observed in this study was the male adult with his family. As Table 13 illustrates, the largest number of farming units were organized as simple iyali. Fifty-six percent of the sampled

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[1] B.J. Buntjer, Rural Society in the Zaria Area: the changing structure of gandu (Zaria: Institute for Agricultural Research, Samaru Research Bulletin 180, 1973); Hill, Rural Hausa, pp. 38-56; see also Goddard, Changing Family Structures. An additional recent source pertaining to rights and obligations of gandu members is M.G. Smith, "Hausa Inheritance and Succession" in Studies in the Laws of Succession in Nigeria, J.D.M. Derrett, ed. (Oxford: Oxford University Press, 1965), pp. 247-251.

smallholders were not members of gandu, and 44 percent claimed to be the sole family member who worked on the household farms. On the other hand, the 44 percent rate of incidence of the gandu reported here does represent a somewhat higher figure than that found in other nearby areas.

Suggestions have been made that, for a variety of reasons, the occurence of the gandu is related to the density of population in villages. This observation appears to be borne out in Soba District where, as will be seen, the incidence of gandu rises in sparsely settled villages and falls in the heavily populated sectors. The suggestion is that rising densities of population frequently spur a substitution of individual effort for communal organization. As Table 13 illustrates, the relative frequency of complex versus simple farming units shares a strong association with village population density. This aspect of smallholder production systems, in sum, provides one of several initial measures of differentiation among village agricultural systems.

Land Tenure

Land holding practices and tenure arrangements are a related aspect of smallholder production in the district which appear to have moved in the direction of individual rather than communal control under the influence of increasing densities of

TABLE 13

ORGANIZATION OF FAMILY FARMING UNITS, SOBA DISTRICT

Type of Unit	Percentage of Total			
	Sparsely Populated	Medium Populated	Densely Populated	Total
Simple (Iyali)	4	15	37	56
Complex (Gandu)				
1-2 members	8	6	15	29
3-4 members	3	1	9	13
5+ members	1	1	-	2
Total	16	23	61	100

TABLE 14

SECONDARY AND OFF-SEASON OCCUPATIONS, SOBA DISTRICT

Category	Percentage of total			
	Sparsely Populated	Medium Populated	Densely Populated	Total
No non-farm Occupation	10	13	25	48
Secondary Occupation, Dry Season Only	2	7	5.5	14.5
Year-round Secondary Occupation	5	8	24	37
Salaried Occupation	-	-	.5	.5
Total	17	28	55	100

population.[1] Land in Soba District, as elsewhere in Hausaland, has traditionally been a communal asset; smallholders have had only usufructuary rights as allocated by village and hamlet heads. Traditional concepts of communal tenure, however, have been modified by Islamic land law, which recognizes absolute individual rights, and by contemporary concepts of freehold tenure with the possibility of alienation of land.

In the past, the village head maintained complete control over village farmlands. Land was allocated to residents or new settlers largely on the basis of need but reverted to community control if the cultivator left the village or if the plot lay in fallow beyond a certain number of years. Family rights to land under their cultivation, however, have long been recognized, and fields have normally been transferred to the heirs of a smallholder at his death.

In recent decades in Soba District, an obvious trend toward individualization of control over land has been in evidence. Of course, since the transfer of farmlands within a family by inheritance has long been standard practice, individual claims on land are not totally new. Moreover, farm boundaries, especially

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[1] An extensive literature exists on the extremely complex topic of land tenure in Hausaland. The discussion in this section draws primarily from the following sources: I.A. Bijimi, "Report on parts of Zaria Province," Traditional Land Tenure Surveys, ed., J.R.N. Marshall (Zaria: Institute of Administration, 1965); Kenneth H. Parsons, Customary Land Tenure and the Development of African Agriculture (Madison: Land Tenure Center, 1971); A.D. Goddard, "Land Tenure, Land Holding, and Agricultural Development in the Central Sokoto Close-settled Zone, Nigeria," Savanna 1 (June 1972): pp. 29-41.

within the infield zone, have long shown a high degree of permanency; trees, shrubs, and drainage canals have customarily been used to mark these boundaries. Nevertheless, it has only been in the relatively recent past that land has become a transferable economic commodity, at least in this district.[1] The impetus for individualization came initially from the common practice of "loaning" fadama plots to seasonal migrant farmers, although it is likely that, until recently, even these fadama rentals were under the control of the village head. It was probably in connection with these fadama rentals that cash payments rather than payments in kind were introduced.

It should be pointed out that this trend toward individualization of tenure is not necessarily to be equated with Western concepts of freehold. Examples of extremely complicated tenure arrangements are common. Productive trees, for example, are often not transferred with the sale of a plot of farmland. The confusion that attends "loan" arrangements is suggested by the fact that a single term, aro, is used to cover a variety of agreements from sharecropping to formal leases. Loan payments are frequently only tokens or acknowledgements of a debt rather than actual lease agreements based on the value of the land. Very similar payments are regularly made for land which has been received as an outright gift. Land allocated to non-Hausa inmigrants for their homes, moreover, was considered by both parties as a gift; nevertheless, they were expected to return

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[1] For a more complete summary of the history of individualized tenure in other regions of Hausaland, see Goddard, "Land Tenure in Sokoto".

this land to the control of the community if they left the area.

At present, farm rentals, loans, and outright sales are commonplace in Soba District. As might be expected, these individualized land transactions are most common in the densely settled sectors of the district; this association will be investigated somewhat further in coming chapters. It appears that, in general, the incidence of farm sales serves as another excellent indicator of differences in village farming systems.

Unlike the loan and leasing agreements commonly found in the district, the sale price of farmlands appeared to bear a strong relationship to the value of a plot based on location and potential productivity. Based on a relatively small sample of such sales, it appears that, as might be expected, fadama plots were most highly valued and most likely to be transferred by purchase. The average price per acre for fadama plots in this sample was 40.00 naira (U.S. $60.00) as compared to 20.00 naira (U.S. $30.00) per acre for upland infield and 12.00 naira (U.S. $18.00) for upland outfield farms. Of course, fadama plots are rarely sold as full-acre plots, whereas farms in the other two categories are frequently in excess of an acre. The fact that examples of land sales from all three categories are relatively common in certain villages should not be overlooked.

Secondary and Off-season Occupations

Reference was made at the outset to the quite elaborate system of secondary and off-season occupations that can be found among Hausa farmers. Soba District is no exception in this re-

gard. Fifty-two percent of the respondents in the district-wide survey reported that they engaged in a secondary occupation at some time of the year (see Table 14). Of these, 37 percent practiced a trade or craft on a year-round basis. It should be recalled, of course, that nearly all of these individuals regarded farming as their primary occupation.

The largest number of those engaging in non-farming off-season occupations are petty traders. As will be shown in connection with more detailed discussions of two villages in the district, a wide variety of secondary pursuits are followed, from traditional craft activities to modern services or even salaried employment. In general, the extent and range of types of such secondary occupations appear to also be related to density of settlement.

Non-Demographic Influences on Village Agricultural Systems

In differentiating among village agricultural systems in Soba District, the primary factor which has been highlighted has been population density. It would be a mistake to lose sight of the fact, however, that other factors are frequently at work to shape the special characteristics of the agro-ecosystems of many villages in the district. It is appropriate to conclude this introduction to Soba District agricultural systems by taking note of several additional non-demographic factors that bear on local systems of land use. After all, one of the more noteworthy findings of this study of the district is that, in spite of their

superficial similarities, villages frequently differ quite remarkably in significant features of their agricultural systems.

In presenting these examples of non-demographic influences on local agricultural systems, it should be recalled that all of the cases cited here pertain to influences on cropping enterprises; variations in proportions of land devoted to the production of different crops, of course, is not the same as variations in proportions of land devoted to intensive cultivation.

Environmental Factors

It was suggested in Chapter IV that one of the reasons for the selection of Soba District as a study site was that the environmental contribution to variations among village land use systems should remain relatively constant throughout the district. While this assumption remains in force, at least one very significant exception was already mentioned in the commentary on the physical setting of Soba District, namely, the influence of local variations in soils. The extent of fadama soils in proximity to villages can strongly influence land use systems, and an excellent example of the influence of this type of land resource is provided by Dan Wata, a village in the northeastern sector of the district.

A large walled gari located well off the main road and far from major transportation routes, Dan Wata is favored with an exceptionally large expanse of nearby fadama which is almost entirely planted with sugar cane. The conventional notion holds that sugar cane is generally only grown in proximity to transportation

arteries used for the evacuation of this bulky commodity, but this is decidedly not the case in this relatively inaccessible village. In Dan Wata there is a flourishing local sugar processing industry in which small scale grinding machines are powered by horses and oxen to produce a large volume of semi-refined brown sugar. The most noteworthy feature in this respect is that the large acreage of cultivated fadama which supports this village sugar industry has an impact throughout the village agricultural system. The demands on farm labor, for example, are set largely by the requirements of the sugar cane plots, and farmers must make commensurate adjustments in their production systems elsewhere, although obviously not to the complete neglect of staple food crops.

Locational Factors

At several places in this analysis, the phenomenon of "urban demand" for food supplies has been mentioned. In most cases, the tactic employed in this study has been to group extra-district demand with local stress as a stimulus to agrarian change. However, some quite distinctive examples of the effects of the proximity of urban markets exist in the district.

The village of Yakasai is located in a sparsely populated area on the western boundary of Soba District, just nine miles from Zaria, and provides a striking case in point. The acreage planted to yams in this village has apparently increased dramatically since 1970. Before that time no yams were grown in this village; indeed, they are an unusual crop elsewhere in the district

even today. Yet here the response of village smallholders to the economic incentive provided by nearby urbanites has been remarkable. As much as 30 percent of the cultivated infield zone of this village may have been planted in yams in the 1973-74 season, very little of which were consumed within the village.

Cultural Factors

The primary cultural influence on land use under consideration in this study is that of farmer spatial preferences. Other comparable influences can play a role in shaping village agricultural systems. A dominant cultural influence in practically all Soba District villages, for example, is that of the Islamic faith and tradition.

In the hamlet of Mallam Dogo, three miles northeast of Soba village, there is a notable absence of tobacco fields despite the fact that ample opportunities for growing this highly profitable crop exist. In this village the influence of several highly respected Islamic teachers is particularly strong. The Koran has been interpreted there as prohibiting the use of tobacco products; hence, no villagers engage in its production. An additional impact of these religious notables on the hamlet has been the quite marked population growth it has experienced due to the attraction of permanent and temporary in-migrants from quite distant regions of Hausaland.

The Demonstration Effect

One final influence which contributes to the "clustering" that is apparent among village agricultural systems is the so-called demonstration effect. A well recognized principle of spatial interaction, the demonstration effect acts to enforce a certain uniformity within village land use systems. It is probably not correct to think of Soba District smallholders as "traditionalists" since they have shown a willingness to adopt new techniques and practices in many instances. However, the pressures for conformity are great and the prime sources of information about agriculture are within the smallholder's own village; hence, farmers tend to act in a manner similar to other individuals with whom they have immediate contact.

CHAPTER VI

INTENSIVE LAND USE IN SOBA DISTRICT: ORGANIC FERTILIZATION PRACTICES ON INFIELD FARMS

Intensity of Land Use

It is apparent from the profile of village agro-ecosystems presented in previous chapters that local economies and farming systems differ within the district in important respects--at least in degree if not in kind. The prime concern of this study, of course, is with land resources and the way that these are utilized with varying degrees of intensity. Hence, it is appropriate to narrow the focus of the investigation by drawing attention to the infield zone of land use and the techniques that are employed to maintain fertility on annually cropped land. Following a preliminary discussion of prominent distinguishing features of intensive land use in Soba District, this chapter reports on a specialized study which was designed to evaluate infield farming with respect to key interpretive factors. In the final section of the chapter, the relationship between population size and supply of organic materials is explored.

The concept of intensity is used in this study as a measure of non-land inputs per unit area over time. In general, such non-land inputs can be classified either as labor or as capital. The

For these reasons, along with the fact that the surveys conducted by D.W. Norman and the Rural Economy Research Unit include data on labor inputs to Hausa agriculture in the Zaria region, no systematic attempt at collection of man-hour statistics in farm labor was included in this study. However, information pertaining to smallholders' perception of difficulty of various farming operations and land use strategies was obtained and will be presented in a subsequent chapter.

Capital Inputs

As is characteristically the case with non-mechanized agricultural systems, capital inputs to Soba District agriculture are comparatively low. The primary inputs within this category are fertilizers. It has already been observed that one of the most noteworthy aspects of Hausa farming is the widespread utilization of organic fertilizers and manures to improve and sustain land quality. In addition, commercial, inorganic fertilizers are widely employed and popular.

This is not to claim that other forms of capital inputs to agriculture cannot be found within the district. In terms of semi-permanent improvements to land, for example, fencing is commonly found on small plots. But such fences, usually constructed from wooden poles and sorghum stalks or dried grass, are entirely crop-specific. No sophisticated analysis is required to conclude that such fences are employed to protect lowland plots and upland cassava fields from foraging animals during the dry season. This type of capital improvement is only indirectly re-

lated to the factors under consideration here; it is first and foremost a function of the dry season utilization of the plot. The only other type of fencing found in the district are henna bushes or other shrubs used to demarcate farm boundaries, but the use of this type of plot delineation appears to be diminishing.

Another semi-permanent improvement, which must periodically be renewed, is the drainage ditch. On fields upon which the flow of water is impeded or excessive erosion is seen to be underway, the farmer will frequently construct a network of shallow channels to drain excessive rainwater away from his plot. Such ditches are most frequently encountered on infield plots which have been in use for some years; in some cases, these drainage networks are quite elaborate and are regularly re-dug at the commencement of each farming season.

A few types of more permanent capital improvements can be found on Soba District farms, but these are the exception. In 2 out of the 650 households interviewed, farmers reported that wells had been dug on one of their fields. In both cases, these wells were located on outfield plots and were used primarily to attract Fulani herdsmen rather than as a source of drinking water for farm laborers. On only one of the sampled farms, also located at some distance from the settlement, was a shelter (bukka) constructed to protect the farmer from daily rains as well as to serve on occasion as an overnight shelter.

Analysis of these minor forms of capital improvements to Soba District farming would probably not yield much differentia-

tion, whereas further examination of fertilizer inputs holds more promise of discrimination in degrees of intensity of use. It is important to point out, however, that fertilizers and fertilization practices are not intended to be used in this part of the study as a "proxy" indicator of intensity in lieu of more comprehensive data on labor. To automatically link fertilizer inputs in this way would be to beg an important question which requires investigation: whether or not Boserup's association of increased frequency of cropping with increased man-hours, hence more intensive agriculture, is correct.

Nevertheless, linking the practice of organic fertilization with increased labor inputs is not completely without foundation. It is not, as might seem at first thought, the labor involved in transporting and spreading fertilizers that is of concern here. Nor is the frequency with which fertilized land is cultivated a significant concern since it is patently clear that land cultivated continuously over say a ten-year period receives greater labor inputs during that time than does a parcel cropped for only four out of the ten years. Rather, the link between increased labor inputs and organic fertilization has to do with the extra farm operation that such a practice customarily requires. Soba District farmers were in general agreement that the addition of organic materials, especially animal manures, to a plot usually necessitated an extra, i.e. a third, weeding. Since mid-season weeding of fields is generally perceived to be the most difficult of farm operations, it is fair to assume that significant labor inputs are consumed in the process. As will be

demonstrated in a section of this chapter pertaining to manuring by Fulani cattle, the desire to avoid this extra labor obligation wherever possible appears to play a significant role in the smallholder's land use decision-making and fertilization strategies.

The application of fertilizers and manures is undoubtedly an important component in determining the intensity of land use of Soba District farmers. It is a distinguishing feature of infield land use as well as an occasional aspect of outfield cultivation. Yet precise information about fertilization practices in Hausaland is relatively scarce. This is somewhat surprising in view of the fact that, frequent statements to the contrary notwithstanding, fairly precise and accurate measurements of fertilizer applications can be made without sophisticated equipment.

In this chapter, the goal is to deal with the question of the relationship between infield land use and demographic, cultural, and locational factors by examining quite closely present fertilizer practices. Such findings can be compared with information pertaining to 1950 practices. More importantly, intervillage variation in practices and proportions of treated versus untreated land can be highlighted.

Although some attention will be given to fertilization practices on outfield farms and on lowland plots, the primary focus here is on the infield zone of land use. It has long been the custom to make distinctions among types of land use in the outfield zone on the basis of length and frequency of cropping;

the categories of short-fallowed and long-fallowed land are of this type. The assumption behind this subsidiary study is that similar distinctions can be made within the infield zone on the basis of a careful assessment of treatment. The infield zone is not necessarily homogeneous; nor is it uniform from village to village. A fundamental finding reported in this chapter is that very revealing relationships with the factors under review begin to emerge when the infield zone is examined in greater detail both within and among villages.

Furthermore, the investigation in this chapter centers primarily upon fertilization with organic materials. Only passing consideration will be given to the increasingly important role played by commercial fertilizers. It should also be noted that the intention in this chapter is to describe and analyze fertilization as it is currently practiced in the district. The literature on such practices, in contrast to a slightly larger body of material pertaining to prescribed practices or to fertilizer trials, consists mainly of scattered brief references.

Prior Accounts of Organic Fertilizer Practices

In most previous accounts of agriculture in Hausaland, organic fertilization practices are discussed only superficially. The assumption is frequently made, for example, that the primary technique of organic fertilization is the application of animal manures and that these are generally provided by Fulani cattle. Yet as will be demonstrated below, the droppings of the animals of nomadic pastoralists form a practically negligible component

of the overall dressings on infield plots in Soba District. Mortimore similarly reports that the corralling of the animals of Fulani herdsmen on fields in Kano was "an unimportant source [of fertilizers] in quantitative terms".[1]

Other reports speak of the application of "farmyard manures", a somewhat misleading terminology since, at present, the farmyard as it is generally understood rarely exists in Hausaland and is not a primary source of organic materials.[2] The term "pen manure" is perhaps more accurate to describe that component of organic materials derived from the rotted mixture of animal excreta and straw bedding which contributes to organic dressings. Furthermore the term "compost" which has been applied to these fertilizers is not strictly correct since little or no actual composting is practiced.

P. Hill properly takes the FAO report on agriculture in Nigeria to task for completely misrepresenting the situation with respect to organic fertilization practices.[3] Yet even Hill, who is otherwise quite careful in her presentation of fertilization practices, makes the mistake in at least one place of suggesting

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[1]Mortimore, "Land and Population in Kano," p. 683.

[2]V.A. Oyenuga, Agriculture in Nigeria (Rome: FAO, 1967), pp. 143 ff.

[3]Food and Agricultural Organization (FAO), Agricultural Development in Nigeria (Rome: FAO, 1966).

that availability of cattle manures is determinative of fertilized acreage.[1]

Both Hill and Mortimore have examined the phenomenon of "manuring" in somewhat greater detail and devote considerable attention to the trade in organic fertilizers that exists within their respective study areas, Katsina and Kano. Household refuse and pen manures are seen as economic commodities, and a lively network of transportation of such materials occurs during the peak fertilization period in the Kano close-settled zone. Hill also draws attention to the fact that organic supplies are frequently sold by farmers in need of cash. But the most important point upon which both of these observers appear to agree is that the available supplies of organic materials acts as a constraint, directly and indirectly, on intensive farming. "The ability of farmers to pursue this method," admits Hill, "depends of course on their having sufficient manure." The main variables in this regard, according to her are: (1) the size of the local cattle population, (2) the possibility of importing refuse and manure, and (3) the size of the settlement.[2] Mortimore takes this third factor further by suggesting that supplies of animal manures and household refuse are a function of human populations and aggregations. Therefore, growing population can be expected to increase

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[1] Hill, "Farms and Farmers in a Hausa Village," pp. 158-159 where she attempts to explain the comparatively small infield zone in Soba village in 1952.

[2] Hill, "Farms and Farmers," pp. 157, 159.

available supplies of organic materials.[1]

A number of researchers have attempted to calculate the extent of the infield, organically fertilized area on the basis of air photographs; Hill makes such a procedure pivotal to her argument regarding the widespread preference for such land use in Hausaland. Yet this simple measurement of total treated acreage tells only a partial story as will be demonstrated in the following sections. Except for an attempt by Mortimore to differentiate between plots receiving less than one ton per acre and those treated with more than that amount, the question of rate of application of organic materials has gone largely unheeded. Only in the recent work of Norman is data collected pertaining to rates of application of fertilizers. Yet, in relation to the problem under consideration in this study, the rate of application of these materials proves to be a telling variable.

Efficacy of Organic Fertilizers

There does not appear to be complete agreement within scientific circles as to the value of the organic materials that are commonly applied to fields in northern Nigeria. In general, soil scientists seem to have concluded that such practices, besides increasing the total content and availability of plant nutrients, maintain the level of organic matter in the upper layers of the soil. Some reports claim a superiority for organic over

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[1] Mortimore, "Population Densities and Agriculture," p. 13.

inorganic fertilizers because of the slow release of nutrients during decomposition, their effects on the physical properties of soils, the increase in supply of trace elements, and the amelioration of the effects of acidifying fertilizers. Yet there is little conclusive information available pertaining to the long-term effects of annual cultivation supported by organic fertilization upon savanna soils. R.G. Heathcote, in experiments designed to test the role of organic manures, found only partial evidence to support claims for their superiority.[1]

Lawes, for one, does not agree with these conclusions, observing that:

> Part of the reasoning in favour of organic manure has been based on the suggestion that a heavy dressing of organic manure could materially affect the texture of the soil and thus confer a benefit that is not obtained from plant nutrients alone. However, as discussed by Smith (1967), a dressing of 10 to 15 tons of farmyard manure per acre amounts to some 2 tons of organic matter per acre or 0.2 per cent in the top nine inches of soil. This small amount is barely measurable by sampling and analysis and is unlikely to change the soil properties materially by its physical

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[1] R.G. Heathcote, Soil Fertility under Continuous Cultivation in Northern Nigeria: the role of organic manures (Zaria: Institute for Agricultural Research, Samaru Research Bulletin 134, 1971). Similar experiments are also reported in M.J. Jones, The Maintenance of Soil Organic Matter under Continuous Cultivation at Samaru, Nigeria (Zaria: Institute for Agricultural Research, Samaru Research Bulletin 158, 1972).

presence.[1]

Ogborn further argues that statements in favor of manuring over commercial fertilizers fail to take account of nutrients that manure removes from the soil.[2]

Whatever the case with respect to their status vis-a-vis inorganic fertilizers, the fact remains that organic materials from a variety of sources are widely used in varying strengths on Soba District fields. Although it appears that commercial fertilizers have made rapid advances in acceptance and usage, it seems safe to conclude that organic materials will remain the basis for maintaining fertility on infield plots for some time to come. Whether or not this application of organic materials will continue indefinitely to support an expansion of infield intensive farming is an open question and will be given consideration in subsequent chapters dealing with the land use practices of two villages in the district.

Organic Fertilization Practices

The procedures followed in this subsidiary, narrowly-focused study of organic fertilization in Soba District were comparatively straightforward. Interviewing of farmers with

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[1] D.A. Lawes, Crop Husbandry and the Yield of Cotton in Northern Nigeria (Zaria: Institute for Agricultural Research, Samaru Research Bulletin 90, 1968), p. 4.

[2] James Ogborn, review of The Harsh Lands, by David Grigg, in Savanna, 2 (December 1973), p. 248.

respect to their fertilizer practices and their reasons for them formed the basis of the study. In addition, a systematic study of plots fertilized in the 1973-74 farming season was conducted.

During the late dry season months, approximately from February through early April, organic materials are transported by farmers from their homes or other sources and deposited on nearby fields. With rare exceptions, these supplies are transported by one of two means: (1) by panyar bags, mangala in Hausa, mounted on donkeys or (2) by headload in a basket, kwando. In both cases an effort is made by whoever transports the fertilizer--frequently a hired donkey handler rather than the farmer himself--to spread the piles of organic materials fairly evenly over the entire area to be dressed. At this time, however, no attempt is made to disperse the individual piles of material, and they usually remain in place on the field until the rains come and the plowing begins.

While these piles are in place on fertilized plots, it is possible to arrive at a fairly accurate estimate of the rate of application of organic fertilizer. Since the means of conveyance tends to standardize the size of the piles, sample piles can be weighed and the mean weight can then be multiplied by the total number of piles counted on a plot. A calculation of the area treated then renders an estimated rate of application of fertilizers in tons per acre. At the same time, data pertaining to distance from field to source and on the types of organic materials present were collected. Care was taken to calculate dry weights of materials, and freshly applied mater-

ials were allowed to dry prior to weighing. This procedure was carried out on practically all plots dressed in Soba village and in Garun Gwanki village as well as sample plots in eight other villages. In all, information pertaining to 80 infield plots was obtained.[1]

Smallholder Perception of Organic Fertilizers

Before proceeding to the analysis of data obtained in this manner, it is useful to take note of several interesting and significant observations that emerged in the course of the study. In the first place, it is probably incorrect to speak of Hausa fertilization practices as "haphazard". Farmers are quite sophisticated in their appreciation of the manurial properties of various materials and are generally deliberate in the manner and the rate in which these are applied. Villagers exercise great care in the collection and accumulation of materials for the rubbish heap. As Hill makes clear, refuse heaps, especially in combination with the dung of small animals, are a valuable resource and are recognized as such. This is not to suggest however, that the Soba District smallholder's handling of his

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[1]The sample weights obtained following these procedures vary somewhat from the only other source available and are worth recording here. The mean dry weight of a mangala of pen manure (takin dabbobin gida) was 120 lbs; a large basket (kwando) of the same material averaged 24 lbs. The mean dry weight of both household refuse (takin juji) and ashes (toka) was the same at 175 lbs. for a mangala and 30 lbs. for a large basket. These weights are substantially lighter than those reported in D.W. Norman, An Economic Survey, p. BCD3. They are only slightly lighter than the estimates that can be calculated from Mortimore, "Land and Population Pressure," p. 685.

organic fertilizers is perfect. Little effort at true composting is attempted, and it has been observed that the wind carries away considerable quanitites of potential nutrients while the piles are left standing on the open fields. Moreover, as will be shown shortly, the extremely wide variation in rates of application gives rise to the impression that over-fertilization and under-fertilization may be frequent occurrences.

Table 15 illustrates the farmer's perception of the utility of varying types of manuring materials available to him. Farmers easily distinguish among the various types and place varying values on each. An important point to be made in this regard is that practically all farmers, regardless of the location of their village, give evidence of an appreciation of the fertilizer properties of these materials and of a willingness to use them.

The general attitude toward such materials is well illustrated by a series of interviews carried out in a pioneer hamlet in the district. This hamlet was newly established in 1974 by refugee farmers from Katsina. Farmers in the hamlet recognized that practically no organic supplies would be available to them for their first farming season and that little fertilization would take place. Yet each expressed the opinion that he would use fertilizer if he could get it, despite the fact that he was planting newly-opened land. "Taimako ne", it's a help, they would report. "In yana da karfi, sai a kara masa karfi"; even if the soil is "strong", one can make it stronger, Such an attitude, which appears to be widespread among Soba District farmers, does lend some credence to Hill's contention that intensive cultivation

TABLE 15

TYPES AND FREQUENCY OF USE
OF ORGANIC FERTILIZERS

(Listed in Descending Order
of Perceived Potency)

Type of Fertilizer		Frequency in Sample	
English	Hausa	Absolute	Relative
1. Bird manure	Takin Tsuntsu	--	--
2. Cotton seed	Anguriya	--	--
3. Latrine manure	Takin Shadda (masai)	2	2
4. Cow manure	Takin Shanu	4	5
5. Goat/Donkey pen manure	Takin Dabbobin Gida	23	29
6. Horse manure	Takin Dawaki	--	--
7. Household refuse	Takin Juji	24	29
8. Ashes	Toka	13	16
9. Mixtures of 5,7,8	----------	14	18
	Total	80	100%

is the preferred system. Of course, the amount of fertilized land in this hamlet bore no relationship to such expressed preferences. Moreover, such a widespread knowledge of fertilization techniques and practices makes it difficult to argue that variations in the use of intensive techniques within the district is attributable to incomplete diffusion of information.

Sources and Types of Organic Materials

In addition to those listed in Table 15, other sources of recycled nutrients are: old grass roofing or matting, tree leaves, crop residues such as corn stalks or cotton stalks, all of which are usually stacked and burned right on the plot. A typical pile of organic matter on an infield plot might consist of burned household refuse and garbage collected during the year, some small-animal manures, and a not insignificant amount of undegraded technological junk such as plastic bags and used flashlight batteries.

Most farmers obtained their organic materials from their own family compound and family animals. But particularly in the larger villages such as Soba or Gimba, other sources were frequently available. Persons who own no farms in the village or who own no infield farms may sell their household refuse. A large pile of refuse (100 to 150 donkey loads) sold in 1974 for between 4.00 naira and 6.00 naira (U.S. $6.00 to $9.00). Interestingly enough, women who keep goats in their compounds do not automatically turn over the dung of these animals to their husbands. They will frequently sell the pen manure if the opportun-

ity arises. In smaller villages and hamlets, where no non-farmers usually reside, sales of organic materials were very infrequent; most households consumed all they produced.[1]

In contrast to the heavily settled regions of Hausaland, no inter-village movement of organic materials and manures could be found in Soba District; none of the villages under study imported fertilizer supplies from neighboring hamlets and villages. The absence of any inter-village transport of these materials implies that each settlement was entirely dependent on its own resources for fertilizer production.

An active network involving the transport of organic materials within the larger villages was in evidence, however. The cost of transporting fertilizers from compound to field, when donkeys were utilized, was directly related to distance. Such transport costs ranged from 3 kobo per donkey-load for a distance of several hundred yards up to 10 or even 15 kobo for longer distances, i.e., up to a mile away from the source (1 kobo = approximately 1.5 cents; hence 10 kobo = 15 U.S. cents). In the case of smaller villages and hamlets where no donkey transport may be readily available or even necessary, the headloading of baskets of refuse and animal manures was carried out by the farmer or by young boys on a casual basis; such manuring may take place over a long period until supplies are eventually exhausted, usually over a period of several months.

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[1]Hill devotes considerable attention to the sales of compound sweepings as an indicator of poverty among farmers.

Of the types of fertilizers recorded in Table 15, four were found to occur with significant frequency in the district. Mixtures of various types, including on occasion cattle or horse droppings, occur regularly on the same plot. Yet in terms of distinct categories, pen manure from small animals and household refuse are unquestionably the most important types. Ashes, mainly from wood fires, are an important source of fertilizer materials which has rarely been mentioned in the literature on Hausa manuring. Interestingly enough, cattle manures and human excrement from dried pit latrines were relatively unimportant in this sample of treated plots.

It should be clear from this table that by far the most important source of organic materials, especially in large villages, is the compound, not the herds of nomadic pastoralists. Of the 80 plots sampled, 47 percent contained no animal manures whatsoever in the product applied. It must be recalled, of course, that this observation pertained solely to infield plots. Moreover, in the case of several smaller, more remote villages, the occurrence of infield plots which had been manured by Fulani cattle increased somewhat.

Cattle Manures

The reasons for the relative absence of cattle manures in this infield zone are complex, but they are worth considering briefly because of the emphasis that has been given to the Hausa-Fulani symbiotic relationship in Hausaland. During the time period of this study, the Fulani population of Soba District

was substantially greater than in previous years. As was explained in Chapter V, this increase was largely due to the pressures of the drought in regions to the north.

The pressures on these Fulani herdsmen to establish their camps at some distance from settlements were quite severe. Obviously, during the actual growing season, farmers did not wish to have Fulani animals anywhere near their fields, and the intrusion of grazing animals onto cultivated fields was a continual source of tension between farmer and herdsman. Yet even during the dry season, no Fulani camps were established in the proximity of the major villages in the district. It seems that the primary reason for the lack of welcome to infield areas was the tendency of the animals to foul local water sources as well as the ever-increasing utilization of fadama areas for dry-season cultivation. Hence, the many Fulani camps were, in the main, located at considerable distances from settlements, and a large quantity of animal manures was deposited in these unfarmed bush areas.

If it were mutually arranged by herdsman and farmer, however, the animals would be coralled on an outfield plot that the villager intended to cultivate the following season. As was suggested above, it was only in the case of the smallest and more remote hamlets that this fertilized plot lay within the infield zone of land use, i.e., near the settlement. In return for the deposit of manure on his field, the farmer customarily provided the herdsman with kanwa (potash) for his animals, possibly a token monetary payment, as well as construction materials for temporary shelters at the campsite. Since the supply of cattle

and manure far exceeded the demand in 1973-74, Fulani frequently reported that they had been paid nothing for their manure, but they retaliated by refusing to disperse their animals over the field, leaving the farmer with huge mounds of dung concentrated in a small area.

After the manure has been deposited on his field, the farmer must follow certain procedures in order to receive its full benefits. Usually this entails collecting the dung into small piles evenly distributed over the plot which are then burned when entirely dry. This burning is necessary in order to prevent infestation by white ants and dung grubs in the field, a threat to any subsequent crops. Apparently, goat dung is favored because it is less of an attraction to these insect pests. In a few instances, dung dropped in the vicinity of remote bush camps was purchased by a farmer and transported via donkey to his fields. But the most important factor pertaining to manuring by cattle appeared to be the near universal agreement that a dressing of such animal manures drastically increased the farmers' problems with weed growth and usually necessitated an extra weeding during the course of the growing season.

In addition to campsite fields where animals were corralled overnight, many village fields received a small supplement of cattle and sheep manure when these latter grazed on the stubble left in field following a harvest. Yet inspection of several of these grazed-over plots indicated that dressings applied in this casual manner were not particularly important in quantitative terms, especially when compared to the volume deposited on camp-

site locations. Moreover, the timing of the application of animal manures is important; in order for the crops to receive maximum benefit from the nutrients added, an application in April or May, just prior to the planting season, was considered most desirable.

Clearly, the process of manuring of fields by Fulani animals is more complex than some observers have detected. For the reasons cited above--primarily the lack of specificity of such manurial dressings--there has emerged among Soba District farmers a distinct preference for an alternative means of fertilization, commercial fertilizers. To the extent that they are able to procure inorganic fertilizers--and there appears to have been a chronic shortage of these in recent years--farmers apparently would choose to dress both infield and outfield plots with commercial products rather than involve themselves in the more tedious process of having fields manured by Fulani animals. The question emerges as to whether or not the encouragement that farmers have received from agricultural extension workers and tobacco company officials to use inorganic fertilizers may also have served to supplant a valuable resource, animal manures. Such cattle manure resources were definitely not maximally utilized in the 1973-74 season, despite the continuing requests of farmers for additional fertilizer supplies. There was every indication that district smallholders have become increasingly reluctant to fully utilize readily available animal fertilizers.

Rate of Application of Fertilizers

The casual observer, seeing piles of organic fertilizers scattered across the landscape around practically all villages in Soba District, might be tempted to conclude that infield plots are treated much the same throughout the district. But the most striking fact to emerge from this study is that just the opposite is true. The rates of application of fertilizers vary quite widely within the district. In the sample under analysis, rates ranged from less than 1 ton per acre to over 14 tons per acre; mean rate of application was 5.5 tons per acre. As will be shown below, this variable, rate of application of fertilizers, turns out to display quite significant relationships to the main interpretive factors under review.

The rates of organic fertilizer dressings found in the sample were substantially heavier than those usually assumed for Hausaland or reported from other areas. Mortimore reports that the average application within the Kano villages he studied was 1.5 tons per acre. Experiments carried out by Dennison at Samaru suggested that, in general, a rate of application of 2 tons per acre permits annual cropping, and a rate of 3 tons per acre gradually builds up soil fertility. Similarly, Lawes reports that 1 or 2 tons per acre is the normal dressing in northern Nigeria.[1] Yet rates commonly encountered in Soba District

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[1] E. B. Dennison, "The Value of Farmyard Manure in Maintaining Fertility in Northern Nigeria," Empire Journal of Experimental Agriculture 29 (1961), p. 331; D. A. Lawes, "Crop Husbandry," p. 3.

were well above these figures. Even if the generally heavier Toka (ashes) are eliminated from consideration, the mean rate of fertilizer application, 4.8 tons per acre, remains higher than these widely cited figures. The rates of application reported by Norman in the Zaria region, on the other hand, are much closer to those found within Soba District. He records an average of 4.9 tons of organic manure per "farm" per year.[1]

Although Dennison recommended estimates for optimum applications to various crops, it appears that these guidelines are not widely followed. The question that arises is whether or not wastage of organic materials occurs. When asked to suggest an optimum dressing for their farms, smallholders revealed a strong preference for a treatment of approximately 100 mangala per acre (about 6 tons). Obviously, the considerable range that was found in rates of application shows that this or any other ideal was the exception rather than the rule. Rates were probably influenced by a variety of factors, including available supplies of materials and transport as well as the diligence of the transporter.

Periodicity of Application

In addition to the rate of application of organic fertilizers, the frequency with which such materials were applied to fields was an equally significant factor bearing on the capacity of land to support annual cultivation. Yet the literature on

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[1] D. W. Norman, An Economic Survey of Three Villages, p.51.

Hausa agriculture contains no references whatsoever to the periodicity of application of organic materials. It is a mistake to assume that all infield plots receive a dressing every year. The prominence of the piles of organics on the dry season infield landscape gives a misleading impression in this regard. Furthermore, if asked whether a given field is "manured", the farmer tends to respond positively if the farm has ever been so treated, but not necessarily during the most recent farm season.

In fact, only a comparatively small portion of annually cultivated land appears to be dressed each year. On the basis of field surveys in Soba village during the 1974-75 season, it was estimated that only 7 percent of the entire infield zone was dressed prior to planting. Air photo interpretation for a key sector of this same zone revealed that only 4 percent had been fertilized in the previous 1973-74 season. In another village, Garun Gwanki, 12 percent of the infield plots received additions of organic manures. Although there may well have been a certain incremental acreage treated after cultivation was underway, close observation suggests that this was probably very small in extent and would not significantly raise the percentage dressed per season.

In part, this comparatively small portion of the infield zone treated per year reflects a consciousness on the part of farmers of the residual effects of fertilizers. In general, it appears that if a plot has been treated in the recent past, a farmer will not be overly concerned at not having access to, or

adequate supplies of,organic materials. Goat manure is considered by farmers to have effects lasting up to five years; household refuse may have some potency up to three years according to local sources. Inorganic fertilizers, in contrast, are seen to have effects for only one or, at most, two years. Yet it does not require sophisticated calculations to realize that even under optimum conditions, it may well require up to ten years for 100 percent of the infield zone to be dressed if the figures cited above are an accurate indication of yearly inputs.

This small percentage of annually fertilized land is clearly related to the supply of organic materials which, as has been suggested, is in turn a function of population size. Operating under such constraints, the farmer appears to apportion the supplies available to him on the basis of greatest need, spreading a dressing on those sections of his fields that have gone the longest without fertilizer. The fact that a farmer frequently distributes organic fertilizers over only a portion of his holding in one location suggests a preference for a certain minimal treatment per unit area rather than a dilution of supplies over his entire acreage. More will be said about this supply constraint in the following section.

Analysis of Data on Fertilized Plots

The data collected from 80 organically fertilized plots were organized into five variables: (1) the type of fertilizer used; (2) the distance from source to field; (3) the rate of application; (4) the source from which fertilizer came; and

(5) the means of transport employed. Of this group, the third, rate of application of organics, was treated as the dependent variable. Also included in the analysis were three additional variables: (1) the density of the village area within which the plot was sited; (2) the size of the nearest settlement in terms of number of compounds; and (3) the accessibility of the settlement with reference to road traffic.

An assumption underlying this analysis is that rate of application of organic fertilizers is a relatively more precise measure of intensity than merely the presence or absence of fertilizers. Even more important for present purposes, however, is the utilization of rate of application as an indicator of differences in infield treatment. It was assumed at the outset, and subsequently proven to be the case, that examination of rate of application would bring to light significant relationships between infield land use and the factors under consideration, notably the locational and the demographic interpretations.

Since decisions pertaining to rate and frequency of application of fertilizers are made by individual smallholders, this analysis represents, to some extent, an examination of influences on the farmer's decision-making processes. Caution must be exercised, of course, in relating this data on fertilized plots to individual farmers rather than to villages. The aggregate data, in the form of mean rates and distances, has some power to indicate aspects of a village system of fertility maintenance, yet, such average figures conceal wide variations in practice. The individual decision about the rate of application on a given

plot may not actually be wholly purposeful or entirely under the control of the smallholder in question. Unplanned or random influences such as immediate cash resources for purchase of fertilizers or the whim of the donkey transporter affect rates on each plot, whereas aggregate influences such as overall supply of organic materials in a village are more likely to govern mean rates of application in a village.

The Locational Interpretation

Two of the variables employed in this study represent the spatial aspects of fertility maintenance; the first of these is operative at the intra-village scale. The distance from the source of materials (in most cases, the farmer's own compound) to the field upon which they were applied could be measured with considerable accuracy by using farm maps or, in some cases, by pacing. The mean distance that such materials in the district were transported was quite far, slightly over 500 yards from source to plot. The range of distance was also great, some 1,900 yards. Among smaller hamlets, mean distance transported was only 51 yards while in larger settlements, it rose to 864 yards. Such great distances obviously indicate that the infield zones in question are not mere "kitchen gardens" adjacent to compounds.

A scatterplot diagram of the data pertaining to the distance (in yards) between fertilized field and source of fertilizer and the rate of application of organic materials (in tons per acre) was compiled as an initial indicator of the relationships involved (see Appendix I). While no clear linear relationship was evident,

it was at least apparent that the heavier rates of fertilizer application tend to fall within the shorter ranges of distance (less than 700 yards). Moreover, none of the extremes of application rates are found at the extremes of distance.

As a better indicator of the degree of relationship between distance from source to plot and rate of application of fertilizer, a coefficient of correlation using the Pearson product-moment formula was computed. The result was a correlation coefficient of -.0120, which is not significant at the .05 level. A chi-square statistic for a table of frequencies of the same two variables, in this case grouped into rank classes rather than manipulated as interval scale values, indicated a similarly weak association (chi-square = 36.011 with 25 degrees of freedom; not significant at the .05 level). These two statistics appear to suggest that the rate of application of fertilizers on the 80 sampled plots bears very little relationship to the distance that organic materials were transported. This implication is somewhat surprising since, as has been shown, transport costs, when they are incurred, are generally related to the distance that fertilizer is carried.

The somewhat contradictory and inconclusive findings above are clarified by disaggregating the data pertaining to all 80 plots in separate villages and examining the infield zone of a single village. Obviously, the maximum distances from source to plot are found in villages with large infield zones, namely large settlements. Infield zones around small villages and hamlets

tend to be smaller; hence, the distance to even the farthest plot is not great. In other words, the size of the settlement exerts an intervening influence which distorts the relationship between distance and rate of application.

If the larger infield zones associated with larger villages are analyzed separately, the association between distance transported and rate of application becomes somewhat stronger. Figure 8, for example, shows the mean rates of application at varying distances from the settlement within Soba village. It would appear from this illustration that, as common sense might dictate, farmers do not transport, or pay to have transported, the heaviest quantities of organic fertilizers to the greatest distances from the village. Conversely, at greater distances from the settlement, farmers endeavor to spread their organic supplies over a greater area; hence, rates of application tend to decline. One possible explanation for the few anomalous heavily fertilized fields found at extreme distances is that these are plots which have recently come under an annual cultivation regime and require heavy dressings to build up fertility.

The other locational variable tabulated in this study, the relative accessibility of the settlement nearest the fertilized plot, appeared to bear little relationship to the rate of application of fertilizers. Since it has already been observed that no inter-village transport of organic materials was found to take place in the district, this result is not very surprising. Regardless of a village's location with respect to the district transportation network, the entire organic fertilizer supply is

FIGURE 8

MEAN RATE OF ORGANIC FERTILIZER APPLICATION
BY DISTANCE FROM SOURCE, SOBA VILLAGE

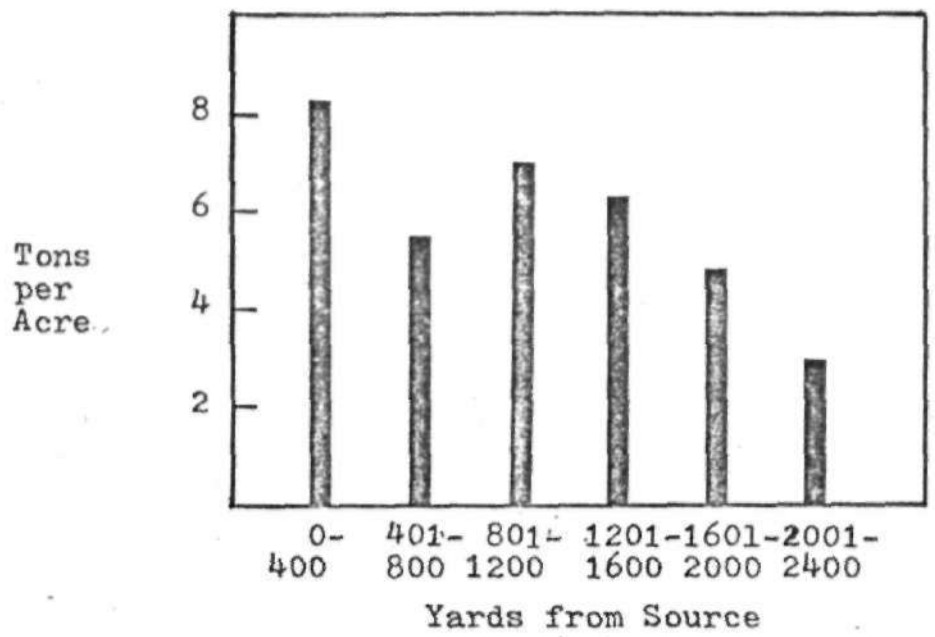
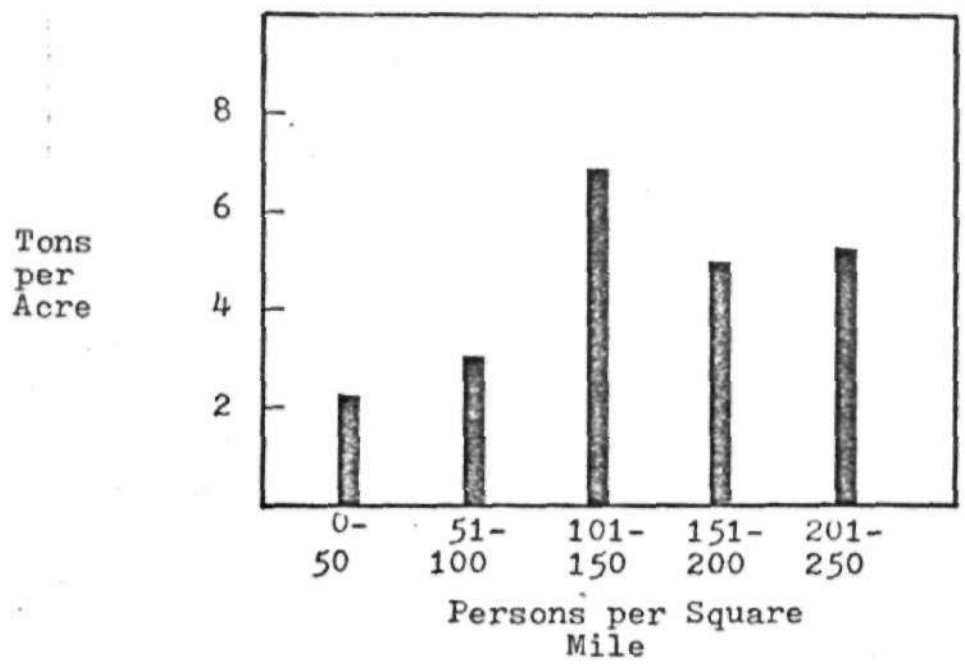


FIGURE 9

MEAN RATE OF ORGANIC FERTILIZER APPLICATION
BY POPULATION DENSITY OF VILLAGE AREA



provided by sources within the village; hence, rates are influenced by other factors. The reasons for this lack of inter-village movement of organic supplies are (1) that villages regardless of size utilize all of the organic supplies produced therein and (2) at present it is probably not profitable to engage in such a trade.

The evidence pertaining to locational variables, in sum, points to two conclusions: first, with reference to infield zones of large villages, it appears that farmers are not entirely indifferent to the effect of distance on their fertilization activities. The location of a plot within this zone appears to be a consideration in the farmer's rate determination. Nevertheless, the relationship between distance and rate appears to be insufficiently strong to serve as a sole explanation of rates of application of fertilizers. Distance to plot could not be used by itself as a predictor of rates of application. Even at the outermost perimeter of the large infield zones, it could be noted, rates vary quite considerably. Nor could it be concluded from this study that there is any limit to the distances which farmers are willing to transport organics. As will be shown in subsequent chapters, the outermost perimeter of these infield zones is subject to change and the distance to be covered is probably not the most severely constraining factor in this regard. Distances from source to plot, it will be seen, have tended to increase during the time period in question.

Secondly, the distance from source to plot does not appear to adequately account for inter-village variation in rates of

application of fertilizers. When consideration is given not just to one infield zone but to the entire sample of fertilized plots from the district, the location of the field with respect to the farmer's home would not seem to be a primary controlling factor of application rates. Factors other than distances involved must be sought to explain variation in mean rates of application among villages.

The Demographic Interpretation

When the fertilization rates of sample plots are cross-tabulated with demographic variables, however, some interesting and quite germane results appear. The two independent variables included at this point in the analysis were: (1) density of the village area within which the plot is found, and (2) the size of the nearest settlement.

In order to explore the relationships involved, a contingency table was constructed in which the rate of application of fertilizers (grouped into three classes representing light, medium and heavy applications) was cross-tabulated with the "village area" population density (similarly grouped into three classes from sparse to dense populations). Table 16 shows the results of this rendering of the data; it is noteworthy that the chi-square statistic computed for this table proves to indicate a significant association at the .05 level. Hence, the inference emerges that the rate of fertilizer application is strongly associated with the population density of the village in which the fertilized plot was found.

TABLE 16

RATE OF APPLICATION OF ORGANIC FERTILIZERS BY POPULATION DENSITY OF VILLAGE AREA
(In percent, N= 80)

	Rate of Application			Total
	Light	Medium	Heavy	
Sparsely Populated Villages	18.8	3.7	1.2	23.8
Medium Density Villages	2.5	6.3	8.7	17.5
Densely Populated Villages	23.7	20.0	15.0	58.8
Total	45.0	30.0	25.0	100

chi square = 16.17245 with 4 degrees of freedom
(significant at .05 level)

contingency coefficient= 0.41007

Interestingly enough, when a comparable table was constructed using the same data pertaining to rates cross-tabulated with the size of the nearest settlement (number of compounds), less of an association was in evidence. The chi-square statistic for this table was not significant at the .05 level. The reasons why this should be the case--that village area population density appears to show a stronger association with fertilization rates than does the size of the settlement involved--will be examined below.

An even clearer association between population and rate is indicated when mean rates of application are broken down according to rank groupings of population density. As is shown by Figure 9, mean rate of application within the most sparsely settled villages is only 2.2 tons per acre. Mean rates then rise in nearly direct association with increases in density. The most densely settled areas show mean rates of several tons per acre higher (5.3 tons per acre).

The indications from these two analyses are clear. As density of population increases, higher rates of application of organic fertilizers become predominant. In other words, there emerges the not unexpected relationship between population and the supply, hence utilization, of organic materials. The compelling feature of these findings is not only that they appear to confirm the expected relationship between demographic factors and the overall extent of acreage that can be fertilized per season, but also that rates of fertilizer dressings seem to be related to population factors as well.

Yet, as has been shown, the size of settlement alone is a less satisfactory explanatory variable in relation to rates of application. It will be recalled that Hill takes settlement size to be one of the crucial variables in determining the extent of manuring activity.[1] Indeed, it would seem logical to suppose that supply of organic materials is a function of human and animal population as suggested by size of settlement. Yet, pressures on land resources are not solely a function of village size; they are related to area as well as to population. Hence, small settlements within densely populated sectors are more likely to apply heavier dressings since they are located in zones of comparative pressure on land resources. The indications from this analysis are that the heavier rates of application are associated not only with size of population, hence supply of materials, but also with available land resources, hence pressure of population. Consequently, population density appears to act as a slightly better predictor of fertilization practices than does settlement size.

Production of Organic Materials

It has been suggested several times in this chapter that consumption of organic supplies is related to their production in any village, and that production of such materials, both those of animal and those of human origin, is largely a function of population. Using some of the villages for which a fairly complete body of data pertaining to population and to fertilized acreages was obtained, it is possible to build on this suggestion

[1] Hill, "Farms and Farmers," p. 159.

and to estimate a rate of annual production of such organic supplies. Since all organic supplies produced in a given village in a given year are apt to be applied to village fields, it is safe to assume that organic materials found on village fields represent the entire output of the village for that season.

Table 17 illustrates the rates of production of organic materials for several villages within Soba District. The average rate of production of organic materials--this includes all types of fertilizers listed in Table 15--is estimated to be .75 tons (1,500 pounds) per compound per year or .075 tons (150 pounds) per resident per year. To the extent that extrapolations from these estimated rates are permissable, it could be hypothesized that a typical small village of 50 compounds (approximately 500 residents) might produce 37.5 tons of organic supplies in a year. At the average rate of application indicated in Table 17 (3.5 tons per acre), this amount could be utilized to dress approximately 10 acres per year. At district-wide mean rates of application (5.5 tons per acre.), only 7 acres could be treated. Assuming that a desirable interval between fertilizer applications is 3 years--a factor which is actually governed by the quality of the materials applied--this hypothetical village could provide an adequate supply of organic materials for an infield zone of from 21 to 30 acres.

Interestingly enough, the actual infield zones around settlements of this size in Soba District seem to be generally somewhat larger than this predicted acreage--frequently as much as double this size. Although the suspicion remains that some

Settlement	Settlement Size 1974 Est. Population	1974 Compounds	Fertilizer Application Fertilized Acres	Rate of Application (tons/acre)	Total Annual Production (tons)	Rate of Production Tons per Compound	Tons per Resident
Soba (central village)	4,000	335	53	5.3	280	.8	.07
Garun Gwanki	340	40	9	2.1	20	.5	.06
Ungwan Limam Yelwa	95	9	3	3.2	9.5	1.0	.10
Ungwan Mallam Dogo	350	34	7	3.3	24	.7	.07
	Average			3.5		.75	.075

THE RATE OF PRODUCTION OF ORGANIC MATERIALS
IN SELECTED VILLAGES, SOBA DISTRICT

TABLE 17

plots may be under-fertilized, this inconsistency is a reminder that a number of intervening factors are involved in determining total infield acreage.

This simple exercise in extrapolation is useful as an indicator of expected rates of production of organic materials and as a basis for assessing adequate treatment of infield acreage. Nevertheless, in the light of the findings about fertilization practices presented in this chapter, it obviously represents something of an oversimplification. As we have seen, fertilization rates themselves vary quite widely in the district, largely in relation to population density. The periodicity of application similarly varies. Additional sources of organic materials, such as Fulani animal manures, are frequently available. Commercial inorganic fertilizers have assumed a significant role in the maintenance of annually cultivated fields. In the final analysis, the rate of household production of organic materials is probably the most influential determinant, but by no means the sole determinant, governing the extent of adequately fertilized infield acreage.

CHAPTER VII

LAND USE PREFERENCES OF SOBA DISTRICT FARMERS: SPATIAL ORGANIZATION AND WORK STRATEGIES

The Cultural Interpretation of Land Use

In an effort to explore the suggestion of Hill that annual cultivation on infield farms represents the Hausa farmer's preferred type of land use, a subsidiary study of Soba District farmer's attitudes toward the two primary categories of upland land use, infield and outfield, was conducted. The objective of this series of interviews was to elicit the farmer's spatial preferences as well as the perceived utility of the types of land use in question.

Hill performs a valuable service by drawing attention to the fact that behavioral and cultural characteristics of Hausa farmers, such as land use preferences, are an important aspect of land use decision-making. The notion that the traditional smallholder plays an active role in determining farming strategies is frequently overshadowed by portraits of a passive farmer who must bow to the forces of environment or population pressure. Research into the behavioral aspects of economic activity, especially in the African context, is in its very early stages.

A second aim of this subsidiary study was to deal with

certain aspects of Boserup's claim that labor economy is the paramount determinant of traditional land use systems. Several references have been made thus far to the difficulty of obtaining reliable data on labor inputs to traditional agriculture. There are problems concerning not only the interpretation of such data but also the uncertainty of what types of labor are to be included in the category of agricultural man-hours. Discrepancies frequently arise in this regard with the evaluation of travelling time or supplementary agricultural activities such as tool repair. More behaviorally-oriented inquiries might well reveal that a strict calculation of man-hours expended simply does not account for varieties in land use types.

Perception of Agricultural Labor

The question pertains not only to the total labor units, however they are measured, which are devoted to agricultural activities, but also to the perception of the farmer of these various types of labor, especially with regard to degree of difficulty. Surely it is perceived labor difficulty that influences the smallholder's decision-making rather than standardized man-hours, a calculation he is incapable of making in any case.[1] With re-

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[1] It should be noted that the discussion in this chapter pertains to the effect of labor inputs and labor economy upon land use decision-making. Frequently, calculations of man-hour inputs to traditional agriculture are employed, not with this view in mind, but to determine relative efficiency of agricultural production relating to time spent on various activities. In this latter case, where labor efficiency is the focus, the farmer's perception of various labor alternatives is of less significance since actual, not perceived, work is at issue.

spect to the matter of traveling time between farm and farmstead, for example, it would seem that the weight given by the farmer to time and effort spent in traveling bears upon the question of its relative importance. In the present study, then, it is the perceived degree of difficulty of various farm operations which are associated with the classes of land use under review that is significant. Indeed, Hill takes this very line of approach by suggesting that Hausa farmers show a definite preference for weedless, stumpless land.

The farmer's perception of lowland farming illustrates this point quite well. Tabulations of labor inputs per acre show that lowland cultivation absorbs a significantly greater amount of labor per acre than does upland farming.[1] Although Soba District farmers were generally well aware of the more strenuous operations involved in fadama cultivation, interviews seemed to suggest that lowland farming, especially of rice, was not necessarily perceived as a more difficult undertaking than say, work on a cotton farm. The reasons for this discrepancy probably have to do with the size of the plots involved and the frequency of visits required. As might be expected, the farmer appears to be influenced primarily by the absolute labor requirements and by the scheduling of such inputs rather than by per acre tabulations.

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[1]Norman found that a fadama sugar cane farm required an average 472 man-hours per acre of labor. This was nearly double the labor inputs of most upland farming crop enterprises. Norman, Economic Survey of Three Villages, Table E11, p. E11.

Fadama plots are always small; the mean size in Soba District was only .23 acres. In the majority of cases these plots were located quite close to the settlement, and farm operations were carried out intermittently. Cotton fields, on the other hand, are normally quite large ($\bar{X}$ = 3.75 acres) and are ordinarily located in the outfield zone, dictating less frequent but lengthier visits. Despite the lesser per acre input, production of cotton is viewed by farmers as more laborious than that of rice; indeed, infield rice production on fadama was generally reported to be comparatively easy. Hence, it appears that what is most important to the farmer in his land use decision-making is the total labor commitment per season, not necessarily per acre labor requirements.

The method used to test for spatial and work preferences in this study was straightforward. It consisted of a series of three questions that were put to a sample of 110 heads of farming households: (1) If you were a stranger coming to this village, and the village head agreed to give you one farm, either an infield or an outfield plot, which one would you prefer to receive? (2) Why would you choose this type? (3) Which type of farm, infield or outfield, is more difficult to work? The replies to these queries were tabulated along with other pertinent variables, including population-related variables and ethnic status.

Definition of Land Use Types

Two very telling observations can be made at the outset

concerning the conduct of this study. In the first place, while the distinction between the two types of land use in question, infield (gonar cikin gida, gonar bayan gari, or gonar karkara) and outfield (gonar daji or gonar waje) is one which is readily made by most Soba District farmers, some complicating issues appeared in interviews with farmers from villages in the more densely settled sectors of the district. Frequently, this line of questioning evoked a discussion about just when or how a so-called "bush" farm becomes an infield farm. Just what constitutes a "bush" or outfield farm? Is the criterion involved purely a locational one based on distance from the settlement, or can a plot of ground change from one category to another? Does a farmer need to cultivate a plot well beyond "normal" fallowing limits in order for it to be considered an infield plot? Does the application of organic materials alone qualify a field as infield use?

These types of questions appear to be suggestive of the fairly large numbers of plots that are actually in a state of transition from one category to another, both in terms of location and use, or for which current terms of reference are inadequate. In the final analysis, it was necessary on numerous occasions to make reference to a specific plot, rather than to general types, in order to ascertain farming preferences.

Interestingly enough, within villages in sparsely settled areas, no such confusion ever arose. The distinction between the two types of land use remains clearcut. The implication here is that the infield-outfield distinction is not fully adequate to

deal with actual land usage in areas where population has stimulated expansion of the infield zone into the former outfield sector, areas where confusion over terminology appeared. This point will be taken up again in a succeeding chapter which pertains to a medium density village, Soba village.

A second preliminary observation concerns the extreme difficulty that was encountered in requesting that farmers make a mutually exclusive choice between the two types. Unless forced to select one or the other categories, it appeared that, for the most part, respondents would choose to cultivate both types, infield and outfield. Such a preference structure emphasizes the systematic nature of the smallholder's land use decision-making, that is, the interdependency of his requirements and his opportunities. The implication from this seems to be that there may well be no clearcut preference for one type of land use such that the farmer is readily willing to give up the alternative. Most farmers appeared to make such a selection only reluctantly. In general, findings from this series of interviews pointed to a rather sophisticated appreciation on the part of the smallholder of his opportunities for optimizing returns to effort as well as total yields by diversifying his agricultural production strategies.

Land Use Preferences

Some simple tabulations of frequencies of the data from this study suggest several interesting propositions. First, additional strength is given to the suggestion just made that

there is no clearcut and well-defined pattern of spatial preference among Soba District farmers. Indeed, just the opposite is true. In the sample of 110 interviews, 50.9 percent expressed a preference for infield farming; 49.1 percent took the opposite view. In other words, opinion was extremely evenly divided in this district-wide sample.

Furthermore, if by saying that Hausa farmers prefer continuous or permanent cultivation (infield farms), Hill intends to suggest that non-Hausa groups living in northern States do not show comparable preferences, then her assertion is not supported by evidence from this study. Broken down by the criterion of ethnicity (Table 18), the expressed preferences for the two types of land use do not appear to show any significant association.[1] It would not seem that a farmer's tribal affiliation alone could account for his response to the inquiry. The chi-square statistic for Table 18 is .5742 with one degree of freedom, which is not significant at the .05 level.

To be fair, it appears that Hill's observation probably refers to Hausaland as a region rather than to Hausa farmers as a distinctive ethnic group--a loosely defined category in any case. She would probably not choose to place great stress upon prefer-

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[1]The non-Hausa groups in this study included immigrants from the Jos plateau as well as Kanuri and Sayawa. It could be noted that these are all northern peoples who in some instances are counted as part of the "Hausa" population. In the survey of Soba District, no traditional smallholder from a southern state of Nigeria was encountered.

TABLE 18

LAND USE PREFERENCES OF ETHNIC GROUPS

IN SOBA DISTRICT
(In percent, N=110)

Type	Hausa	Non-Hausa	Total
Infield	41.8	9.1	50.9
Outfield	45.5	3.6	49.1
Total	87.3	12.7	100

Chi-square = .5742 with 1 degree of freedom
Contingency Coefficient = .15486

Note: It is acknowledged that 1 cell in this table contains fewer than 5 observations. Nevertheless, it was felt that the chi-square statistic should be presented as an indicator of the degree of association.

TABLE 19

LAND USE PREFERENCES BY VILLAGE

POPULATION DENSITY
(In percent, N=110)

Type	Density per Square Mile (0-100)	(101-199)	(Over 200)	Total
Infield	10.9	10.9	29.1	50.1
Outfield	25.5	7.3	16.4	49.1
Total	36.4	18.2	45.5	100

Chi-square = 5.54365 with 2 degrees of freedom
Contingency Coefficient = .3026

ence structure as distinguished by ethnicity. Nevertheless, it is important to point out that non-Hausa farmers operating under conditions similar to Hausa farmers, in terms of environment and pressure of population, do not display significantly exceptional land use preferences.

A similar contingency table (Table 19) tabulating responses to the preference question by a population-related variable, density of the village area of the respondent, seems to indicate more of an association. Grouped into three categories according to population density, and cross-tabulated by land use preference, a distinct patterning of responses begins to emerge. Farmers in the more sparsely settled sectors appear to show a greater tendency to select the outfield category; farmers in more densely populated villages demonstrate more of a tendency to choose infield farms than might otherwise be expected. This suggestion of a relationship between population density and preferred style of farming will be given further consideration in connection with more specific discussion of a low density village and a medium density village which follows in Chapters VIII and IX. Suffice it to say that Boserup's notion of a feedback relationship that operates between the work habits that are forced on a farmer by pressures of population growth and his own perception of these work habits seems to be supported here in Soba District.

Rationale for Land Use Preferences

The relationships delineated above are illuminated somewhat by a more detailed examination of the reasons offered by respondents for their preferences. It is argued here that any consideration of the character of agrarian change in general and of the factors which influence its course should give attention to the attitudes and perceptions of the individuals involved toward work habits, labor strategies, and land use preferences. Hence, the responses to the question of why one type of land use or another is preferred turn out to be very revealing.

The reasons proposed by respondents for their selections were grouped into eight categories (Table 20). Interestingly enough, the most frequently cited criterion for choice in this survey was related to labor inputs associated with the two types of land use in question. Nearly 30 percent of farmers sampled referred to work-related reasons as the primary motive for their choice. For the most part this group of farmers appeared to perceive the outfield farm as less laborious, but no firm conclusions could be reached in this regard since nearly 40 percent of this sub-population claimed that infield farming was easier.

More detailed questioning of farmers pertaining to which of the two types they found to be "easier", or less laborious, confirmed the initial impression that, with the possible exception of newly cleared cotton fields, outfield farms are seen as easier to work simply because they require less initial plowing effort, even though the total acreage involved is frequently greater than

Type	Labor Input	Crop Specific	Fertilizer Status	Location/ Travel	Crop Yield	Crop Variety	Size of Plot	Other	Total
Infield	12.7	7.3	10.9	9.1	7.3	1.8	0	1.8	50.9
Outfield	16.4	5.5	3.6	0	0	3.6	16.4	3.6	49.1
Total	29.1	12.7	14.5	9.1	7.3	5.5	16.4	5.5	100

LAND USE PREFERENCES BY
REASON FOR CHOICE
(In percent, N=110)

TABLE 20

that of an infield farm. On the other hand, infield plots are seen to require more labor, not necessarily because of the effort that goes into fertilization, but because they tend to require an extra weeding during the course of the growing season. As has been shown, the application of organic materials to these plots spurs the growth of desirable and undesirable plants alike, and heavily fertilized fields are readily acknowledged as more laborious to cultivate.

Such responses patently contradict Hill's argument that weedless, stumpless, manured fields are generally seen as easier to work. It should be recalled, of course, that in Batagarawa, the site of Hill's investigations, ox-drawn plows were regularly utilized. In Soba District, in contrast, such plows were extremely rare; this researcher encountered only one such plow in use during the course of the study. Undoubtedly, the type of farm implement employed influences both actual labor requirements as well as perceived labor inputs. It may well be the case that Hill's argument pertains particularly to areas where animal traction is used although she makes no such claim. The types of hoes which are the basis of agriculture in Soba District, of course, represent an older and far more widespread technology in Hausaland than do the ox-drawn plows of Katsina.

Furthermore, it appears that labor requirements which fall outside of the peak season, May through September, are given less weight in the farmer's assessment of difficulty of labor. Fertilization, for example, is done during the off-season and, particularly in smaller villages, is carried out in a relatively

casual manner. The farmer or a member of his family simply transports several headloads of organic materials to the infield plot each evening. He does not view this as a labor input of serious consequence. Similarly, the initial clearing of outfield farms--the cutting of small trees and clearing of bush--is done during the dry season. A considerable span of time may be taken up by this type of activity, but it is rarely perceived by the farmer as concentrated, difficult labor. As has been suggested, in his calculation of labor requirements the farmer appears to pay greatest attention to those farming operations which must be fit into the peak season: initial plowing or ridging, as well as successive weedings. Table 21 illustrates the farmer's perception of difficulty of labor, by selected crop enterprises and by land use type. A maize and tobacco combination is seen to involve the most labor because it requires two ridgings and three weedings. A Millet-sorghum combination grown on an outfield plot is seen as requiring the least amount of labor since it generally requires only two operations after planting: an initial ridging/weeding and a second weeding. Peanut farming is seen as slightly more laborious because of the digging effort required in harvesting. Rice production is somewhat anamolous, as we have seen, but is regarded as less tedious largely because of the small amount of land under cultivation. There was near universal agreement among district farmers that tobacco farming constituted the most difficult enterprise because of the many extra operations involved. There was less than complete agreement among farmers interviewed as to where cotton farming fits on this scale of

TABLE 21

PERCEPTION OF LABOR INPUTS BY
CROP AND LAND USE TYPE

	Crop Combination	Land Use	Operations* Required
Most Difficult	Maize/ tobacco	Infield	2 ridgings; 3 weedings
	Cotton	Outfield	Clearing; ridging; 2 weedings
	Peanuts	Infield or Outfield	2-3 weedings; dig for harvest
	Millet/ Sorghum	Infield	3 weedings
	Millet/ Sorghum	Outfield	2 weedings
Least Difficult	Rice	Fadama	Intermittent weedings

*other than planting and harvesting

difficulty; a number of farmers claimed that after the initial clearing and ridging of a field, for example, it was frequently possible to get by with only one subsequent weeding of a cotton field.

To return to the reasons for choice listed in Table 20, it is possible to detect in this breakdown a quite high level of sophistication. It is noteworthy that the size of the farm--usually based on the assumption that outfield farms are in most cases larger in extent than infield plots--was the determining factor for over 16 percent of those questioned. The reasoning in this case seems fairly clear. If the farmer has only one of the two types at his disposal, he will choose the field of greater size, hence greater potential productivity. Among those expressing an opposite opinion were some 14 percent of the respondents who took note of the fact that infield plots were generally heavily fertilized and consequently of greater potential value. Another 12 percent cited crop-specific reasons for their choice; most of these felt that one or another of the staple crops grows best on one or another type of farm. Millet is regarded as producing higher yields on infield farms; sorghum is seen as most productive on one-year-old outfield farms (fields having carried a previous "breaking crop" of cotton). Another 7 percent cited higher prospective yields on one or the other type of plot as their reason while approximately 5 percent viewed the potential for a variety of crops as determinative of their choice. A point to be stressed regarding the reasons cited here for land use preferences is that smallholders give every evidence of a

full appreciation of the assets and liabilities involved with each type. While labor-related reasons stand out as an oft-repeated theme, no single consideration appears to override all others, just as no particular type of land use seems to be undisputably preferred.

The Locational Interpretation

Interestingly enough, only 9 percent of these sampled farmers made reference to the location of the plot or to the distance involved from home to farm in this survey. The whole of this subpopulation, as might be expected, expressed a preference for infield farming. Such an outcome is consistent with the findings reported in the previous chapter pertaining to organic fertilization. The distance from farm to farmstead would not appear to operate as a prominent consideration in the smallholder's land use decision-making. In this survey, locational considerations are clearly overshadowed by other factors such as peak season labor requirements and potential quantity and variety of crop yields. Once again, arguments in favor of locational factors as a primary determinant of Hausa land use systems are not supported by the evidence from Soba District.

The Influence of the Bicycle

It is entirely likely that the widespread ownership and use of bicycles has served to significantly expand the maximum traveling time acceptable to the farmer. The farmer's indifference curve with respect to distance, in other words, has been

altered by the impact of the bicycle.

The observer of Soba District is struck by the extensive and frequent utilization of bicycles along major thoroughfares and on the maze of footpaths that connect farms with hamlets and villages. The sight of farmers pedaling to distant fields is not at all an uncommon one in Soba District. This researcher frequently recorded observations of farmers who made two round-trips by bicycle per day to distant farms (upwards of 3 miles).

This impression of the importance of the bicycle is confirmed by the district-wide sample of farming households in which approximately 70 percent reported that they owned or had immediate access to a bicycle in their compound. Indeed, the bicycle might well be regarded as having become an essential farm implement, especially in sectors of the district where outfield, long distance farming forms a major component of village land use. It could be noted that traveling time over "bush paths" has been significantly shortened by use of the bicycle. Several trials revealed that an average trip to long-distance outfield farms, 2.5 miles, could be covered in 15 to 20 minutes by this means. This equals an approximate rate of 10 miles per hour,or more than double the normal speed of travel by foot.

In the survey presented in this chapter, one condition frequently expressed pertaining to a farmer's choice of types was the availability of a bicycle. In nearly all cases the implication was that availability of a bicycle was related to a preference for outfield farming. Stated another way, the distance to outfield farms proved to be of lesser importance given

the possibility of bicycle transport. It seems a fair conclusion to draw from these observations that the bicycle can be seen to play an important role in the farmer's decision-making, particularly with respect to outfield farming, and has had a significant impact upon the relation of location to land use.

Decisions on the Landscape

Recent behavioral-oriented research has stressed the fact that "land use patterns are...the geographic expression of many decisions by individuals."[1] Spatial preferences and preferred labor utilization strategies are obviously important elements of individual decisions pertaining to land use. Hence, the objective of this subsidiary study was to utilize such expressed preferences to relate the two types of land use under review to the decision-making processes and perceptions of individual farmers.

In addition to its suggestion of the outlines of a behavioral framework within which the Soba District farmer makes his decisions about land use, this study of land use preferences provides several important insights into village agricultural systems. In the first place, there is some evidence here to support Boserup's claim that intensification of land use which produces a gradual lengthening of working hours in agriculture

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[1]This quotation is drawn from a discussion of individual spatial decisions which might well serve as a background for this study of land use preferences in Ronald Abler, John Adams, and Peter Gould, Spatial Organization: The Geographer's View of The World (Englewood Cliffs: Prentice-Hall, 1971), p. 455.

also results in a changed perception of that agricultural labor.[1] Some very subtle shifts in attitude toward work strategies show through here. It appears that Soba District farmers whose production comes primarily from more intensively cultivated infield plots, namely those residing in the densely populated sectors, actually develop a preference for this style of farming. This notion is certainly not inconsistent with Hill's claims about the preferences of Batagarawa farmers. As is revealed by their land use preferences and their perception of the labor involved, a significantly greater number of farmers who prefer to work less exhaustively over a large area for longer periods can be found to reside within the sparsely settled zones of the district. Conversely, a greater than expected number of farmers whose preference is for concentrated effort over a smaller area can be detected among densely settled village areas. The preferred style of farming, in other words, is not unrelated to population-induced pressures on the land.

Secondly, the analysis of findings from this study leads to the suggestion that at least two distinctive land use systems exist in Soba District. Each of these reflects the decisions of individual farmers and their preferred style of farming in the light of available land resources. The first of these, associated with less populous villages, can be considered to be a true infield-outfield agricultural system. In this system each of the two types of land use is distinctive; each has its place in

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[1] E. Boserup, "Population Growth and Working Hours," chapter 5 in Conditions of Agricultural Growth, pp. 43-55.

the overall land use strategies of farming families. Moreover, the respective importance of infield and outfield land use is relatively constant among all village farmers. An example of this type of agricultural land use system is analysed in greater detail in the following chapter.

The other type of land use system which emerges from this study is somewhat more complex because of its transitional character. As will be seen in the presentation of an example of this type in Chapter IX, infield land use forms a far more important component in village land use, but not all smallholders display similar preferences or similar farming strategies. As has been shown, the infield-outfield distinction begins to become cloudy in the context of more densely farmed village areas--which are actually only medium density villages in relation to Hausaland as a whole.

CHAPTER VIII

THE LOW DENSITY CASE: GARUN GWANKI VILLAGE

Garun Gwanki village is located in the very sparsely populated southeastern sector of Soba District. This comparatively small settlement is sited well removed from the main road which transects the district and is accessible only by bicycle, motorcycle, or heavy duty vehicles. It lies astride a primary north-south cattle trail and is adjacent to the 88 square mile Kona Forest Reserve (see Map 3).

In fact, there are two villages about one mile apart with this name at this location, an old and a new Garun Gwanki. The new village, which is the subject of this investigation, was established in 1941 at the time that the nearby forest reserve was created and farmers were forced to leave the restricted area. Unlike the old Garun Gwanki village, which is still inhabited and which bears all the characteristic marks of an old walled Hausa gari, the more recently established settlement has no wall and has more the appearance of a kauye or country hamlet.[1]

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[1]No lengthy description of the characteristics of the Hausa gari (walled town) is included here. For more detailed information, see Hill, Rural Hausa, pp. 10-19, or Mortimore, Zaria and its Region, pp. 108-117.

Population Growth

The primary impetus for the growth of the new Garun Gwanki settlement was the selection of one of its prominent residents as village head in 1966. The sarauta or nobility of the village consist of twelve sons of the former village head who had been resident in the old village. Following the transfer of the title to his eldest son, all of the remaining sons migrated to the new location. Hence, the population of new Garun Gwanki has increased quite considerably in recent years. Census figures are of little utility in this regard since they record total "village area" population.[1] Interpretation of 1962 aerial photographs, however, suggests an estimated population of 150 residents at that time; only 16 compounds are in evidence. In 1974, 39 compounds were occupied and the total resident population of the settlement was established at 340. These figures represent an increase of over 125 percent in twelve years or an approximate rate of annual increase of 7 percent. Obviously, such population growth is not the result of natural increase alone, but reflects the in-migration of residents from the old village as well as from other areas of the district. Over 11 percent of the current heads of households in the village report that they have lived in Garun Gwanki less than twenty years; 6 percent have arrived within the last five years.

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[1]The population reported for the "village area" was 2,248 in the 1952 Census and 4,056 in the suspect 1963 Census.

An additional 26 percent of the household heads migrated to this settlement between the time of its founding and 1955. Of course, all of these "immigrants" have taken up permanent residence in Garun Gwanki and now consider it their home village. Only one farmer in this village engages in seasonal migration for farming. In this case, a non-Hausa Plateau tribesman has arranged to borrow land for his own use during the farming season each year; he returns to his home during the dry season.

The approximate area under the administration of the village head resident in Garun Gwanki is 65 square miles, one of the more expansive "village areas" in the district. Within this territory an estimated 3,500 people resided in 1974. Hence, the crude population density figure for the village administrative area was on the order of 50 persons per square mile, among the least densely settled sectors of the district as well as within Hausaland.

No attempt was made to measure the proportions of cultivated to uncultivated land within this extensive village territory, but frequent and widespread observation within the village area suggests that a very large percentage of the village lands were not farmed in 1973-74. Probably less than 10 percent of the area was under cultivation. Other indicators, such as the number and location of hamlets and villages and the utilization of large tracts of land for grazing by Fulani herders, also point to a similar conclusion--that only a small proportion of the land resources of the village area are presently utilized for farming.

The village under study here, in sum, is relatively small,

relatively new, situated within a very sparsely populated sector and, in comparison to the site of most other village headships, remote. The question to be given consideration in this chapter, then, is whether there are any features of its agricultural system, particularly in the use of land, which stand in contrast to those already listed for the district as a whole or those which will be described in the following chapter pertaining to a more densely settled area.

Village Morphology

Because of its age, size, and location, Garun Gwanki is not particularly favored with respect to services and amenities. It has no concrete-lined wells, no primary school, and no periodic market--all of the typical characteristics of more populous administrative centers. Its residents must travel to Soba village, 10.5 miles distant by foot and bicycle paths or 15 miles by dry season track, or to Kubau village, 10 miles away by rather low, hence seasonally swampy territory, in order to do their marketing. Although one might assume that such comparative isolation might have encouraged self-sufficiency in crafts and traditional basic services, the village has not in fact developed any large scale craft industry such as weaving or pot making. Indeed the opposite appears to be true. Table 22 indicates that just over half of the adult farmers in the village report that they have no secondary or off-season occupation, a figure significantly higher than the district norm. The number of villagers in each category

TABLE 22

SECONDARY AND OFF-SEASON
OCCUPATIONS IN GARUN GWANKI

Category	Percent of Adult Males	Type of Occupation	
No Secondary Occupation	51		
Dry Season Occupation	16	4 Petty Trading 2 Roofing/Repair 1 Weaving	
Year-round Secondary Occupation	33	3 Petty Trading 1 Administration 1 Bicycle Repair 1 Barber	2 Hunting 1 Koranic Teacher 2 Butcher 2 Tailor
Total	100		

TABLE 23

HOUSEHOLDS IN GANDU,
GARUN GWANKI (N=43)

Category/Size	Percent	
No Gandu	23	
Small Gandu (2)	49	77
Medium Gandu (3-4)	23	
Large Gandu (5+)	5	
Total	100	

of year-round or dry-season occupation is also small, in most cases only one of each type. Interestingly enough, the village has no permanent blacksmith of its own; an itinerant from Katsina arrives yearly to repair and refurbish agricultural implements.

A diesel powered grinding mill operates in one of the village compounds. Along with several foot-treadle sewing machines and the motorcycle belonging to the village head, it is the only machinery found there. The only non-residential structure, apart from numerous small granaries, located in the village is a mosque. This latter along with only two out of the forty compounds in the village is roofed with corrugated tin rather than the customary thatching.

Two probable reasons account for this village's relative lack of self-sufficiency and its comparatively low level of services. The first has to do with its inter-dependence with the rest of Soba District, especially the district's primate village, Soba, and is obviously related to the more general processes of integration and modernization that have occurred in Hausaland in the last quarter century. The widespread ownership of bicycles and the consequent ease of access to nearby service and marketing centers has undoubtedly been a contributing factor in this respect. Eighty percent of Garun Gwanki farmers reported that they owned or had access to a bicycle in their compound. As has been suggested in a previous chapter, the bicycle has had a decided impact upon the spatial inter-relations of Soba District villages.

Secondly, this village, for a variety of reasons, has an

overwhelmingly agricultural economy. As is the case with many such small, remote villages, no non-farmers reside there. As will be demonstrated shortly, the smallholders of Garun Gwanki farm generally larger acreages and probably receive a greater than average proportion of their annual incomes from farm activities rather than supplementary or secondary means.

Aspects of Rural Economy

Farm Labor

The number of occupants per compound varied greatly in this village (from a small nuclear family of 2-4 up to extended kinship groups of 23), but the mean size of a compound was 8.8 persons. Family (iyali) size was somewhat smaller (7.9 persons) since several large compounds included more than one family. By far the largest number of these households were organized as gandu, the economic work unit described in Chapter V. As is indicated by Table 23, 77 percent of the village households were organized in this fashion; most of these were small, however, consisting of only two members. Consequently, a very high proportion of the village land under cultivation is worked by gandu labor, in some cases with the assistance of supplementary hired labor (kwadago). Table 24 reports that the cultivated acres of 27 sample households which was farmed by gandu, with or without hired assistance, amounted to 80 percent of the total.

While most labor inputs to Garun Gwanki agriculture came from family sources--and as we have seen, most of this is organ-

ized as gandu--hired labor is also employed on a greater scale than might be expected. On 51 percent of this sample of farmed acreage, hired labor was utilized at some point during the agricultural season; 11 percent of this sample was reported to have been exclusively worked by hired farm laborers. This latter observation is probably somewhat misleading to the extent that it suggests large numbers of farmers who do not work on their farms at all. As we have seen, farmer/respondents tend to think primarily of the initial plowing and subsequent major weeding operations in response to inquiries about labor inputs. Farms which are reported to have received exclusively hired labor inputs usually receive inputs of family labor as well on a more casual basis, particularly for harvesting. Nevertheless, one cannot discount the frequent use and impact of paid farm labor. Many of these yan kwadago are migratory workers; their number and availability was undoubtedly increased in the 1973-74 season as a result of the impact of the drought in more northerly regions of Hausaland.

Such widespread utilization of paid non-family labor in such a remote location calls into question the severity of the well-known and widely cited "labor bottleneck" period. How much of the difficulty in getting land plowed and planted experienced by farmers during the critical period of initial rainfall in May and June is properly considered a shortage of available labor? Would it be more correct to attribute these difficulties, at least in part, to a shortage of cash resources with which to pay farm labor. It appeared that non-family, non-village labor was available on a widespread basis in Garun Gwanki village during the

TABLE 24

FARM LABOR IN GARUN GWANKI
(N=27)

Type of Labor	Cultivated Acres	Percentage
Farmer Alone	14.8	4.5
Farmer/Family	14.9	4.5
Gandu	137.6	40
Farmer/Gandu plus hired labor	136.9	40
Hired labor alone	37.8	11
Contract labor	0.0	0
Total	342	100

TABLE 25

FARM TENURE IN GARUN GWANKI
(N=27)

Type of Tenure	Cultivated Acres	Percentage
Allocation by Village Head	285	83.5
Inheritance	55	16
Lease	2	.5
Total	342	100

period under study. Moreover, 34 percent of Garun Gwanki farmers reported that they engaged in kwadago. To the extent that labor can be said to have operated as a constraint upon the extent of land actually cultivated, it was probably the economic circumstances of individual farmers that prevented the more extensive utilization of such labor resources.

Female Farm Labor

Another labor resource that is extensively used in Garun Gwanki is adult female labor. The conventional view of Hausaland holds that very few, if any, adult Muslim Hausa women engage in heavy farm labor other than the tending of kitchen gardens. In the more strict Islamic villages and towns, one would rarely see an adult Hausa female plowing or weeding fields, although it is not at all unusual to see elderly or very young women engaged in light farm tasks such as planting and harvesting. But such is not the case in Garun Gwanki.

Most of the fadama rice farms in Garun Gwanki are the entire responsibility of women. Females could occasionally be seen plowing fadama, an extremely arduous task, and quite regularly engaged in weeding and cultivating these lowland plots. At least one upland, infield plot was considered by villagers to be the possession of a middle-aged widow, who along with occasional hired laborers tended the field herself. When asked why young women worked so frequently on farm plots, the usual response from villagers, male and female alike, was that Garun Gwanki was merely a kauye, directly translated as a countryside hamlet but

figuratively signifying a remote "hick" village. Although no further investigation of the role of female labor was undertaken, it was obvious that this common practice adds to the amount of land under cultivation, especially fadama. The use of such female labor is no doubt related to the enforcement of Islamic strictures which in turn bears some relationship to distance from urban centers.

Land Tenure

Following the general scheme of Boserup, as well as her more specific statements relating to land tenure, one might expect that in the context of a sparsely populated village area such as this, very little of the farmland is held as freehold. Such is indeed the case in Garun Gwanki. Table 25 shows that, among the sampled farms, 83.5 percent of the acreage had been allocated directly to the present farmer by the village head. The comparatively low rate of inheritance of farmland is accounted for by the relative youth of the village. Moreover, the very small amount of acreage that can be classed within one of the more mobile types of tenure is suggestive of the absence of any pressures on land resources, at least in terms of availability. The small amount of rented land, it should also be noted, is held by non-villagers. There were no farm sales reported in Garun Gwanki. The typical explanation for this is that no one would buy a farm when he could merely ask the village head for the use of a tract of village land.

Interestingly enough, all of the rented acreage and all

except 17.5 acres of the inherited land fell in the infield category of land use. Most of the non-allocated acreage, in other words, was within the infield zone. Although only 55 percent of the total sampled infield acres fell into these non-communal categories, it was obvious that family rights to land were firmly established in this zone. The village head could not arbitrarily reassign cultivation rights to these farms, and present owners appeared to have the right to lease their infield plots if they wished. While the rights to fields in the outfield zone which had long been cultivated by a single family did indeed appear to be associated with that family, the village head retained ultimate authority over the outfield zone. Boserup's claim that there is a causal relationship between land use and land tenure appears to some degree to be supported by these observations.

Livestock

The indigenous livestock population of Garun Gwanki village was small; hence, the animal dung contribution to organic fertilizer supplies could not be expected to be very great. Sixty-five percent of the household heads in the village reported that they owned no livestock or only a few fowl. The twelve owners of small livestock held a total of 120 head of sheep and goats. Typically, the village head owned a horse, and an additional 9 donkeys were held by several villagers. Two of the villagers reported that they owned several head of cattle, but these were never in evidence in the village. In terms of animal contributions to fertilizer, it should be recalled that the village is sited close to a major

cattle thoroughfare, and a number of nearby fields were manured by Fulani cattle during the dry season. During the rainy season, in contrast, farmers had no desire to have the Fulani animals anywhere near the village or their planted fields.

Land Use

Cropping Patterns

All of the crops noted in Chapter V as characteristic of Soba District were observed in Garun Gwanki, with the single exception of yams. Typically, practically all cultivated plots contained mixtures rather than sole stands. Close to 70 percent of the sampled cultivated acreage was devoted to the production of cereals which provide both the staple diet of villagers as well as a major source of income. Within this category, millet and sorghum combinations predominate. In the sample, 57 percent of the acreage was planted solely to these grains while another 9 percent included these along with other staples. In addition, a significant acreage of maize (29 percent of sample in combinations) was observed, although only a tiny portion of this was in sole stands. Most of this maize was grown on land which was planted late in the farming season to cotton.

A comparatively small acreage in the sample was devoted to peanut production, a crop for which Garun Gwanki farmers do not feel their efforts are sufficiently rewarded. Most of the peanut production appears to be consumed locally rather than being marketed via state agencies. Another legume crop which probably accounted for a substantial acreage within crop mixtures was black-

eyed peas (cowpeas).

Cotton acreage accounted for the largest non-food category of farm production; 28 percent of the sampled acres included cotton and 9 percent of this subtotal was planted in sole stands. Despite the ease with which cotton can be marketed since the establishment of a cotton buying station in the village, cotton has remained a generally unpopular crop among Garun Gwanki farmers. The view was frequently expressed that cotton did not produce a return commensurate with the labor investment required. Indeed, numerous farmers said that if cotton were not required as a "breaking crop" for newly opened lands, they would devote all of their acreage to cereal production.

Although no tobacco acreage appeared in the sample of cultivated acreage, it was known that several village farmers regularly planted small plots of this high value crop. The fact that the extension and incentive schemes managed by the tobacco companies have not penetrated on any large scale to the more remote villages of Soba District probably accounts for this comparatively small acreage. The only master farmer who had contracts for tobacco in the Garun Gwanki village area resided in the old town nearby.

Vegetables, notably okra and "garden eggs", and non-food crops such as henna and Deccan hemp dominated on the small interstitial plots located within the settled area. Typically, such areas were maximally utilized, including large sections within compound walls. At the height of the growing season (August), such crops along with the staple cereals and numerous vines, com-

TABLE 26

PRIMARY CROP MIXTURES,
GARUN GWANKI*
(N=27)

Crop Mixture	Cultivated Acres	Percentage
Sole Stands		
Sorghum	5.0	1.5
Millet	3.0	.9
Cotton	30.5	8.9
Rice	5.0	1.5
Two Crop Combinations		
Millet/Sorghum	193.8	56.7
Maize/Sorghum	17.5	5.1
Maize/Peanuts	9.8	2.9
Maize/Cotton	64.0	18.7
Three Crop Combinations		
Millet/maize/sorghum	3.4	.9
Maize/sorghum/peanuts	2.8	.8
Other	7.2	2.1
Total	342	100

*Includes only prominent crops in mixtures

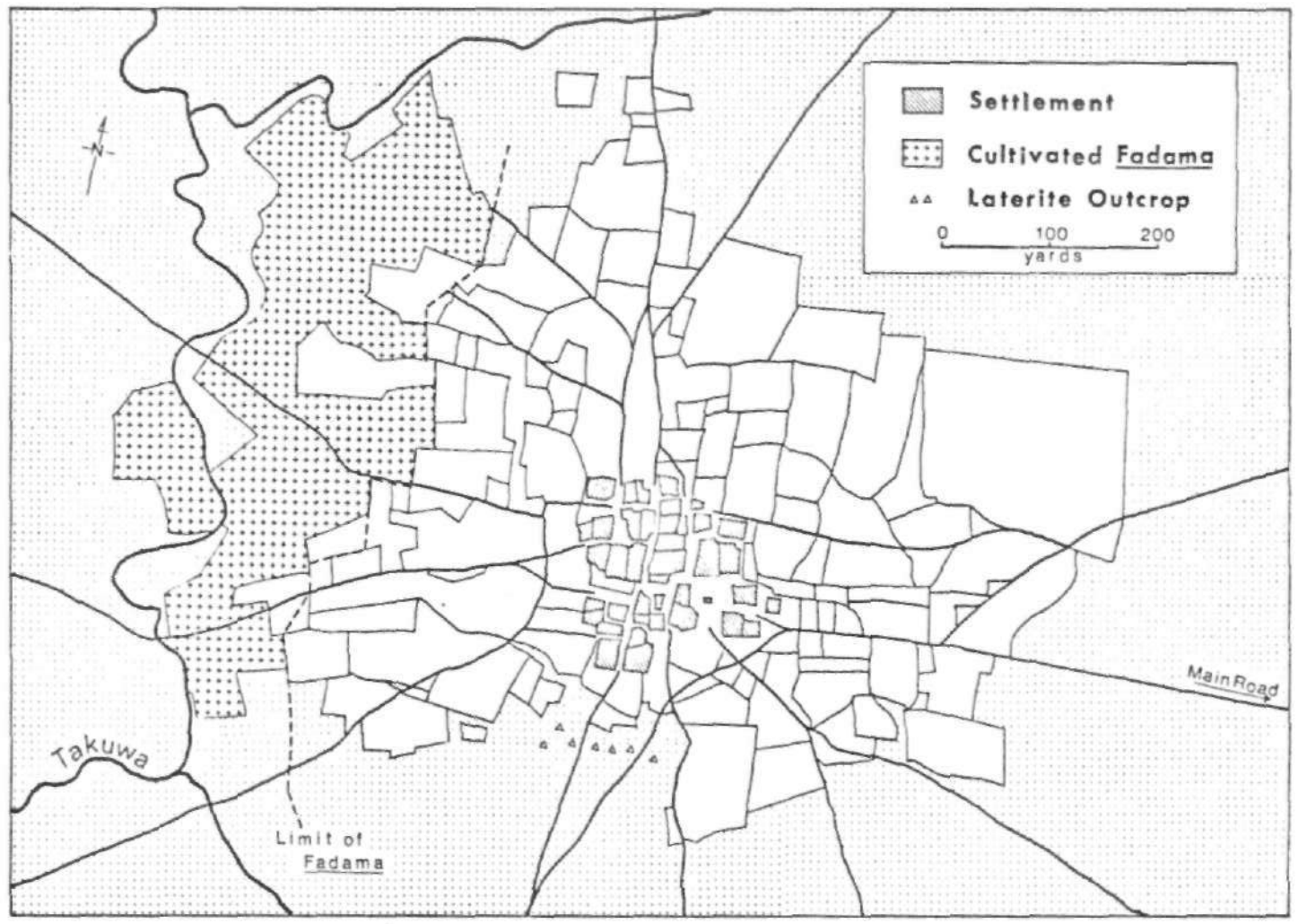
pletely overgrow the settlement. Compound walls and huts are barely visible during this period of the year, and villagers refer to it as duhu (darkness). Despite the high visibility and obvious profusion of these crops, such inter- and intra-compound plantings probably accounted for less than two acres of cultivated land.

Practically all of the cultivated lowland near Garun Gwanki was devoted to rice production; a small number of these fadama plots included maize as well. Yet such plots accounted for only 2 percent of the total cultivated acreage in the sample. Only two such plots were planted in sugar cane, and in contrast to more accessible villages, all of the cane produced is consumed locally.

Size and Composition of Holdings

The average size of farm holding as derived from this sample in Garun Gwanki was quite large in comparison to other more populous sectors of the district. It was estimated that the mean holding of a farming household (in most cases the same as a compound) was 12.5 acres. Of this, 2 acres or 16 percent was in the infield category; the remaining 10.5 acres consisted of outfield land. Consequently, in the typical farmer's holding, 84 percent of his acreage lies one half mile or more from the settlement.

This relatively large size of average holding compares favorably with the findings of Norman in another sparsely settled region of North Central State. There he estimates the average farm holding to be 11.9 acres. It should also be noted that such a sizeable holding is substantially greater than that frequently cited for northern Nigeria as a whole, 4.5 acres. Such findings



MAP 6 Garun Gwanki Infield Zone

from Garun Gwanki are also consistent with the widely held view in Soba District that the "large farmers" are to be found in small villages.

This total farm holding of an average houschold consisted of four separate plots of contiguous land; of course each location was typically subdivided further. Two of these plots lay within the infield zone while the remaining two would be located at some distance from the settlement in the outfield zone.

Infield Land Use

The mean size of an infield plot in Garun Gwanki in 1973-74 was .88 acre. The range of plot sizes, as can be seen from the Map 6, was quite broad, from less than .1 acre to slightly over 7 acres. The fact that the average farm holding included 2 acres within this zone suggests that most village households hold more than one plot in the infield zone; such an observation is borne out by analysis of the infield zone by cultivator. Table 27 reveals that 68 percent of these infield plots were less than one acre in extent and that 38 percent of the total consisted of plots smaller than .5 acre. Of the 79 infield farms, only 4 were larger than 2 acres. These figures suggest that considerable fragmentation has taken place within the infield zone, although since its total extent is not great the distance between plots belonging to a single household is not great.

The total amount of upland cultivation in the infield zone in 1973-74 was approximately 75 acres. Its boundaries are readily observable on the landscape; no confusion exists about where its

TABLE 27

SIZE-DISTRIBUTION OF INFIELD PLOTS,
GARUN GWANKI

Acreage Range	Frequency	Percentage
less than .5 acre	30	38
.5 to .9 acre	24	30
1 to 2 acres	21	27
more than 2 acres	4	5
Total	79	100

TABLE 28

CULTIVATED ACREAGE IN
GARUN GWANKI

Type of Land Use	Cultivated Acres	Percentage
Upland		
Infield	75	15
Outfield	425	83
Lowland	10	2
Total	510	100

perimeters lie. Some slight increments to its total acreage were made late in the farming season when Hausa potatoes were planted in a few outermost plots, but this did not increase the overall size of the zone significantly.

Farms within the infield included practically all crops mentioned above with the notable exception of cotton, which was reportedly never grown on infield farms. Maize, sorghum, and millet dominated production in this zone. Plots were rarely, if ever, fallowed during the agricultural season. Indeed, most of this same infield zone had reportedly been cultivated annually since the initial settlement of the village.

As was reported earlier, out of the total of 75 acres in this zone, only 9 (12 percent) were observed to receive organic fertilizers prior to the 1973-74 farming season. Some small increment of this zone was treated with cottonseed as a fertilizer; most of this latter acreage lay near the site of the temporary cotton buying market. In addition, it appeared that much of the infield zone received inputs of commercial fertilizers which were readily available in the district although not inexpensively. Precise calculation of the acreage so treated proved to be impossible because of the intermittent and spatially haphazard manner that inorganic fertilizers were applied. Nevertheless, information from village smallholders suggests that such fertilized acreage may well amount to a considerable portion of the infield zone, perhaps as much as half. On non-fertilized land, reliance was placed upon the fertilizer inputs of previous years.

One additional semi-permanent improvement found among the

farms in this infield zone was the construction of lengthy drainage canals and ditches. A quite extensive network of these improvements could be seen in this zone, and the labor involved in redigging them each year was not inconsiderable.

The most noteworthy feature of this infield zone, in terms of the theme under investigation in this thesis, is the lack of any significant change in its size during the past decade. Despite the relatively high rate of population growth that can be demonstrated to have occurred in Garun Gwanki since the early 1960s, it appears that the infield land use zone has not increased measurably during this same period. Analysis of 1962 air photographs in comparison with a map compiled of this zone in 1974 shows very little change in the perimeter of this zone. On the contrary, because of the increase in area taken up by newly constructed residences during this interval, the infield zone may well have shrunk in size. Moreover, as a proportion of total cultivated area, the infield zone has likely decreased in importance as more and more outfield land has been taken under cultivation. Such a finding is altogether inconsistent with the view that Hausa farmers prefer infield land use, since under conditions of an increasing number of smallholders during the last decade, one would have expected a comparable increase in infield farming.

During this same period, the infield zone has been increasingly subdivided and fragmented. Plots formerly in the hands of village nobility and early settlers are now farmed by more recent arrivals. The structure and location of plots within this zone, as we have seen, revealed this subdivision process quite clearly

and local informants made similar observations about processes at work in the infield zone. The implication here is that, although the infield zone has not increased in size, the village head has felt it important to assure that all villagers cultivate a portion of this type of land rather than merely allowing the earliest families to dominate production in the infield area.

Several reasons are in evidence for this relative lack of expansion of infield land use (refer to Map 6). In the first place, fairly obvious physical barriers limit expansion of the zone on two sides: to the west of the village lies a stream and a wide expanse of fadama. The higher ground to the south of the settlement is dominated by lateritic outcroppings at the surface, unsuitable land for farming. Similarly, to the north of the village at a distance of 3/4 of a mile lies a small stream bed surrounded by seasonally inundated lands, beyond which lie the farmlands belonging to the older village.

The question, then, is why this zone has not expanded in a northeasterly direction where it would seem that considerable additions could easily be made. Not only is this a relatively empty area, but it follows the orientation of the village in terms of dominant traffic flow. Interviews with village smallholders quickly revealed a consistent reason why no expansion in this seemingly likely direction had taken place: soils. The land in this sector has been judged as tauri (hard). It remains firm, heavy, and difficult to plow by hand long after the initial planting rains have come. The barrier to expansion, in other words, seems to be clearly one relating to the physical environment. The

proximity of this land to the settlement and the spatial preferences of individual farmers are secondary in this case. Obviously, the failure to utilize what in other circumstances might be deemed a valuable land resource is not unrelated to the presence of more desirable and offsetting opportunity elsewhere within the village territory.

Secondly, one cannot fail to recognize the limits placed upon the expansion of the infield zone by shortages of organic fertilizer materials. As has been suggested, the relatively low livestock population of the village means a small animal manure contribution. The fact that only 12 percent of the zone was treated during the study year implies that there is no surfeit of these supplies in the village.

Outfield Land Use

No direct comparisons with acreages of outfield from previous years could be made, but it appears that population growth in Garun Gwanki has largely spurred an increase in the cultivated area in the outfield zone in recent decades. In 1973-74 approximately 425 acres within the outfield category were cultivated by village farmers. Out of the typical holding of 12.5 acres, 84 percent lay in the outfield zone. By a quite sizeable margin, most of the food staples produced by villagers, as well as all of the cotton raised, came from the outfield farms. Although average yield per acre is probably higher on infield land, the substantially greater proportion of outfield land (approximately six times that of the infield

zone) overcomes any advantage in per acre production capacity.

The mean size of fields in this zone was 5.5 acres, substantially larger than the .88 acre average for an infield farm. As has been observed, such mean figures suggest that the average smallholder cultivates two such outfield plots; however, the variation in practices is great and there were numerous (22 percent) farmers with only one holding of outfield land.

The rotation and fallowing practices in Garun Gwanki are not ironclad. A considerable degree of judgement is exercised by individual farmer decision-makers, although a cotton-sorghum-cotton-sorghum rotation was certainly the standard. If land is assessed as "strong", it may well be cultivated for 6 to 10 years before being returned to fallow for a comparable period of time. "Weaker" land may be cropped for only 3 or 4 years before fallowing.

Nevertheless, a very substantial portion of village territory had not been cropped for many years. This is especially true in the outer reaches of the outfield zone where the vegetation was quite dense and the size of trees implied that they had been allowed to grow for many years.

Many of these outfield plots were located at a considerable distance from the settlement. Few of them were closer than 3/4 of a mile and many were 2.5 to 3 miles distant. Close examination of the structure of holdings in this outfield zone reveals a most significant feature of Garun Gwanki land use: a very large number of these outfield farms are located in an area 3 miles to the southwest of the village called Gwargagi. The reason for the abundance of outfield farms in this site is obvious from observa-

tion as well as from reports from farmers. Because of certain special micro-topographical relationships giving rise to favorable soils, farmers have found this to be an especially fertile and easily worked section of village territory. This particular Gwargagi area was discovered in 1967 by one of the village smallholders and has since attracted 65 percent of the village's farmers. Nearly all of the plots in the Gwargagi area have been farmed annually since their initial clearing without fallowing and without the addition of organic fertilizers, some for the entire seven-year period.

Between this heavily cultivated tract of some 150 acres and the settlement lies a vast expanse of untouched bush land. Yet because of its productive and amenable soils, farmers bicycle the intervening 3 miles sometimes twice daily to work their holdings.

Factors Governing Land Use

Enough has been said about Garun Gwanki to draw several pertinent conclusions about land use and land use change in the context of a sparsely populated, remote village. Firstly and most importantly, the configuration of land use found in this village can be regarded as a true infield-outfield land use system. Each of the two types of land use is clearly discernable on the landscape. More significantly, each appears to be important and to perform a function within the land use strategies of Garun Gwanki farmers. Given what appears to be a clear opportunity to farm entirely in one or the other land use zone, Garun Gwanki

smallholders all employ both types in an effort to diversify labor inputs over time and over space as well as to maximize total production of crops within desirable limits of labor expenditures. The systematic nature of land use and land use decision-making is emphasized in this example; more will be made of this point in a concluding analysis.

No clear preference for infield land use is in evidence in Garun Gwanki. Rather, farmers show a sophisticated appreciation of the variations in physical properties of the land available to them, and they tend to select those soils most favorable given the narrow limits of time within which plowing and ridging operations must take place for maximum yields.

A. T. Grove has suggested that above certain ranges of population density, a broad correlation between land capability, in the form of micro-soil variations, and land utilization emerges. He states that,

> Where population densities are lower than... (150 or 200 per square mile)...land use is commonly unspecialized; land is not used for different purposes according to its inherent capabilities..(whereas)...in more heavily settled areas, there is a closer relation of the land-use pattern to soil conditions.[1]

The evidence from Garun Gwanki, however, suggests that such a correlation may not exist in all cases. Here, in a low density situation where considerable freedom of choice exists with respect to which land will be utilized, a broad correlation be-

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[1]Grove, "Population and Agriculture," p.125.

tween preferred soils and cultivated land has emerged. If, as is to be expected, farmers continue to seek out and to show a preference for favorable soils, and to avoid less desirable soils regardless of their location, the association between land capability and land use will likely be strengthened. Hence, in this case, soil-selective land use is a feature of low density farming, the opposite of Grove's assumption.

The impact of physical variables upon land use is clearly in evidence in the case of Garun Gwanki village. As commonly appears to be the case, the initial siting decision with respect to the actual settlement set the eventual outer limits for the expansion of the infield land use zone. There has been little pressure or incentive to exceed these limits because of more favorable opportunities elsewhere, albeit at greater distances from the farmer's homestead.

The impact of distance factors upon the pattern of land use, in contrast, seems to be practically negligible. Distance appears to pose no impediment whatsoever to the utilization of favorable outfield plots. Conversely, proximity is no guarantee for the utilization of potential infield tracts.

CHAPTER IX

THE MEDIUM DENSITY CASE: LAND USE IN SOBA VILLAGE

In comparison to the low-density farming system described in the previous chapter, a distinctly contrasting system of land use was found in Soba village. A sizeable village which serves as the administrative headquarters for the district, Soba lies very near the center of the district astride the main Zaria-Pambeguwa road. It is located within one of the most densely settled sectors of the district. As might be expected, the size and relative density of its population along with its age and relative location have had a marked impact on the pattern of agricultural land use around the village. Much of the present chapter is concerned with the changes that these factors can be seen to have brought to the agricultural landscape during the period 1950-1975, especially the influence of a rapidly growing population.

Village History

Like several of the twelve other old walled villages in Soba District, it may well be possible to trace the origins of the settlement at Soba to the thirteenth century. According to oral traditions in the village, the settlement came into being as a result of the struggles for power within the ancient Bornu

Empire. From Kukawa several sons of a chief migrated to the area now known as Soba District and eventually founded its three major early villages: Soba, Maigana, and Gimba.[1] By the early 1800s, Soba village was under the sway of the Zaria Emirate which has maintained traditional authority over the region up to the present. Conflicting claims and internal strife over the village headship gave rise to several lines of succession for that title, and there are at present four dynasties within the village that lay claim to noble status. The District headship, in contrast, has remained firmly in the control of the Zaria Emirate and has traditionally been occupied by a prominent member of the family of the Emir of Zaria.

Obviously the pre-colonial history of Soba village is not of especially great consequence for the argument in progress in this thesis. Yet this brief account should serve to stress the fact that land use around this village may well have a history of some five hundred years, a strong contrast to the case of Garun Gwanki village.

Stimuli to Growth

Soba village became district headquarters under the British colonial administration in 1913, at which time the approximate present boundaries of the district took shape. Following the construction of the Bauchi Light Railway which traversed

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[1] R. Shehu, "Soba From the Start," Port Harcourt Teacher Training College, 1973. (Typewritten)

the district from northwest to southeast, the village became an economic center as an agricultural marketing and transshipment center.

The stimulus for its subsequent development as an educational center came as early as 1921 with the opening of one of the first rural primary schools in the region. This fact, along with the later opening in 1956 of a very early senior primary school, shaped the growth of the village in a way that is illustrative of an important and interesting feedback relationship. A significant number of the individuals educated in these maiden institutions located in Soba have since attained positions in which they exercise some influence in governmental decision-making that concerns village development.[1] The fact that the village has since become the site for major state educational installations, for example, is probably not unrelated to the status of its former denizens. At present, the village is the site of a Government Secondary Technical School, begun as a craft school in 1961, and of the Government Girls Secondary School, opened in 1969 on the site of the former senior primary school. It should be borne in mind that both of these schools were constructed during the period under study here. Moreover, since secondary schools are few in number in the region, the presence

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[1]Among these "sons" of the village and of these early educational institutions are: the Chief Education Officer of North Central State, the Chief Social Work Officer, N.C.S., the Chief Engineer, N.C.S. and the Senior Veterinary Officer, N.C.S.

of these institutions lends a state-wide significance to the village.

Settlement Pattern

The original settlement of Soba village was on a lateritic ridge on the southern side of the stream which bisects the old village walls, a section known locally as Hayin Kado. The attraction of the road typically proved very great, however, and by the turn of the century the main settlement lay astride the path of the present road. By 1950, only a few families remained in this Hayin Kado section; many of these few compounds were occupied by "strangers" who came seasonally from Kano to farm the *fadama*. By 1975, no compounds at all remained on Hayin Kado although their former presence was in evidence. This former settlement site within the walls has been used in recent years primarily for agricultural purposes, although its shallower soils and lateritic surfaces make it of inferior quality. Interestingly enough, there are plans for a reoccupance of this area. The 1974 Five Year Plan for Soba Village, drawn up by the Office of the District Head, calls for a survey of this sector with an eye to laying out plots for occupance since the increase in urban land use in practically any other direction would result in the loss of prime agricultural lands.

Demography

Commensurate with the high rates of annual increase in the district at large, the population residing in the Soba village

area has increased considerably since 1950. In 1975, the estimated population of the Soba "village area" was nearly 8,000; approximately half of that number resided in the central village which is the focus of the present investigation. The remaining villagers inhabited the 11 peripheral villages and 5 peripheral hamlets that lie within the domain of the Soba village head. It could be noted that a number of these peripheral villages were similar in size (200-400 residents) to Garun Gwanki village. Since village area population was tabulated at 4,124 in 1952, this 1975 figure represents an approximate doubling of village population in 25 years.

Comparison of the results from analysis of recent air photographs with interpretation of earlier maps suggests that a similar doubling of compound numbers occurred during this period. Approximately 170 compounds were in evidence in 1950, almost all of them within the village walls. The residential area within these walls has remained virtually unchanged since that time, but an additional 165 compounds had been added in other areas by 1975.[1]

Population Density

Based on these population figures, the density within

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[1]The term "compound" is used here in its generalized conventional sense to signify an enclosed cluster of dwellings. As recent inquiries have stressed, these households can frequently be quite complex, encompassing sub-sections or even non-family units within a single compound wall.

the "village area" was calculated to be approximately 250 persons per square mile, while the population density of the area actually accessible to, and farmed by, residents of the central village rose to well over 300 per square mile, certainly among the highest in Soba District. Such density figures are still well below those associated with the "close-settled" regions of Hausaland, but they are past the 200-250 per square mile mark which has frequently been cited as a critical transition point with reference to land use. Furthermore, the population density of the Soba village environs is without doubt greater than that found in the vicinity of Garun Gwanki.

These current population density figures also represent a rather substantial increase since mid-century. Prothero's study estimated a density of only 103 persons per square mile in 1952.[1] As has been noted, the actual "village area" involved has been slightly altered in the intervening period, but it remains true that the ratio of human numbers to available farmland may have tripled in the past twenty-five years. It would be somewhat unusual indeed if some indications of this increase in density were not evident on the landscape.

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[1]This population density figure actually comes from an interpretation of Prothero's study in Gleave and White, "Population Densities and Agriculture," p. 282. Since another statistic reported in this same interpretation appears to be highly suspect--namely the figure given for percentage of village land under cultivation--this estimate should probably be treated with caution.

In-Migration

One significant contribution to the population growth of Soba village has been the rather heavy rate of in-migration, especially in recent years. The development of two of the more recently established residential areas of the village (Tashar Jirgi and Tudun Wada) is largely associated with the arrival of migrant families. In addition to individuals of southern Zaria origin and a number of railway employees who stayed behind after its closure, a steady flow of people of Jos plateau origin, known locally as Mango people, has come to Soba. The dispersed isolated dwellings of this particular non-Hausa group are a new and noteworthy feature of the landscape on the outer fringes of the village lands. Since the conclusion of the civil war in Nigeria, families from Kwara State and other southern areas have arrived in the village, typically to engage in non-farm activities and services. The rate of inflow of migrants during the past twenty-five years is indicated by the fact that fully 35 percent of the sample of household heads in Soba village reported that they had arrived in the village since the age of 15 years.

Reference has already been made to the importance of the factor of mobility in Hausa culture and economic systems. It appears that, in the case of Soba village, the frequency of seasonal and temporary migrations may have diminished but continues to be important. The seasonal migrants who formerly came from Kano to work village fadama sugar cane plots, for example, had been entirely supplanted by local residents. However, as

was reported earlier, similar Kano seasonal migrants continued to appear each dry season to manufacture clay pots. Migration of seasonal farm laborers was certainly heightened as a result of the drought, but it also appears to have become a permanent feature of the farm labor scene in Soba village and was not unrelated to the appearance of regular, rapid mass transit by minibuses. Well-to-do farmers from outlying hamlets who had established residences in the central village for off-season occupance were another, apparently growing category of seasonal migrants. More permanent types of in-migration had also been increasing in importance as Soba village increasingly functioned as an "urban growth pole" within the region. As will be demonstrated shortly, the impact of these permanent in-migrants, as well as of the seasonal agricultural migrants, was apparent in the Soba village agricultural system.

Village Morphology

In setting out the thesis problem in the first chapter, the suggestion was made that improvements in the transportation infrastructure in the district--most notably the upgrading of the primary bisecting road--have stimulated change in a variety of ways. This is nowhere more evident than in Soba village itself.

At the time of Prothero's study of the village, the primary transportation artery serving Soba was the Bauchi Light Railway, a narrow gauge railway extending from Zaria to Jos whose main function for Soba District villages was in the evacuation of

agricultural commodities. As has been noted, the road that linked the village to Zaria at that time was a seasonally impassable gravel track. In 1957, the railway was taken out of service, and by the early 1960s, the roadway had been substantially upgraded, leveled, and hardsurfaced, with bridges constructed at stream crossings. Since that time, the traffic volume on this link has risen dramatically, with a regular flow of heavy lorries, passenger buses, and private vehicles utilizing it in 1975.

Associated with this appreciable increase in ease of access to the nearby urban center, as well as with the more generalized process of modernization in the region, the number and range of services and amenities present in Soba village rose, particularly in the period since the Nigerian Civil War. According to Prothero, the Soba village of 1950 was closely akin to one of its peripheral hamlets of 1975 in terms of level of differentiation of services and presence of amenities. Soba village of twenty-five years ago, in other words, would have been comparable to Garun Gwanki village of 1975. Aside from granaries and storage facilities, the only non-residential structures in existence in Soba in 1950 were as follows: a dispensary, a market place, several mosques, a "bush" rest house, a railway station and several railway warehouses, and the District Head's office. Practically all of these non-residential buildings were related to the village's function as an administrative center and as a bulking point for commodities.

By 1975, the "bush" rest house had collapsed and the railway structures had fallen into disrepair, but the village's

capacity as an administrative, commercial, and transportation hub had expanded measurably, and the level of services in existence had been substantially increased. The inventory of non-residential structures shown in Table 29 stands in strong contrast to the meager listing given above and suggests the rapid acceleration of urban development within the village in recent years.

Periodic Market

Improvements to transportation links have obviously not been the only stimulus to differentiation and specialization of function in the village. The presence of the largest and most influential periodic market in the district, which is in turn related to the district's transportation network, has encouraged the development of certain urban functions. There are five other official periodic markets in Soba District, all of them sited in large older villages, but none of them located on the main Zaria-Pambeguwa road. One other fairly sizeable periodic market operates unofficially at Maigana, a roadside village which has also experienced rapid growth in the last decade.

The Soba village market meets every four days and during its peak periods--notably in late November following the sorghum harvest and in early May at the beginning of the rains--displays a variety of goods and services almost equal to that of the nearby urban center, Zaria. This particular market enjoyed a reputation among Zaria region residents as an excellent source of economical foodstuffs. Hence, the flow of agricultural commodi-

TABLE 29

AMENITIES, SERVICES, AND GOVERNMENT FACILITIES IN SOBA VILLAGE

Agency	Type	Number
Public Sector:		
State Government		
Ministry of Public Enlightenment	Reading Room and Library	1
	Public Television Pavilion	1
Ministry of Education	Primary School	1
	Secondary School	2
Ministry of Health	Dispensary	1
	Maternity Clinic	1
	Slaughter Slab	1
	Hides Drying Rack	1
Ministry of Agriculture	Commodity Warehouse	2
	Experimental Plots	2
	Tree Nursery	1
Local Authority		
	District Head's Office	1
	District Head's Rest House	1
	Area Court	1
	Police Station	1
	Lorry Park	1
	Marketplace	1
Private Sector:		
(Pre-1970)	Tailors	10
	Bicycle Repair	4
	Open Air Restaurant	4
	Small Retail Shop	9
	Deisel Grinding Machines	6
(Post 1970)	Motorcycle Repair	1
	Photography Studio	2
	Barber Shop	2
	Indoor Restaurant/Hotel	4
	Christian Churches	2
	Bakery	1

ties out of Soba village during the harvest season was quite substantial, frequently resulting in shortages of broken-package, non-bulk staples for Soba village residents. While much of the activity surrounding any meeting of the Soba periodic market stems from the sale of goods and services by small scale itinerant traders to village area populace, an analysis of the cash and commodity flows in the marketplace would probably suggest that the primary function of the market was to serve as a bulking point for transshipment of village area agricultural produce. The term "village area" is not used casually in this instance since it is important to recall that much of the produce evacuated comes from satellite village production, not from farmers resident in the central village. The seasonally active cotton market located in Soba village apparently functions in a similar manner.

It was Prothero's judgement in the early 1950s that the central Soba village was not self-sufficient in foodstuffs; the same assessment was probably true in 1975. A large portion of the commodities that passed through the Soba marketplace originated elsewhere in the "village area". Urban demand can be seen here to operate in hierarchical fashion. Typically it is seen as emanating from major urban centers such as nearby Zaria; yet a similar center-periphery relationship exists between Soba village and its satellite hamlets. Indeed, the linkages and flows between villages and hamlets in the Soba village area were extremely complex, possibly even more so than those between the central village and the city.

No comprehensive analysis of the operation of the Soba periodic market is included here, but it is important to take note of a significant implication in terms of the models of agrarian change under review, notably in the relation of the market to village land use. The activity of this periodic market and the commodity buying stations in Soba are very visible reminders of the impact of "urban demand" upon rural agricultural systems. In the consideration of changes in agricultural land use, the suggestion has been made that extra-village consumption of agricultural produce must be taken into account as a likely stimulus to intensification. Since Soba village was a net exporter of foodstuffs as well as commercial non-food crops, such extra-village forces are a factor to be reckoned with in explaining local land use.[1]

Aspects of Village Economy

Like all other villages and hamlets in the district, the economy of Soba village rests on agriculture. Unlike most other

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[1]Much of the evidence for this claim that Soba is a net exporter of agricultural foodstuffs is fairly impressionistic since no comprehensive study of commodity flows was conducted. Such a study done in 1973-74 may well have been significantly deviant from the norm in any case since drought conditions produced severe shortages of foodstuffs elsewhere and raised prices quite markedly. Since the focus of the present study is not on the volume of agricultural production but on agricultural land use, which by its very nature responds much more slowly to variations in economic incentive, the impact of commodity prices was considered of little consequence.

villages, however, Soba also contained a modest size non-farming population. Residents whose primary means of livelihood was not from farming--this included the large educational contingent--amounted to approximately 1 percent of the village population. Because of its size and location, moreover, the structure of secondary and off-season occupations of individuals who considered their primary occupation to be farming was highly developed and diverse. Table 30 gives an indication of the range and frequency of such occupations. Furthermore, the number of managerial farmers, individuals who rely almost exclusively on hired labor to carry out farm operations, was quite sizeable in Soba village, amounting to nearly 16 percent of the sampled farm population.

This modest but apparently growing population whose livelihood came from outside the agricultural sector--which included a substantial number of government employees--had begun to stimulate construction of non-family dwellings on a large scale in the village. Such housing was at a premium in 1975, and local landlords received rents of from 2.50 to 3.00 naira (U.S. $3.75-4.50) per room per month.

Farm Labor

The utilization of hired farm labor (yan kwadago) probably increased quite substantially in Soba village since mid-century. Prothero reported on a labor problem in the form of a bottleneck during the crucial months of July and August. Adequate sources

TABLE 30

SECONDARY AND OFF-SEASON
OCCUPATIONS, SOBA VILLAGE

Category	Type	Percentage
No Secondary Occupation	N.A.	28
Secondary Occupation Dry Season Only	Trader Craftsman Construction Leatherworker Herding Laborer	23
Secondary Occupation Year-Round	All of above plus Blacksmith Carpenter Tailor Barber Butcher Koranic Teacher Musician Buying Agent Watch Repair Bicycle Repair Mechanic Washerman Contractor Grinder	40
Salaried Position	Public Official State Employee Domestic Worker Messenger	9

of financing for hiring farm labor, he continues, were usually not available. This necessity for quite careful and considered utilization of labor resources during peak agricultural periods had by no means disappeared by 1975, but the widespread availability of agricultural labor for hire may have alleviated the problem to some extent. Fully 56 percent of the sampled households reported the use of non-family paid labor at some point during the 1973-74 agricultural season. The shortage of available capital rather than actual labor inputs, on the other hand, continued to act as a constraint on the total amount of land any farming household brought under cultivation.

The Managerial Farmer

A prominent element which has emerged of late in the village economy is the farmer whose input to the agricultural system consisted of an equal, if not greater, measure of managerial and entreprenurial skills as of actual farm labor. This category of farmer has been noted in several different contexts above; he is fairly readily distinguished from the "peasant smallholder" and his impact on the village agricultural system has been considerable.

Hill devotes lengthy attention to the economic inequalities that are to be found in Hausa villages and provides an excellent analysis of this and other categories of Hausa farmers although she does not specifically refer to them as managerial

farmers.[1] She strongly rejects the notion that these generally more prosperous farmers form a special class within village societies. Leaving aside the question of whether or not "class-stratification" can be said to exist, it does seem apparent that these individuals enjoy high status commensurate with their prosperity and, in many cases, religious or hereditary titles.

The hallmarks of this category of farmer are at least threefold: (1) In general, they have major sources of income outside of farming. As has been explained, it is not at all unusual for even the poorest Hausa smallholder to engage in secondary activities, but in the case of this category of farmers, economic resources are utilized primarily to pursue agricultural activities and not as merely supplemental income. Some of these managerial farmers hold salaried positions; others are engaged in service occupations, merchandising, or commodity purchasing. (2) These farmers tend to rely very heavily on hired farm labor. (3) In terms of land holding practices, a large portion of the land in categories other than direct allocation by the village head is possessed by these individuals.

One special group of farmers in this category are the "master farmers", a designation given by the Nigerian Tobacco Company to prominent farmers with whom they have contracted for certain amounts of tobacco production. These individuals, gen-

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[1] Hill, Rural Hausa, pp. 153-174; P. Hill, "The Myth of the Amorphous Peasantry: A Northern Nigerian Case Study," Nigerian Journal of Economic and Social Studies (July, 1968).

erally prestigious farmers within their communities, in turn grant subcontracts for tobacco production and receive a commission on the basis of deliveries to the company warehouses. In 1968, there were only 21 of these "master farmers" in the whole of Soba District. By 1975, 110 had been so designated, and 28 of these resided in the Soba village buying area--an indication of the growth of tobacco production. It could be noted that the master farmer program came under attack from some quarters concerned with rural development in Nigeria because of its association with the growth of a rural middle class.

Although clearly demonstrable evidence is not available from the present study, it would probably be a mistake to associate all intensification of land use with this managerial category of farmers. Undoubtedly the entreprenurial activity of these individuals, largely in response to extra-village economic forces, has strongly influenced the village economy and is reflected in the village agricultural system--from crop preferences to actual cultivation practices. The "leading edge" of the infield zone--farms on the outer perimeter of the annually cultivated sector--for example, are almost entirely the result of the purchasing and hauling of organic supplies to distant farms by these managerial farmers. However, analysis of the ownership of intensively cultivated infield plots would certainly reveal that such farms are by no means the exclusive domain of prosperious managerial farmers. Hence, it is appropriate to call attention to this category of farmer as a major vector through which extra-village forces have acted to stimulate

changes in land use, but undue weight should not be given to this factor.

Livestock Ownership

Prothero reported that no cattle were kept by Soba village residents in the early 1950s because of the presence of the tsetse fly, the vector of bovine trypanosomiasis. While informants from the large numbers of Fulani herders in the Soba environs in 1974 similarly reported that the tsetse fly remained a hazard--especially in the dense undergrowth of outlying village sectors--its impact on resident livestock holding had undoubtedly been reduced.

Surveys revealed that there were at least 9 individuals in Soba village in 1975 who engaged in the practice of holding cattle in small corrals and providing fodder during the dry season. If they had not been slaughtered, these cattle were contracted out to herders for their maintenance during the rainy season. This practice of short term "fattening" of cattle appeared to have been increasing of late because of the substantial profits to be realized from sales of beef during relative shortage periods such as Muslim festivals. Moreover, the value of the droppings of the penned animals was of no small consequence.

Although this type of livestock keeping approaches the concept of mixed farming, it should be recalled that the primary objective is short term capital gain and that in no case were the animals utilized for traction. In all cases, the individuals who engaged in this practice could properly be considered as

managerial farmers.

It is probably true in Soba village, as Norman concludes from his studies in the Zaria region, that the contribution of small livestock to household income is not great; nevertheless, the importance of fowl, sheep, goats, and donkeys within the village economy should not be overlooked.[1] Some 38 percent of the sampled farming households in Soba claimed ownership of sheep and/or goats, a figure not significantly different from that in Garun Gwanki village. The mean size of these household herds was 6 animals. It is entirely likely that these figures represent something of an underestimate since, as other authorities have reported, sheep and goats are frequently held independently by female members of a household. Since donkey ownership was widely considered a specialized occupation in Soba, only 15 percent of the respondents claimed ownership of these animals; most of these individuals held only 1 donkey. Unlike smaller villages, where only the village head usually maintains a horse, there were 8 horse owners in Soba village in 1975.

With the exception of horses and cattle, most livestock

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[1] An economic analysis of small livestock as a part of smallholder production is included in Norman, An Economic Survey of Three Villages, Vol. 1, p. 103. The entry on "Sheep and Goats" in the commentary section of Hill, Rural Hausa, pp.317-318, provides an excellent summary of the place of such small livestock in village economies, taking note of the fact that this resource is generally neglected in the literature on Hausaland. Hill cautions that statistics pertaining to small livestock ownership are frequently unreliable because of the many difficulties involved in data collection.

were left to scavenge food on their own for most months of the year; they were penned and given fodder only during the prime agricultural season. Since the damage that could be inflicted on a planted field by only a small number of these animals can be quite considerable, loose animals were a constant source of concern for the cultivator and stockholder alike.

Land Tenure

Prothero found that, with the exception of fadama, tenure on Soba village farms was dominantly communal. He noted that conflicts between customary tenure and Islamic law, which specified absolute ownership by individuals, were not uncommon in areas of Zaria province then experiencing land shortage, but that this did not appear to be the case in Soba.

By 1975, these findings were no longer true. In contrast to the low density case described in the previous chapter, land tenure in Soba had been "individualized" to a very great degree. Farm leasing, rentals, and sales were quite common in all categories of land use. Family and individual rights in land appeared to be a firmly established principle; there was considerable security of tenure.

The most telling observation that can be made regarding current land tenure is that, in 1975, the village head of Soba had no outfield land at his disposal for allocation. In contrast to other less populous village areas, all land under the jurisdiction of the Soba village head had been claimed by resident families. Rights to land could only be acquired by inheritance

or by an individual transaction, not by allocation from a communal pool.

The sources of stimuli to individualization of tenure were not difficult to uncover. For the most part, individualized land transactions can be linked to in-migration. The earliest deviations from communal tenure, as reported by Prothero, were associated with the seasonal migrations of Kano sugar cane farmers. Fadama plots were rented to these temporary migrants by local residents. Although Soba inhabitants have since acquired the techniques of fadama cultivation themselves, in-migration has remained a stimulus to leasing and sales of farmland. The extent of association between farm sales or leasing and in-migration is indicated by Table 32. In the case of the non-Hausa in-migrant, it should be added, only short term leases of two to three years were customarily granted.

A further stimulus to individualization of tenure had been provided by the intrusion of extra-village agencies into local tenurial systems. Local and state governments, for example, surveyed and purchased large tracts of land adjacent to the settlement for school grounds. Several wealthy individuals who reside outside the village assembled parcels of land which they purchased for their own farming. Similarly, agricultural extension agencies had surveyed and marked out plots for demonstration purposes. Needless to say, the concept of fixed boundaries and alienable land was not lost on resident smallholders. Judging from the marked increase in frequency and

TABLE 31

FARM LABOR IN SOBA VILLAGE

Type	Cultivated Acres	Percentage
Farmer alone	258	22
Gandu	247	21
Farmer/gandu plus kwadago (hired labor)	352	30
Kwadago (hired labor)	294	25
Other	24	2
Total	1,175	100

TABLE 32

IN-MIGRATION AND FARM TENURE,
SOBA VILLAGE

Tenure Type	Percentage of Cultivated Acreage		Total
	Resident	Migrant	
Inheritance	46	2	48
Allocation/Gift	10	11	21
Loan (no payment)	4.5	.5	5
Sharecrop	1.5	1.5	3
Lease	2	6	8
Purchase	4	11	15
Total	68	32	100

extent of non-resident farm purchases during the brief period of this study--especially in sectors of Soba District closer to Zaria--the impact of exogenous forces on local land holding practices can probably be expected to be intensified.

Along with this discernable trend toward individualized types of tenure, there appeared to be a tendency for the actual value of farmland to be increasingly reflected in the sales price or rental fee. It has long been the custom in this village as elsewhere in Hausaland for token monetary payments to accompany agreements and transactions of all kinds. In many cases, the payments involved in aro (rental or borrowing) have merely been tokens of obligation and have not necessarily reflected the location or quality of the land involved. A sampling of recent farm sales prices and rental fees, however, indicated that variations in price correlate highly with variations in land capabilities. Although it is risky to generalize from this very small sample, it seems safe to conclude that farmland sales and rental payments will increasingly be based on such desirability and scarcity factors.

It is interesting to consider, in the context of this discussion about farm sales, the question of who places land on the market. Information pertaining to the selling and renting of fields, as opposed to that covering the purchase or leasing of land, seemed to be highly sensitive. The total amount of land which was reportedly purchased was not fully accounted for by the few respondents in the sample who admitted to releasing their own land for sale. Nevertheless, it appeared that farms

were sold in Soba by two primary categories of farmers, neither of which suggested outright impoverishment or abandonment of farming: (1) elderly farmers, or in some cases widows, no longer capable of farming and who have no direct heirs and; (2) individuals with significant income from non-farming sources.

There is inconclusive evidence from this study of Soba pertaining to Boserup's claim that land tenure is largely determined by land use. To support such a claim, one would expect to find a near perfect correlation between the more individualized types of tenure and more intensively cultivated land, namely infield and fadama. While it is apparent that most farm sales and rentals are associated with intensive land use, it is equally clear that outfield land sales are not uncommon.

Land Use

Cropping Patterns

With minor exception of several high yielding varieties which cover very little acreage, no new crops had been adopted in Soba village since the time of Prothero's study. The crops and crop combinations recorded by him in 1952 remained dominant. However, the relative proportions of several of the major crops had undergone some significant shifts.

Cotton

Prothero reported that cotton was far and away the major

"cash crop" in Soba village.[1] Land use maps compiled by Prothero and by Watson reveal that approximately 45 percent of the infield zone was devoted to cotton production in the 1950s.[2] One thousand tons of cotton were purchased at the Soba buying station in 1952-53.

While Soba remained an important center of cotton production in 1975, the expansion in production had not kept pace with population growth; the acreage devoted to its production was proportionately much less than at the time of the ear ier study. There was no cotton, either in sole stands or in combinations, growing within the infield zone in the 1973-74 season. The crop was grown exclusively on large outfield holdings, frequently in combination with black-eyed peas.

Only 841 tons of cotton were purchased from Soba in 1974, but two additional stations in the former domain of Soba cotton market had been opened since 1952. Nevertheless, with the purchases from these two stations added, the total production figure reached only 1,560 tons--a multiple of only 1.5 times 1952 output.

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[1]The distinction between cash and food crops is certainly less clearcut today than it once may have been. A large proportion of food crop production regularly enters the market. The division into food and non-food crops is perhaps more appropriate to current practice.

[2]Prothero, "Land Use at Soba," p. 77 and G. D. Watson, "An Account of Field Work in the Teaching of Geography," The Nigerian Geographical Journal 1 (December 1957): pp. 38-44.

The primary reason for the decline in prominence of cotton production is fairly evident. As was noted in the previous chapter, cotton was an unpopular crop in many quarters; the labor inputs required were not seen by smallholders as sufficiently justified by set market prices. The Northern States Marketing Board recently attempted to deal with farmer complaints by raising cotton prices by several kobo per pound for Grade 1 cotton. Yet it is unlikely that the comparative advantage of other more profitable crops could easily be overcome. Even at the higher rate of payment, the return per acre for cotton would probably not exceed 25.00 naira (U.S. $37.50). In 1974, the return per acre was probably closer to 15.00 naira (U.S. $22.50) although Norman's figures in this regard are even lower: less than 6.00 naira per acre (U.S. $9.00).

Tobacco

Among the foremost reasons for the drop-off in importance of cotton was the pronounced increase in the production of tobacco in Soba village. Whereas in 1952, tobacco was primarily a fadama crop, it was found in 1975 on all categories of land, and was generally given a dressing of commercial fertilizer even on infield plots. The nearly 1 million pounds purchased from Soba village in 1974 represented a twenty-five-fold increase over 1946 production.

Despite the very considerable demands on labor involved in its production--the preparation of seed beds, transplanting, intensive weeding, and drying operations in addition to normal

cultivation requirements--tobacco remains a highly profitable crop. The Nigerian Tobacco Company estimates that an average return per acre is 70.00 naira (U.S. $105.00), 10 percent of which has usually been extended to the farmer as credit. A master farmer, who receives a 9.2 percent commission on contracts delivered, may receive an additional 200.00 naira (U.S. $300.00) per season. Hence, it would appear that the expansion in tobacco production was largely due to this distinct economic advantage as well as to the efforts of the two large tobacco companies to encourage its production.

It would be misleading, however, to suggest that tobacco acreage had replaced cotton acreage. Of the 28 master farmers within the Soba buying area, only 3 were actually resident in the central village. Hence, tobacco production was extremely concentrated in the farming enterprises of these few men and their subcontractors. Because of the nature of tobacco production and the concentration of its cultivation, total acreage given over to tobacco cultivation in the central village probably did not exceed 40 acres. It was in the allocation of labor and capital resources rather than land resources that tobacco could be seen to have out-distanced cotton as the prime agricultural commodity.

Peanuts

As we have seen, Soba village is not located within the primary peanut production zone of northern Nigeria. It was comparatively rare to find peanuts growing in sole stands in the

village although the crop was frequently encountered as a supplementary combination with cereal crops. According to the earlier study, 208 tons of peanuts were purchased from Soba village in 1952. Nineteen hundred seventy-two purchases from the same area were only 228 tons; it should be added hastily that this figure is somewhat misleading since official prices at that time were well below local market prices for peanuts. In 1974, for example, when the profitability of selling to local buyers was even greater, no peanuts at all were purchased from the Soba area. Nevertheless, the indications are that peanut production has probably remained at a fairly constant ratio as a part of overall agricultural production.

Cereals

Watson estimated that approximately 44 percent of the cropped acreage of Soba village was devoted to the production of cereals in 1955, primarily to millet and sorghum. Prothero had similarly estimated that more land was devoted to cotton production than to food crop production. By 1975, the balance between food and non-food acreage had shifted.

Only a very small percentage of the infield zone in the 1973-74 and 1974-75 seasons was planted to crops other than millet, sorghum, and maize. Cassava, tobacco, and vegetables accounted for only about 8 percent of the acreage in this zone. Although the staple cereals were frequently grown in combinations with black-eyed peas, peanuts, and okra, they undoubtedly dominated infield production. Within the entire sampled cultivated

acreage, moreover, cereals similarly predominated; their share of total cultivated acreage was estimated to be 60 percent.

Whereas maize had been a relatively minor crop in 1952 and was grown chiefly on fadama plots, it had by 1975 captured a major share of agricultural production. Nearly 28 percent of the sampled farm acreage included maize, and it appears to have been an increasingly popular crop especially to be grown in multiple crop sequences. Maize was customarily grown prior to a tobacco, sorghum, or on occasion, cotton crop.

Interestingly enough, if one disregards tobacco and sugar cane production, the relative proportions of cultivated acreage devoted to each of the major crops in Soba did not differ significantly from those found in Garun Gwanki. The implication here is that the economic incentives which appear to act as a strong influence on crop choice were evenly diffused throughout the district. Accessibility or the lack of it, in other words, does not appear to play a determinative role in the relative weight given to various crop enterprises.

Size and Composition of Holdings

Unlike crop selection, however, the average size of a farm holding in Soba village was significantly different from that of Garun Gwanki village. The mean size of holdings belonging to a farm household in the Soba sample was 9.4 acres, nearly 3 acres less than the Garun Gwanki mean. Table 33 gives an indication of the range of plot acreages within this average figure.

TABLE 33

SIZE-DISTRIBUTION OF UPLAND FARMHOLDINGS
IN SOBA VILLAGE

Land Use Type	Acreage Range	Percentage of Type	Percentage of Total
Infield	Less than 1 acre	48	14
	1 - 1.9 acres	23	7
	2 - 3.9 acres	11	3
	4 - 5.9 acres	15	5
	6 - 9.9 acres	3	1
	over 10 acres	--	--
Outfield	Less than 1 acre	--	--
	1 - 1.9 acres	20	14
	2 - 3.9 acres	28	20
	4 - 5.9 acres	17	12
	6 - 9.9 acres	33	23
	over 10 acres	2	1
Total		100	100

The composition of this average holding also varied quite markedly from that found in the smaller village. A larger share of the average holding, for example, consisted of infield acreage (2.8 acres or 30 percent). Moreover, the range in the variation in composition of farm holdings was much greater than in the low density case. It will be recalled that practically all smallholders in the less populous village held land in all categories of use. In Soba, nearly 30 percent of the respondents, in contrast, claimed that they cultivated no infield land at all. Another 17 percent held no outfield farms. Furthermore, nearly 50 percent of the sampled farmers did not engage in any fadama cultivation. As might be expected, in sum, both the average size and the composition of farm holdings in Soba reflects the significantly greater pressure on land resources found there.

Infield Land Use

In his 1952 study of Soba, Prothero delineated a broad concentric zone of land use around the village which he described as follows: this zone is,

> an area of almost unbroken cultivated land immediately outside the village and extending up to a maximum distance of a half to three quarters of a mile from the village walls. Small patches of fallow do occur and there are areas of non-agricultural land...but they are of no significance.
>
> This zone is under continuous cultivation, its fertility being maintained by manuring with droppings of horses, donkeys, sheep, and goats kept in the village; and from Fulani cattle which are kraaled on the land after the harvest when they are

> being trekked southwards through this area...[1]

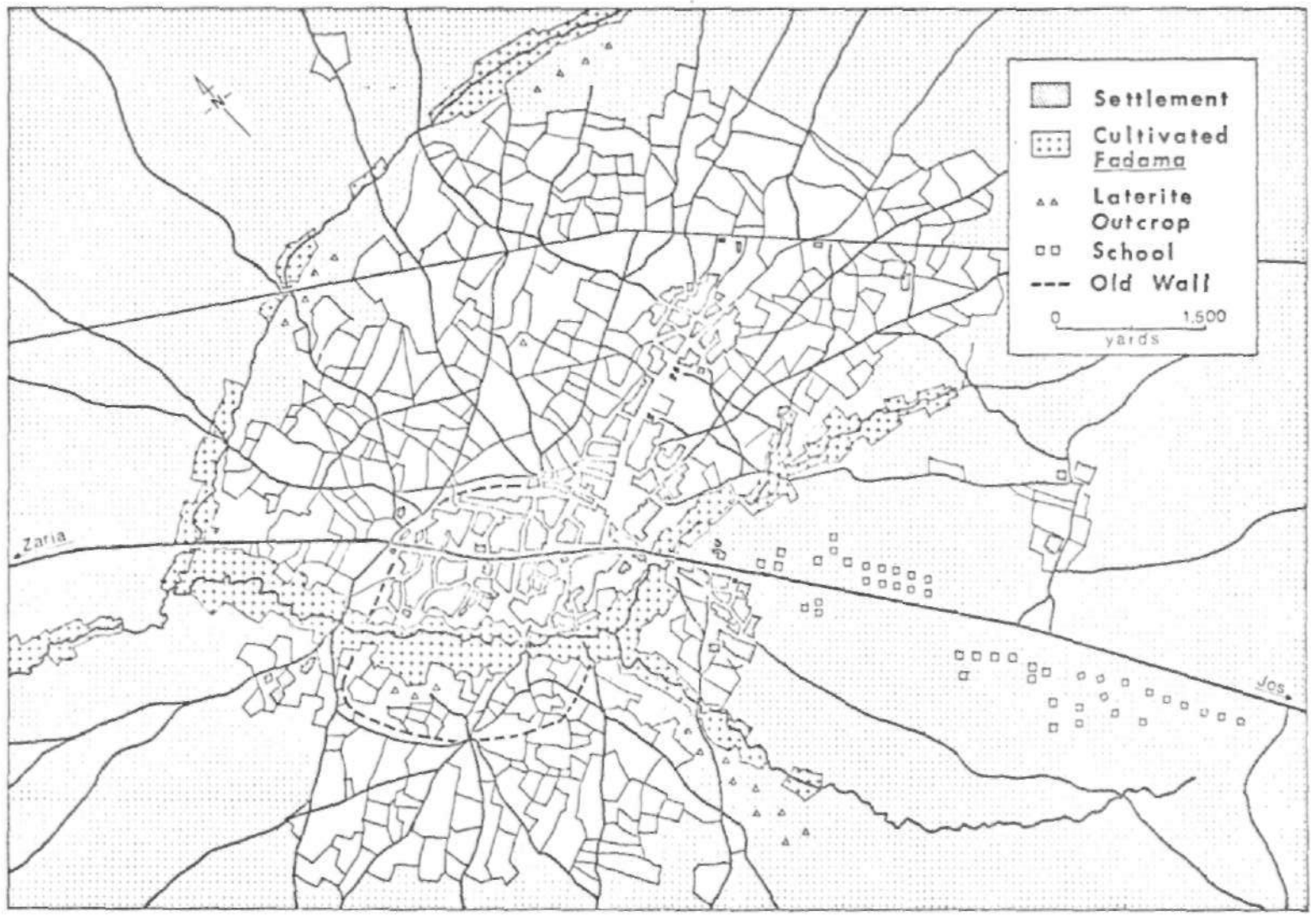
Measurements from Prothero's land use maps reveal that this zone was approximately 480 acres in extent at that time; hence, it accounted for about one third of the total cultivated acreage of the village.

Although Chapter VI reported that the fertilization practices within this zone have undergone some changes, this general description of the infield zone remained accurate in 1975. However, the most noteworthy feature of this zone was its quite sizeable expansion (see Map 7). Exclusive of enlarged residential and non-agricultural areas, this infield zone consisted of approximately 940 acres in 1975, roughly double its mid-century area. The perimeters of the zone were in some cases one to one-and-a-quarter miles from the settlement. The most distant infield plots--those sited at the leading edges of the zone--were typically located along one of the network of radial paths that radiate outwards from the central village.

In contrast to the low density setting described in the previous chapter, the proportion of infield land use as a part of total cultivated acreage has measurably increased in Soba village. If one considers the approximately 11.5 square mile area which is accessible to and farmed by central village residents--eliminating from consideration the remainder of the administrative territory

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[1]Prothero, "Land Use at Soba," p. 74.



MAP 7 Soba Village Infield Zone

which includes numerous hamlets and their cultivated fields--the proportion of infield cultivation is very sizeable indeed. As Table 34 shows, such infield land use accounted for over 40 percent of the cultivated acreage in 1974.[1] In other words, the infield share of cultivated acreage had risen from one-third to one-half during the twenty-five year period under review.

The range of field sizes within this zone is quite broad: from less than .3 acre to well over 5 acres (refer to Map 7). Moreover, the mean size of infield farms was 2 acres, well above the average figure found in Garun Gwanki. As was reported above, not all Soba farmers have holdings in this zone. Of those in the sample who did cultivate infield farms, the average number of separate plots was 1.3, suggesting that less than half of these individuals maintain more than one such farm. Except for one fairly sizeable parcel of fallowed land, the rights to which were under litigation, the entirety of the infield zone was cultivated in the 1973-74 and the 1974-75 farming seasons.

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[1] The observation that the Soba infield zone has expanded in the last twenty-five years carries the implication that some of this acreage was in a state of transition from outfield to infield. Some land which has in the past been fallowed, either by the present or a previous cultivator, will not be taken out of cultivation in the future. For the sake of consistency, the criteria utilized to delimit this infield zone were twofold: (1) the application of organic materials and (2) the intention on the part of the farmer to keep the land in annual production. No criterion specifying a set number of years in continuous use was applied; hence, several fields which were given their first dressing of organic materials in 1974 were included in this zone.

TABLE 34

LAND USE IN SOBA VILLAGE
1950 - 1975

Land Use Type	1950 Acres	1950 Percent	1975 Acres	1975 Percent	Change Acres	Change Percent
Urban and Residential	70	1.4	230	4.5	+160	229
Cultivated:						
Infield	480	9	940	18	+460	96
Outfield	960	19	1260	25	+300	31
Fadama	15	.2	140	2.7	+125	833
Uncultivated/ Fallow	1715	33.4	2000	39	+285	17
Heavy Bush	1880	37	550	10.8	-1330	-71
Total	5120	100	5120	100	----	---

Expansion of Infield Zone

Unlike Garun Gwanki village, variation in soil quality and properties has not seemed to act as a barrier to the expansion of the infield zone. With the notable exception of marmara (lateritic outcroppings), farmers identify practically all of the major categories of soils within this zone. As has been suggested, variations in the physical characteristics of soils in this region correlate highly with slope position; to be sure, there was a very sizeable northern sector of this infield zone around Soba which appeared to be of relatively uniform soil and slope characteristics (bakar kasa soils). The fact that this particular sector has been farmed for centuries has doubtless contributed to its uniformity; there is ongoing evidence, for example, of villagers' activity in leveling out lateritic formations. Nevertheless, the southern sector of the infield zone included a variety of land classes including the inferior tsakuwa (gravelly) soils. Recent expansion to the north, in addition, has taken place on similar sloping land as well as on jar kasa and daboro soils.

It may well be the case that physical features of the landscape will exercise more of a delimiting role for the contiguous expansion of this zone in the future. At the very least, the fact that the outer reaches of this zone were facing barriers of fadama or lateritic surfaces will necessitate a "skipping-over" effect before expansion can continue. There is ample evidence that such a process has already begun, since the outermost infield plots are generally not contiguous to the older fields.

The relationship between soils and infield farming in Soba village appears to contradict the observation made by Grove that higher densities of population can be associated with soil-selective land use. This association was not borne out in Garun Gwanki. In Soba, the findings are consistent, namely that increases in population density and the expansion of the zone of intensive land use seem to have resulted in a decrease rather than an increase in soil selectivity. This is not to suggest that Soba village farmers are ignorant of, or indifferent to, favorable soils; however, unlike the sparsely populated situation, Soba farmers do not have offsetting opportunities elsewhere which allow them to completely avoid less desirable classes of land.

Crop Enterprises

The crop enterprises found within this zone were comparable to those elsewhere on cultivated village lands as well as to those on Garun Gwanki infield farms. The proportion of multiple crop mixtures (4-6 crops rather than 2-3), on the other hand, was probably greater in Soba. With the exception of two small cassava plots, there were no single stands of crops in this zone which were not grown in succession with another crop; practically all infield farms, in other words, were inter-cropped or double-cropped each season.

The most noteworthy change in cropping patterns within the infield zone is that referred to above, namely that no cotton acreage was found here. Earlier land use maps indicate that cotton was once a comparatively important infield crop. Village

smallholders suggest that part of the reason for its disappearance from this proximate zone has to do with problems caused by the village goat population. This may be partly the case, but it also seems apparent that the extensive acreages most suitable for cotton production were simply no longer available in this zone, and, as we have seen, the economic advantage had unquestionably shifted away from cotton.

Within the Soba village administrative area, it appeared that infield cultivation around peripheral hamlets and villages had undergone comparable expansion. No measurements of these outlying infield zones were made in the course of this study, but if the recollections of Dr. Prothero on a return visit to one of these hamlets are indicative, a comparatively dramatic increase in proportion of infield acreage had taken place in recent decades around these satellite villages. Moreover, residents of these hamlets agreed that their infield farms had been expanded and fragmented since mid-century. Interestingly enough, most answers to questioning in this vein seemed to suggest that shortages of organic materials were readily perceived as a constraint on the expansion of intensive land use. The implication of such findings, it should be noted, is that the expansion of infield cultivation has been primarily a function of augmented density of population rather than merely the increase in settlement size.

Outfield Land Use

Prothero distinguished two categories of land use within

the outfield area. He delineated a roughly concentric zone from one-half to one mile in width within which cultivation was based on a system of land rotation. Plots were cleared and tilled for three to four years, and then allowed to revert to fallow for a period of at least five years. Some outfield land was fallowed as long as thirty years and "a great deal" of this zone was reported not to have been cleared for 15 to 20 years. Secondly, Prothero described an outermost concentric zone, 2 to 3 miles away from the settlement, which consisted largely of dense bush interspersed with the cultivated acreage belonging to outlying hamlets.

By 1975, it seemed more satisfactory to include all of this land in a single outfield category. The zone of dense bush had all but disappeared from the landscape as a distinct and continuous feature; the isolated examples of heavy undergrowth with trees of any size were confined to small tracts largely unsuitable for cultivation. As has been noted, the rights to cultivation of all of this outfield area had been assigned to residents of the central village or of peripheral settlements.

Rotational fallowing remains the basis for the maintenance of fertility within this zone although, as we have seen, commercial fertilizers have begun to play an increasingly important role in this respect. Fallowing practices on outfield farms were not nearly so uniform as they appear to have been at the time of Prothero's study. In general, fallowing periods appear to have been significantly reduced. The range in length of fallowing intervals was great, from only 2 years to nearly 20 years. Yet

the incidence of examples which approach long fallow, say, from 5 to 10 years in fallow, was relatively small. Only 6 out of the 150 outfield farms sampled were reported to have been fallowed for such lengthy periods. The mean length of fallow period for all sampled outfield farms in Soba village was only 3.2 years; the mean length of cultivation periods for these farms was 5.1 years. Informants spoke of a few parcels of land which had lain in fallow for more than 10 years, but the overall extent of such heavily overgrown land was certainly not very great.

The mean size of sampled outfield farms around Soba village was just over 4 acres, about an acre smaller in area than those belonging to Garun Gwanki. With the exception of one unusually large holding (approximately 20 acres) belonging to a non-resident government official, the largest of these outfield farms was 9.5 acres; the smallest was still over an acre (1.2 acres). It should be recalled, of course, that these figures pertain to actual cultivated acreage and not to contiguous holdings. The difficulties involved in ascertaining precise boundaries around both cultivated and fallowed land belonging to a single family made it nearly impossible to arrive at a figure for the average size of contiguous outfield holding which included all land in fallow.

It was estimated from 1973 air photographs that the total extent of cultivated outfield belonging to the central village

of Soba was some 1,220 acres.[1] (See Table 34). While this figure amounted to nearly 60 percent of Soba's total cultivated acreage, it implies that another 2,500 acres of uncultivated land lay within two miles of the central village. Most of this uncultivated land which was interspersed among the outfield farms consisted of fallowed farms, although about one-fifth of it may have been only marginally cultivable. The implications of these relative proportions of cultivated and uncultivated land within the outfield zone will be examined at the conclusion of this chapter.

One final noteworthy feature of outfield land use was that large tracts within this zone were held by immigrant farmers, many of them non-Hausas from the Jos region. There were three concentrations of such in-migrants in the Soba village area, two of which emerged following the departure of the railway and the other of which is of more recent origin. It is only this latter concentration, situated to the west of the central village along the main road, which falls inside the area defined

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[1] It is important to be reminded of the problem of discrepancies in areal measurement discussed in Chapter IV. Some of the tabulations reported in this chapter are not strictly comparable with those from Prothero's work since they are based upon the land area accessible to and farmed by central village residents. Hence, they do not include land which, while under the administrative control of the Soba village head, had in practice been allocated to the control of peripheral village and hamlet heads. Thus the total of 4,000 cultivated acres estimated by Prothero for the "village area" might at first glance make figures presented here appear to show an overall reduction in cultivated area during the 25 year period. Actually, the figures are based on different areal units.

here as accessible to, and farmed by Soba farmers. Because of their preference for single-family, isolated, dispersed dwellings, the settlements of these in-migrants stood in marked contrast to those of nearby Hausa villages. Nevertheless, land use around these dwellings closely resembled that of the surrounding outfield plots.

Because of their comparatively recent arrival, most of these in-migrants had been farming the fields available to them every year since the initial clearing. Widespread use of commercial fertilizers along with the expressed intention of many of these in-migrant farmers to continue to cultivate their original plots rather than rotate their production suggests that a sub-type of land use may be in the making--annually cultivated land based on inorganic fertilizers. It was evident that very few of these newly arrived farmers were aware of local land capabilities or fallowing traditions. Still, few of these farmers held leases for longer than a three-year period, and the original owners may exercise some control over leased land especially at the point of its possible exhaustion.

Fadama Land Use

Prothero reported that in 1952 the "main fadama area utilized, not amounting to many acres, is along the Jamana stream particularly where it flows through Soba village."[1]

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[1]Prothero, "Land Use in Soba," p. 73.

The primary crops grown on these lowland plots were tobacco and maize, with several interspersed sugar cane plots and a few banana trees as well. He reported a severe problem with "Red Rot" disease which was destroying sugar cane at that time, encouraging its replacement by tobacco. Watson's land use map compiled several years later shows similar findings. He estimates the acreage devoted to sugar cane production, some of which lay outside the lowland sector within the village walls, at 14 acres or 2.5 percent of annually cropped land.

By 1975, fadama cultivation had undergone quite a sizeable expansion, and its significance in the village agricultural system was not easily overlooked (see Table 34). Almost all of the lowland areas in the vicinity of the settlement were under cultivation. Approximately 140 acres of cultivated fadama could be found in the environs of Soba village, an increase by a factor of 8 over 1950 utilization of lowland. A very large portion, perhaps as much as 60 percent, of this cultivated fadama was devoted to the production of sugar cane, but rice, maize, tobacco, potatoes, cassava, and vegetables were grown there as well. As was typically the case in the district, fadama plots in Soba village were invariably quite small. Few were over .3 acre; many were as small as .1 acre.

Despite the fact that lowland farming consumes significantly higher labor inputs per acre and frequently requires fencing in order to prevent access by livestock during the dry season, there was much evidence that fadama farming had become increasingly popular. Just over 50 percent of the sampled

households reported that they engaged in fadama cultivation, implying that certainly not all village smallholders had the labor and financial resources needed to cultivate lowland plots. Rather, fadama farming appears to have become a relatively specialized pursuit in Soba; nearly 18 percent of fadama farmers, for example, held more than 2 separate plots. In general, the reasons for the growing popularity of sugar cane are probably tied to the increasing ease of access to Soba village which has meant an increase in demand for, hence profitability of, sugar cane, most of which is consumed directly by chewing rather than processed for its sugar content.

Projections for Land Use Change

It is interesting to pose the question of just how long the trends in land use change that have been cited here can be expected to continue before constraining factors, such as serious land shortages or gross environmental deterioration, might alter the processes at work. Are there any foreseeable limits to the expansion of intensive infield farming, for example? Obviously fallowing intervals cannot be continually reduced before land rotation becomes disfunctional; are there large enough margins of unused land in the outfield zone so that rotational fallowing will remain a primary component of Soba land use systems for some time to come? In other words, are there any indications that Soba village is about to make the transition to a "close-settled-type", high density land use system?

The simple extrapolation of present trends into the future has its weaknesses as a predictive technique, primarily that it fails to account for precisely the kind of innovations or intensifications that Boserup claims are to be expected. Already, as we have seen, the bicycle has had an impact in this regard and widespread use of motorcycles might similarly alter the use of outlying land. Moreover, it should be obvious from this accounting of Soba land use that no single process or cause is sufficient to explain all variation in land use over time. Nevertheless, it is instructive to carry out a simple "land potential" exercise based upon the findings shown in Table 34.[1]

It is probably accurate to conclude that the approximately 10 percent of Soba land which presently contains dense bush vegetation consists largely of tracts which will never be suitable for productive farming. If one disregards these tracts of minimal productive potential, then the cultivated portion of Soba territory presently exceeds in acreage the uncultivated portion. Moreover, existing rates of expansion of cultivation

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[1]Since the figures shown on this table are from lands actually farmed by resident Soba smallholders, these projections cannot purport to be a comprehensive carrying capacity model for the entire Soba village area. Acreages here do not reflect the potential of satellite village farmlands or uncultivated territory. It has been noted that the capacity of Soba village to support human population is already inextricably linked to the productive capacity of its peripheral hamlets and will doubtless become even more so in the remaining decades of the twentieth century.

imply that over 75 percent of this area will be under cultivation in two more decades. With such a ratio of farmed to fallowed land, the likelihood of a serious deficit in land available for rotation presents itself. To the extent that central village smallholders are forced to rely on rotational fallowing to maintain the productive capacity of outfield farms, there may well emerge serious problems in this regard.

Of course, as long as farming possibilities exist elsewhere there is little reason to suppose that smallholders would continue to expand outfield production if it required the return of insufficiently rested land to cultivation. Hence, the rates of expansion of cultivation in the outfield zone can probably be expected to fall off. After all, there is a check already in operation on the expansion of new cultivation in this zone since all the rights to daji (bush) have been assigned in Soba village. Except for individuals who inherit large tracts of outfield, new farmers who break ground in this zone after 1980 or so will probably not expect to rely on rotational fallowing.

On the other hand, the pronounced expansion of the intensively cultivated infield zone which has taken place suggests that central village residents will probably increasingly rely on annual cultivation of fertilized land for a major portion of their production. The rate of growth of infield farming around Soba since 1950, along with evidence from other populous areas of Hausaland, seems to lend credence to this conclusion. Within the next decade, in other words, infield land use will likely

surpass outfield as a proportion of total cultivated acreage. At that point rotational fallowing will have become a supplementary rather than a primary agricultural technique.

Analysis of organic fertilization practices, however, has suggested that expansion of the infield zone may not continue indefinitely at present rates. The likelihood that some sectors of this zone are even now not receiving a fully adequate dressing of organic materials is great. Of course, commercial fertilizers appear to have performed a major role in taking up the slack and dependency upon such external supplies is likely to increase.

Over and above an increase in total cultivated acreage, the change in the Soba village land use system since mid-century has been in the direction of intensification: the frequency with which outfield farms are cropped has been increased and the proportion of annually cultivated infield farmland has grown. Yet obvious limitations on both trends are readily apparent. A minimally practical fallowing interval prevents continued increase in frequency of use. The supply of organic materials, which at present at least remains the basis of infield cultivation,poses a constraint. The upshot of these limitations is that land use in Soba central village is approaching a threshold. Until the population densities of surrounding areas reach those of Soba village, however, its own land use system is not likely to be converted to an entirely intensive type.

Although the rate of expansion of infield farming may gradually decline, the proportion of intensive land use will

surely increase. Yet, extensive outfield land use will not likely disappear from the landscape any time in the immediate future. Rather, intensification of agricultural land use--to an ever greater extent based on inorganic fertilizers--and the expansion of total cultivated acreage will probably occur in less heavily farmed sectors of the village area.

CHAPTER X

THE INFIELD-OUTFIELD SYSTEM OF LAND USE AND AGRICULTURAL CHANGE IN HAUSALAND

As the foregoing analysis demonstrates, there are clear differences in the composition of village land use systems in Soba District. Admittedly, these differences are not readily apparent to the casual observer, but they exist nonetheless and are especially important for the problem under consideration in this study.

It is appropriate to conclude this investigation of village agricultural systems in Soba District by reconsidering three sets of questions, each of which formed the basis for an early chapter: (1) In the light of findings presented thus far, what can be concluded about the relationship between population growth and agriculture in Soba District? (2) Which of the interpretations of Hausa land use appears to best fit the circumstances encountered in Soba District? Have any of the explanatory factors under review been clearly dominant as influences on agricultural land use? (3) How satisfactory is the Boserup model of agrarian change for explaining events that have transpired there?

Clearly all three sets of questions revolve around the central issue in this inquiry, namely, to what extent can it be established that differences in land use among villages in the district are attributable to demographic factors? Hence, a

complete response must begin with a summary and appraisal of the distinctive land use system found in the study area.

The Infield-Outfield System of Land Use

In an early response to Hill's challenge to the long-standing demographic interpretation of Hausa land use, Mortimore remarked that "land use is more complex" than Hill acknowledges and that

> practices [such as fallowing, annual cultivation, and lowland cultivation] may be combined in variable proportions to make up a land use system, and the emphasis which is given among these options, whether resolved at the level of the individual farmer or of the village community, must be determined by a complex process of decision-making influenced by many factors.[1]

The view that underlies this comment is that traditional agricultural land use is best seen as a *system* which contains a set of interacting and inter-related components; this view has clearly prevailed in the present study.

Certainly Hill was correct in drawing attention to the fact that annual cultivation with "manuring" (infield land use) appears to be a major component of Hausa land use systems--both past and present and in both densely populated and sparsely populated areas. Yet she overstates the case--at least with respect to sub-regions of Hausaland such as Soba District--by labeling "permanent cultivation" (infield land use) the preferred system.

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[1] Mortimore, "Population Densities and Agriculture," p. 10.

It seems far preferable to regard infield use as merely one element in a widespread and apparently popular land use system--a system which may represent an old and long established practice in Hausaland although no such claim can be made on the basis of evidence from the present study. Consequently, the agricultural practices found in Garun Gwanki village in 1975 and those described by Prothero in Soba village approximately 25 years earlier are best seen as examples of an infield-outfield land use system, a system in which both categories of land use, infield and outfield, have distinctive functions, an associated set of practices, and a range of advantages and disadvantages for the farmer. The outlines of this system of land use can be brought into sharper focus by a brief summary of the contributions of each type of land use.

Land Use Types: Assets and Liabilities

Infield Land Use

In situations where land is abundant, infield farming is nonetheless advantageous for at least two primary reasons: ease of access to farms and enhanced productive capacity. The relative proximity of these fields to the settlement is conducive to maximum utilization of casual labor--from short weeding spells in the evenings to brief visits for fertilizing. It also facilitates the casual harvesting of early grains such as maize or early millet during the difficult pre-harvest season and affords opportunity for close observation of growing crops, a distinct advan-

tage where roving livestock present a threat. Finally, regular fertilization of infield plots means that their productive capacity is maintained and in many cases even enhanced.[1]

Annual cultivation of a field also means that obstructions and undesirable roots are eventually removed. Yet this is no overwhelming advantage since such obstructions generally pose no great obstacle on outfield farms; the outfield cultivator merely ridges around them and makes no attempt to remove them. Hence, the initial plowing of infield farms following the planting rains is not necessarily lighter work than that demanded by outfield plots, despite the fact that roots on infield plots have been removed.

As has been shown, the most strongly felt disadvantage of infield farming appears to be its proclivity to excessive weed growth because of the indiscriminate nature of fertilizer practices. Moreover, plots within this zone tend to be smaller than outfield farms and subject to greater fragmentation pressures--in older villages because of division at inheritance and in younger, smaller villages because of a desire for equal treatment of all smallholders. Finally, a certain level of regular main-

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[1] Whether one relies on the trials of agronomic experts or on the perceptions of local smallholders, the evidence pertaining to the ability of organic materials to improve the productive capacity of soils to a point where yields per acre surpass those on well-rested, high quality outfield land seems to be inconclusive.

tenance is required on infield plots since improvements such as drainage ditches must be periodically renewed.

Outfield Land Use

A significant advantage of outfield farming for the smallholder is that these generally larger fields provide a greater total return; this is not necessarily because per acre yields are superior--an open question--but merely because the overall area under cultivation is greater. These farms appear to consume less labor per unit area than annually cropped land, but a final judgment on this point awaits more detailed study on labor inputs. Certainly, it seems apparent that outfield farms require less peak season labor since they typically require one less weeding operation. Furthermore, among the advantages of outfield farming, its superiority for specific crops such as cotton should be listed.

On the other hand, outfield farms demand attention in the form of cutting back brush and burning prior to the onset of planting rains. Especially in the case of a newly opened plot, the labor requirement for clearing and felling of trees is not inconsequential, although burning is relied on to do a great amount of the work in this regard. In general, the characteristic location of outfield farms should probably be listed as a liability although, as has been shown, distance does not appear to be a severe restriction on farmer behavior, particularly since the advent of widespread reliance on bicycles.

Fadama Land Use

Clearly the principal advantage of lowland farming is that it is productive during the off season as well as the fact that it is suited for the production of certain high value crops such as sugar cane.[1] Labor inputs do not necessarily fall in the peak demand period, and a potential source of income during the slack season is gained from fadama cultivation.

On the other hand, fadama, especially areas that are waterlogged at some point in the year, is suited only to certain water-tolerant crops. Not all crop requirements can be met on fadama alone. Furthermore, cultivation of lowland is extremely arduous and time consuming. These sizeable per acre labor requirements as well as the limitations on the total amount of fadama in proximity to most villages are reflected in the diminutive size of most individual lowland plots.

The Smallholder Decision-Making Function

Each of the types of land use delineated above forms an essential component of a common land use system, the infield-outfield system. The emphasis given to each component is influenced by an array of factors--most of them noted at some point in the foregoing analysis--but is ultimately resolved at the level of the individual farmer decision-maker. The weighing of the

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[1] It should be recalled that lowland farms are not the only plots carrying crops during the dry season; frequently upland plots hold a crop of cassava during the off-season.

assets and liabilities involved in each type of land use above is intended to be suggestive of the decision-making processes of the individual smallholder.

A striking observation to emerge from the present study pertains to the level of agricultural sophistication of the typical Soba District smallholder and to his awareness of the advantages and disadvantages involved in the various categories of land use. Obviously, there were variations in this regard, largely having to do with age and length of residence in Soba District, but most farmers demonstrated a keen appreciation of the opportunities at their disposal and the obstacles which confronted them as they formulated land use strategies.

It could be observed that the arguments presented by both Hill and Boserup overlook, to some extent, the decision-making function of the smallholder. Boserup, for example, might be read as support for the case of the lazy and benighted African farmer although that is surely not her intent. Yet her suggestion that labor economy is the prime motivating factor which governs land use, to the exclusion of all other considerations, fails to give sufficient weight to the smallholder's power to shape his family land use. Within the context of a desire to maximize both returns and security as well as a desire to minimize unnecessary labor expenditures, the smallholder ascertains which combination of land use types meets his requirements.

Similarly, Hill's culture-dominant interpretation appears to disregard the set of interacting forces within which the smallholder operates and makes decisions. Like Boserup, she could be

interpreted as restating the case of the powerlessness of the smallholder, an argument which has been overdrawn by physical environmentalists in the past. Cultural preference, not the smallholder, determines common agricultural practice. In contrast, the portrait which emerges from this study of Soba District is that of an active decision-making and knowledgeable smallholder, not one of a passive, traditionalist or culture-bound peasant farmer.

Infield-Outfield as a Distinctive Sub-Type of Land Use System

Infield-Outfield can be regarded as a distinct sub-type of agricultural land use systems, one which combines elements of so-called "permanent" agriculture with those of rotational fallow systems in a characteristic spatial pattern. In the classification scheme of Benneh, for example, infield-outfield land use represents a union of small-scale, permanent, "compound farming" with bush fallowing. Similarly, it can be seen as an amalgam of several of the "seven major systems of cultivation" that Morgan and Pugh list for West Africa.[1] Yet, as has been shown, this is a system of land use that is apparently very widespread in Soba District and probably throughout Hausaland apart from the densely settled sub-regions such as Kano; therefore, it deserves recognition as a discrete system of land use in its own right.

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[1] Benneh, "Systems of Agriculture," p. 245; Morgan and Pugh, West Africa, p. 100.

Within Boserup's scheme, the types of land use in question represent older and more recent forms; for her, the infield-outfield system is essentially indicative of a region undergoing transition under the stimulus of population growth. The existence of both types in the same village serves as an illustration of "the slow penetration of new systems of land use and techniques which coexist for long periods with older systems."[1]

Yet the infield-outfield system has been in existence in Soba District for the entire period under review and probably for much longer; as Hill has suggested, infield land use is not necessarily to be seen as a recent innovation in Hausaland. Admittedly, the relative newness of infield cultivation in Hausaland depends entirely on the time frame under review. Nevertheless, it seems more profitable to regard both categories of land use, infield and outfield, as components of a relatively longstanding system of land use rather than as indicators of a transitory stage in the evolution from dominantly extensive to primarily intensive agriculture.

Changes in the Infield-Outfield System

It may be correct to characterize the infield-outfield system as a prominent system of land use in Hausaland, possibly even as the preferred system in certain sub-regions. Yet the foregoing analysis of agriculture in Soba District made clear

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[1] Boserup, Conditions of Agricultural Growth, p. 56.

that there is no ironclad preference for an unchanging pattern of land use among Hausa farmers. Certainly it would be a mistake to assume that the infield-outfield system was dominant throughout the whole of Hausaland. Even within Soba District, the proportions of land devoted to each type of use are variable and in the most populous areas such as Soba village, the infield-outfield system gives way to a fundamentally different land use system. After all, the infield-outfield system exists by definition only so long as large numbers of farms of each type are found around villages. When population increases to a point where opportunity for outfield farming is limited, a different set of choices confront the farmer, and a different system of land use becomes dominant. Hence, the infield-outfield system is best seen as a low to medium density farming system.

Within Soba District, the most significant change that has been occurring in village infield-outfield systems has to do with the relative proportions of village land resources that are devoted to each type of use. The evidence from this study suggests that these changes are best viewed within the framework of local population growth in relation to available farmland. Within this context, there appear to be threshold levels at which the influence of various factors under review here undergo shifts in their relative impact on land use.

In lowly populated sectors of the district, for example, physical factors such as soils and micro-topography exert a powerful influence on the relative amounts of land in each category. In more densely farmed sectors, on the other hand, the

constraints on intensive land use may be altered as outfield land assumes a scarcity value and the organic materials required for infield cultivation become more plentiful. In the final analysis, however, it is increasing densities of human population which appear to be the most formative factor in increasing the percentage of intensive, infield cultivation.

Environmental Factors: The Impact of the Initial Settlement Site

As has been explained, infield-outfield land use *per se* is primarily a low to medium density farming system. The example discussed in Chapter VIII, Garun Gwanki village, illustrated the extent to which in the most sparsely populated areas, the initial siting decision for the settlement strongly influences the subsequent pattern of land use--including the proportion of land which is used intensively. Another case from within this same sparsely populated sector of the district demonstrates this point quite well.

Reference was made in another context to the pioneer hamlet, Ungwan Katsinawa, that was established in Soba District in 1973. It is interesting to consider what these Katsina refugee farmers did in the context of a clear opportunity to exercise any preferences they might have and to use the abundant land resources nearby in the manner they felt most satisfactory.

Most of the first fields cleared and planted in the first year of occupancy of this hamlet were those immediately outlying the newly established residential area; these plots constituted

a nascent infield zone although no fertilization transpired at that time since no organic materials were available. Nevertheless, the intention of these new farmers was clear; they planned to maintain these fields in an annual cultivation regime. It might seem that this example reveals a strong preference for infield-style farming, yet such a judgment would be somewhat premature. Certainly, however, it does indicate that intensive cultivation was not avoided for reasons of labor economy.

If this case is analyzed further, however, it becomes apparent that the foremost influence on hamlet land use was the settlement location. The settlement site was quite deliberately selected according to a formula which appeared to be well known. The residential area was placed at a mid-slope position in such a way as to (1) maximize the opportunity for growth of an infield zone on amenable soils; (2) avoid less favorable upslope soils; and (3) remain in relative proximity to a watercourse for household supplies and for fadama cultivation.

Moreover, smallholders in Ungwan Katsinawa did not confine themselves to infield cultivation in their first year of farming in this location. Many farmers opened up outfield farms nearby, despite the fact that the entire potential infield zone was not yet fully utilized. The advantages of outfield cultivation listed above were no doubt prominent in the minds of these villagers, particularly the desire for expansive acreage for cotton production. In the final analysis, this example of a pioneer hamlet in Soba District reveals quite clearly an appreciation on the part of smallholders of the virtues of the infield-

outfield land use system.

Locational and Economic Factors

In this summarization of the infield-outfield land use system, greatest stress has been placed on the impact of demographic variables in relation to changes in the proportions of each type of cultivation found around villages. What about the influence of locational and economic factors on the system? Examples of possibilities in this regard have appeared at numerous points in this study. Yet, in the final analysis, such factors appear to play a secondary role in view of the importance of local population-land resources relationships.

Throughout this study of Soba District, the factor of distance between settlement and farm has shown itself to be an insufficient explanation for variations in land use intensity. Where land scarcity is a major factor or where land capabilities vary significantly, distance seems to pose no great obstacle for the smallholder. As has been shown, the bicycle has made a notable impact in this regard. Hence, variations in the distance from farm to farmstead fail to account for variations in the infield-outfield system.

The findings with respect to the relative accessibility of villages and to the influence of economic variables such as "urban demand for surplus production" are somewhat more complex. Nonetheless, the general principle seems to hold: demographic influences provide a more satisfactory explanation for variations in the infield-outfield system. It should be recalled that a

prime criterion for the selection of Soba District as a study site was the comparative constancy of some of these factors; despite the relative uniformity in macro-economic and macro-locational factors, significant differences in village land use were found there.

Admittedly, Soba District is not an isotropic plane. Differences with respect to the immediate availability of transportation and communication linkages certainly exist there. Nevertheless, in the two village studies presented here, it would be difficult to argue that in 1975 there was a differential impact of price incentives, urban demand for foodstuffs, or of ready access to agricultural markets. Although changes have occurred in recent years in transportation networks, the opportunities for smallholders in remote, sparsely populated sectors of the district to evacuate agricultural commodities have probably not been significantly dissimilar from those for farmers in roadside, densely populated villages. In terms of the diffusion of incentives and information, then, the district can rightly be compared to an isotropic plane.

As has been shown, the foremost influence of economic and locational factors seems to have been in relation to crop selection and to the proportions of various crops grown. The upsurge in tobacco production, the increase in sugar cane acreage, the introduction of high value crops such as yams, and the relegation of cotton to the outfield zone are all examples of such shifts. Yet all of the crops noted here can be, and are, grown on both categories of land. Only fadama crops such as sugar cane demand

a specific type of land use; hence a shift in the proportion of land devoted to various crops does not necessarily imply a comparable shift in the composition of village infield and outfield land. Thus, while economic forces may have been responsible for rearrangements in cropping patterns, they are not necessarily the reason for increases in the amount of intensively cultivated land in any given village.

Cultural Factors

It may be that the prominence of the infield-outfield system in Soba District is an expression of a cultural preference, although such a conclusion would be difficult to demonstrate from the present study. Even so, such a preference structure is clearly not inflexible or unrelated to other factors since the infield-outfield system itself is not uniformly practiced even within the boundaries of Soba District. Moreover, emphasis on cultural preferences does little to explain the differences that exist in relative proportions of each type of land found around villages.

In terms of agricultural land use in Soba District, cultural predelictions are probably best seen as an indirect rather than a direct influence. As has been demonstrated, for example, the preference for nucleated settlements gives rise to several important features of infield-outfield farming, notably in regard to the accumulation of organic fertilizers.

A Reconsideration of the Boserup Model

If the changes in agricultural land use in Soba District

since mid-century are seen as rearrangements within a constellation of land use that has been termed the infield-outfield system, the question remains as to how satisfactorily the Boserup model explains why these shifts occur. Can the model be used successfully to understand the variations in land use that have been discussed?

Classification of Land Use

In the first place, Boserup was surely correct in directing attention to the complexity of traditional agricultural land use. Analysis of pre-industrial systems is not merely a matter of comparing extensive with intensive use, or subsistence with commercial agricultural production. Nor was it correct to assume that land use is merely a function of the physical environment. It will be recalled that Boserup argued that the frequency with which a unit of land is cropped constitutes an important distinction in non-mechanized agricultural systems; furthermore, these systems, more often than not, display the coexistence of several land use types within a single region. Between the categories of "extensive" and "intensive" agriculture, in other words, lies an entire spectrum of discrete land use systems.

In this study, the infield-outfield distinction was utilized as a somewhat more comprehensive classification than any of Boserup's classes of land use; it includes not only a frequency of cropping criterion but a locational and fertility renewal referent as well. Nevertheless, the link between intensity of use and frequency of cropping proved to be helpful as a

basis for differentiation among village agricultural systems. Boserup's broadened concept of intensification and her suggestion that various combinations of land use can be taken to represent stages of intensification were fundamental to the distinctions made in this study.

Elastic Carrying Capacities

It has been argued above that the infield-outfield land use system constitutes a distinctive system for the utilization of land resources, but nowhere is it claimed that this is a static system. Quite the contrary is true. The emphasis in this study has been on the changes in the relative proportion of each category of land use found in village land use systems; furthermore, it has been shown that an array of adaptive mechanisms are present in Soba District agro-ecosystems, many of which have been noted in the course of this study. Hence, there is much evidence here to confirm Boserup's contention that pre-industrial agricultural systems are best seen as dynamic systems which are eminently responsive to changes in the population-land ratio as well as to other factors.

On the question as to whether or not restrictions are imposed on the expansion of local carrying capacities by the physical environment or by economic constraints, the findings of this study are somewhat guarded. The influence of soils and microrelief, for example, has appeared at several points in the foregoing analysis. Nowhere, however, has there been evidence to suggest that the intensification of agriculture by traditional

Primacy of Labor Economy

Although Boserup's stress on labor economy in land use decision-making was not fully tested in this study, there were numerous indications that labor inputs are a major consideration in the minds of smallholders. The reasons offered for expressed land use preferences provide the clearest example of this. As has also been shown, however, a range of additional considerations over and above labor inputs are taken into account; hence, it may be preferable to regard labor inputs as only one of several factors that influence the smallholder's land use decision-making.

The emphasis given here to infield-outfield land use as an integrated system for the use of land resources should not be read as a denial of the importance of labor economy. The fact that intensive cultivation is found in villages where abundant land is available does not necessarily mean that farmers care little about labor inputs to agriculture. Rather, the presence of both types of use in most villages suggests that the Soba District smallholder is primarily concerned with a maximally productive labor allocation in the face of constraints imposed by macro- and micro-environmental factors, family labor resources, cash resources, and land availability rather than simply with minimizing total labor inputs. While the law of least effort remains as a general influence on land use, then, "effort" cannot be defined as merely the lowest per acre number of man-hours on the field.

Population Growth as a Stimulus to Agricultural Intensification

The argument has been made in this study that demographic factors, rather than cultural, spatial, or environmental imperatives, form the best starting point from which to consider variations in the infield-outfield system. Does this mean that Boserup's assertion that population growth stimulates intensification in agriculture has been supported by findings from Soba District?

Inferences from the study presented here point to an affirmative answer to this question. It has been demonstrated that, among other things, significant differences in proportions of infield and outfield land under cultivation can be found among villages in the district. Moreover, during the period under review, 1950-1975, a sizeable expansion of infield acreage has occurred around Soba village. The impetus for the expansion of intensive cultivation in Soba village has come largely from increases in population. Hence, differences in the composition of infield-outfield systems among villages in the district are primarily attributable to the fact that outfield land use remains the dominant mode of production in lowly populated sectors where little pressure on land resources exists while infield land use assumes a more prominent role where demands for land are greater because of increased population.

None of the alternative explanatory factors under consideration seem to satisfactorily account for these differences among village agro-ecosystems. Certainly there occurred major improve-

ments in transportation and other infrastructural developments during the period 1950-1975. Urban demand for agricultural commodities rose, and the incentive to produce certain commercial crops was similarly increased. Yet, if these developments are used to explain changes in Soba village, for example, the question remains as to why they have not stimulated comparable changes elsewhere. The assumption in this study is that modernizing forces and increasing commercialization of agriculture have been felt relatively evenly throughout the district; despite this fact, differences in the composition of village land use can be shown to exist. Hence, increases in density of population remain as the most likely explanation for these differences.

The Boserup model, in sum, provides a suitable framework for analyzing changes in agriculture in Soba District in recent decades and for explaining differences in contemporary land use. It serves to explain both <u>how</u> and <u>why</u> agricultural land use has been intensified. As is characteristically the case when a broad-ranging model is applied to a specific case, complicating factors come to light and modifications must be made to take into account local conditions. Within the general framework of population growth, for example, differences in micro-environmental variables in Soba District have been shown to have an important bearing on variations in intensity of land use. Intervening exogenous factors such as urban demand for foodstuffs, improvements in transportation links, and other aspects of modernization such as the widespread use of bicycles have probably had an impact on the rate of change within the infield-outfield system. Moreover, as

has been shown, intensification of agricultural land use has not been the sole response to population growth in this region. Nevertheless, in its broad outlines, the Boserup model can be utilized as an explanatory framework for understanding agrarian change in Soba District.

Conclusions About Agricultural Change in Soba District

Village land use systems in Soba District were found to be more complex, more dynamic, and more responsive than has frequently been assumed. In the populous sectors of the district, growing demands for food and fibre production over the past 25 years have been met, not simply by expanding cultivated acreage, but by the intensification of land use with primary reliance on traditional techniques. In sparsely settled sectors, in contrast, intensive land use is generally present as an adjunct production technique, whereas outfield, extensive cultivation has remained the dominant mode of production. The major conclusions from this study of Soba District agriculture and population can be summarized under the following two headings, each of which includes a series of relevant sub-points.

The Infield-Outfield System of Land Use

Rather than pose a mutually exclusive dichotomy between intensive and extensive land use as some observers have been prone to do, it is preferable to regard the types of land use delineated here as interacting components in a dynamic land use system. This

system has been termed the infield-outfield system here, and it represents a discrete and integrated system of land use found throughout Hausaland. With this construction placed on Soba District agriculture, the following corollary points become apparent:

1. Hill's emphasis on annual cultivation with manuring as a preferred system of Hausa land use fails to give due regard to the prevalence of outfield cultivation, not simply because of supply constraints, but because of the distinctive advantages of extensive land use.

2. Conversely, interpretations which stress the link between land shortage and intensification in agriculture frequently overlook the distinctive place of infield cultivation in this widespread land use system, regardless of land availability.

3. Infield land use, which is defined on the basis of a combination of locational and cropping regime criteria, is not homogeneous. Although organic fertilizer is the primary capital input to infield farms, rates and periodicity of fertilization vary quite widely among villages.

4. The smallholder exercises an active and informed decision-making role in determining the use of family farmland, a fact which has frequently been overshadowed in negative accounts of the African "peasant farmer." Ultimately, the amount of land in each category of use around a village results from decisions made by individual farmers, decisions which are influenced by an array of factors from family size to entrepreneurial ability.

Hence, differences in the composition of infield-outfield systems largely reflect different land use decisions made by smallholders.

Relationship of Population Growth to Infield-Outfield Land Use

Despite the undeniable influences of locational, economic, and physical factors on village land use, synchronic and diachronic differences in land use are best interpreted as a function of human population density. The findings of this study of Soba District are consistent with the orthodox demographic interpretation of Hausa land use. Village area population density, which is reflected in both the size and number of settlements within a village's territory, provides a relatively reliable indicator of local demand for land resources, an over-arching determinative factor of village land use.

1. Thus, while intensive, infield land use is characteristic of nearly all villages and hamlets in Soba District, the ratio between settlement size and the size of the infield zone is not a constant. The extent of infield acreage--hence, the proportion of intensive cultivation in the village land use system--is related to population pressure on land resources. As demand for land increases with a growing population, the rate of expansion of the infield zone increases.

2. Intensive cultivation is further related to village population ir that, contrary to persistent belief, organic materials that are applied to infield lands come not from wandering Fulani herds but from village compounds. The total yearly production of organic

fertilizers is a function of population size, and since there is no inter-village movement of organic materials in Soba District, village production governs the rate of use.

3. Outfield land use similarly shows the apparent impact of local population-land ratios. The average size of outfield farms, the characteristic fallowing periods, and the availability of outfield land to newcomers are all related to local demands for land.

4. As other observers of Hausaland have noted, there is an array of features of rural economies and agricultural systems which vary according to local population densities. The average size of household farm holdings, the amount of village land in individualized categories of tenure, the frequency of use of non-family or non-gandu labor, and the range of off-farm employment opportunities are among the more prominent of these features.

5. The result of an increase in village population density is an increase in the proportion of intensively cultivated infield land in the local land use system. An increase in population numbers alone, on the other hand, does not necessarily imply an expansion of intensive farming since adequate opportunities for outfield farming may still exist if overall densities remain low.

6. Within the general progression from sparse-population-dominantly-outfield to dense-population-primarily-infield land use, the influence of non-demographic variables changes. Whereas micro-environmental variables exercise an influential role in shaping low density land use, their influence wanes as densities

frequently fail to grasp--should probably be stressed. Rural development involves a rising standard of living for a rural populace and may or may not include increases in agricultural productivity. Agricultural development, on the other hand, is concerned with increased production and efficiency in agriculture to meet national needs, including the demands of an expanding urban population.

For all of the stress given in this study to demographic factors as a stimulus to agricultural intensification, there has nowhere appeared the suggestion that population growth alone can be relied on as the basic tool for the development of rural economies. Implications for population policy from this analysis are merely that gradual increases in population densities in rural areas can be sustained within the framework of an infield-outfield land use system. Extremely rapid or excessive population growth as well as substantial increases in food demands by a non-farming populace are another matter entirely and probably require measures over and above the slow intensification of land use by traditional smallholder techniques.

Nevertheless, the past successes of Soba District smallholders should not be overlooked. To a great extent, the increases in intensive land use that have been in the foreground of this study have taken place outside the national agricultural planning framework. Even the increase in connectivity in the district transportation network that is in evidence on Map 5 results largely from local initiatives and never appeared on any National Plan. In general, national planning seems to overlook the contributions

of the smallholder and of traditional techniques of intensification. Recent inorganic fertilizer distribution policies, for example, seem to have discouraged the use of locally available sources of fertilizers and caused the wastage of large amounts of Fulani manures. While the gradual transition from dominantly outfield to dominantly infield land use within an infield-outfield system might not meet the food and fibre requirements of a burgeoning regional populace, it represents at least one avenue of approach to rural development which has a strong likelihood of continued success.

APPENDIX I

Notes for Appendix I

The data presented in this appendix form the basis for the analysis presented in Chapter VI. The following information serves to explain abbreviations and symbols used in Table 35 and Figure 10.

TABLE 35 DATA PERTAINING TO ORGANIC FERTILIZATION OF INFIELD PLOTS, SOBA DISTRICT

Column (1) Case Number

An arbitrary number assigned to each sampled plot.

Column (2) Village Size

Size of settlement nearest sampled plot. Figure indicates the estimated number of compounds in this settlement.

Column (3) Village Population Density

Estimated population density of village area in which sampled plot is located. Figure indicates persons per square mile.

Column (4) Accessibility of Village

The relative accessibility of settlement nearest the sampled plot. Abbreviations used are:

P= poor access (dirt track or footpath only)
F= fair access (dry season road to settlement)
E= easy access (all weather road near settlement)

Column (5) Type of Fertilizer

The type of fertilizer found on sampled plot. Abbreviations used are:

A= ashes (Toka)
R= household refuse (Takin Juji)
PM= pen manure (Takin Dabbobin Gida)
M= mixture of above types
L= latrine manure (Takin Shadda)
F= Fulani cattle and goat manure (Takin Shanu)

Column (6) Rate in Tons/Acre

The calculated rate of application of organic materials expressed in tons per acre. The methods used to arrive at these figures are explained in Chapter VI.

Column (7) Distance from Source

The distance expressed in yards from the source of the organic materials. In most cases, this was from the

farmer's own compound.

FIGURE 10 SCATTERGRAM SHOWING RATE OF APPLICATION OF ORGANIC FERTILIZER BY DISTANCE FROM SOURCE

Symbols used on this figure are:

o = one observation
● = two observations

(1) Case Number	(2) Village Size	(3) Village Population Density	(4) Accessibility of Village	(5) Type of Fertilizer	(6) Rate in Tons/ Acre	(7) Distance in Yards from Source
1	300	260	E	A	8.5	660
2	300	260	E	M	6.0	580
3	300	260	E	PM	4.0	726
4	300	260	E	PM	3.5	924
5	300	260	E	F	12.0	330
6	300	260	E	PM	4.0	680
7	300	260	E	A	13.0	250
8	300	260	E	PM	2.0	1
9	300	260	E	PM	1.8	264
10	300	260	E	M	6.0	265
11	300	260	E	PM	2.0	880
12	300	260	E	R	4.5	924
13	300	260	E	M	3.5	450
14	300	260	E	PM	3.0	790
15	300	260	E	PM	5.0	550
16	300	260	E	PM	5.5	510
17	300	260	E	M	3.0	815
18	300	260	E	PM	6.5	790

TABLE 35 DATA PERTAINING TO ORGANIC FERTILIZATION OF INFIELD PLOTS, SOBA DISTRICT

(1) Case Number	(2) Village Size	(3) Village Population Density	(4) Accessibility of Village	(5) Type of Fertilizer	(6) Rate in Tons/ Acre	(7) Distance in Yards from Source
19	300	260	E	PM	4.0	440
20	300	260	E	R	8.0	770
21	300	260	E	M	3.4	900
22	300	260	E	A	2.5	154
23	300	260	E	M	11.0	460
24	300	260	E	PM	7.0	835
25	300	260	E	PM	2.5	110
26	300	260	E	M	10.0	130
27	300	260	E	A	3.0	175
28	300	260	E	A	5.0	200
29	300	260	E	PM	2.0	175
30	300	260	E	F	9.0	440
31	40	50	F	R	1.5	10
32	40	50	F	R	1.1	5
33	40	50	F	L	1.3	10
34	40	50	F	M	3.2	15
35	40	50	F	A	6.1	100
36	40	50	F	R	1.6	18

TABLE 35 - Continued

(1) Case Number	(2) Village Size	(3) Village Population Density	(4) Accessibility of Village	(5) Type of Fertilizer	(6) Rate in Tons/ Acre	(7) Distance in Yards from Source
37	40	50	F	R	1.0	10
38	40	50	F	A	3.0	8
39	250	200	F	PM	5.0	840
40	250	200	F	M	7.5	700
41	250	200	F	M	5.0	1400
42	250	200	F	A	3.0	300
43	250	200	F	R	5.0	1300
44	250	200	F	PM	8.1	650
45	250	200	F	PM	4.0	900
46	250	200	F	M	3.0	900
47	250	200	F	A	3.0	50
48	250	200	F	R	4.0	100
49	280	200	F	M	14.0	250
50	280	200	F	PM	1.0	1100
51	100	100	P	F	13.2	150
52	70	100	P	M	5.0	50
53	70	100	P	R	2.0	40
54	70	100	P	R	1.8	20

TABLE 35 - Continued

(1) Case Number	(2) Village Size	(3) Village Population Density	(4) Accessibility of Village	(5) Type of Fertilizer	(6) Rate in Tons/ Acre	(7) Distance in Yards from Source
55	70	100	P	R	1.8	25
56	70	100	P	PM	2.8	380
57	9	140	P	R	12.0	150
58	9	140	P	R	9.0	1
59	9	140	P	R	9.0	50
60	9	140	P	PM	4.0	50
61	9	140	P	R	2.3	190
62	9	140	P	PM	5.5	60
63	60	100	G	A	10.0	300
64	60	100	G	M	8.0	250
65	60	100	G	R	13.5	50
66	60	100	G	R	13.0	1
67	60	100	G	R	6.3	100
68	60	100	G	R	5.8	50
69	60	100	G	PM	2.3	380
70	60	100	G	PM	1.8	200
71	20	260	F	A	2.3	250
72	20	260	F	A	4.1	300

TABLE 35 - Continued

(1) Case Number	(2) Village Size	(3) Village Population Density	(4) Accessibility of Village	(5) Type of Fertilizer	(6) Rate in Tons/ Acre	(7) Distance in Yards from Source
73	20	260	F	R	2.0	450
74	20	260	F	R	1.0	100
75	20	260	F	A	6.0	50
76	10	60	F	L	2.3	10
77	200	180	F	F	3.7	1350
78	200	180	F	R	2.5	1700
79	200	180	F	R	11.8	700
80	200	180	F	R	8.0	1100

TABLE 35 - Continued

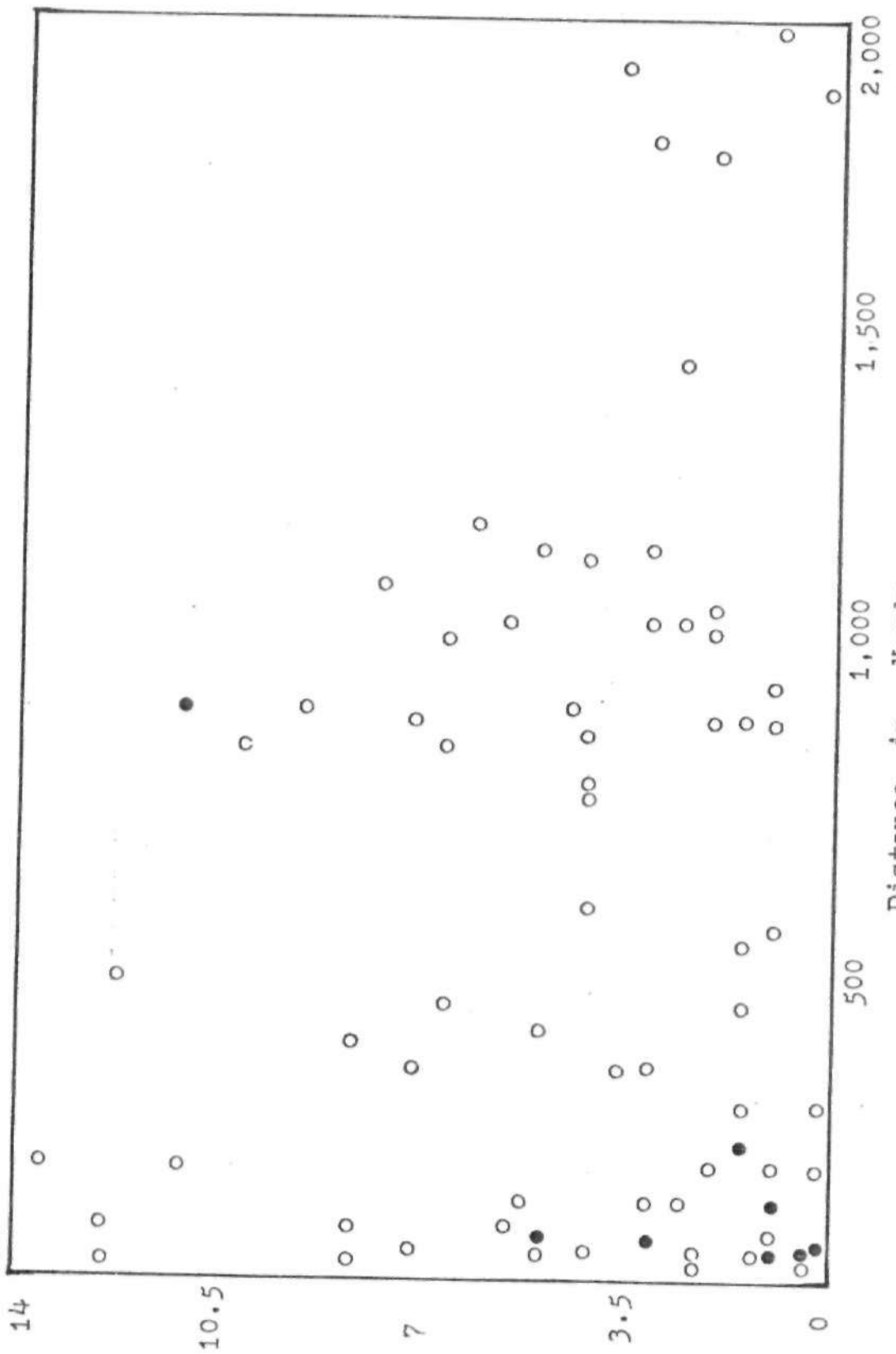


FIGURE 10

SCATTERGRAM SHOWING RATE OF APPLICATION OF ORGANIC FERTILIZER BY DISTANCE FROM SOURCE

APPENDIX II

Notes for Appendix II

The data presented in this appendix form the basis for the analysis of spatial and land use preferences contained in Chapter VII. The following information serves to explain abbreviations used in Table 36.

TABLE 36 DATA PERTAINING TO LAND USE PREFERENCES OF SOBA DISTRICT FARMERS

Column (1) Case Number
Arbitrary number assigned to each respondent-farmer.

Column (2) Tribe
Reported ethnic/tribal affiliation of respondent-farmer.
Abbreviations used are:

H = Hausa
N = non-Hausa

Column (3) Village Population Density
Estimated population density of respondent's village area.
Abbreviations used are:

S = sparsely populated village area (less than 50 persons per square mile)
M = medium populated village area (50 to 199 persons per square mile)
D = densely settled village area (over 200 per square mile)

Column (4) Land Use Preference
Expressed preference of respondent-farmer.
Abbreviations used are:

I = Infield (Gonar Karakara, gonar cikin gida, or gonar bayan gari)
O = Outfield (Gonar daji, gonar waje, or saura)

Column (5) Reason for Preference
The reason offered by respondent for expressed preference.
Symbols used are:

a = Work-related reason
b = Crop-related reason
c = Fertilizer-related reason
d = travel time or location-related reason
e = Crop yield (amount)-related reason
f = Crop yield (variety)-related reason
g = Field size
h = other reason

TABLE 36

DATA PERTAINING TO LAND USE PREFERENCES
OF SOBA DISTRICT FARMERS

(1) Case Number	(2) Tribe	(3) Village Population Density	(4) Land Use Preference	(5) Reason for Preference
1	H	S	I	d
2	H	S	O	g
3	N	M	I	a
4	H	D	O	b
5	H	D	I	e
6	N	D	I	a
7	H	S	I	d
8	H	S	O	g
9	H	M	I	a
10	H	D	O	b
11	H	D	I	e
12	N	D	I	a
13	H	S	I	a
14	H	S	I	g
15	H	M	I	b
16	H	D	O	a
17	H	D	I	b
18	N	D	I	d
19	N	S	I	a
20	H	S	O	g
21	H	M	I	a
22	H	D	O	a
23	H	D	I	b
24	N	D	O	h
25	H	S	I	c
26	H	S	O	f
27	H	M	I	e
28	H	D	O	a
29	H	D	I	c

TABLE 36-Continued

(1) Case Number	(2) Tribe	(3) Village Population Density	(4) Land Use Preference	(5) Reason for Preference
30	N	D	O	a
31	H	S	I	c
32	H	S	O	a
33	H	M	I	b
34	H	D	O	a
35	H	D	I	c
36	H	S	I	c
37	H	S	O	a
38	H	M	O	b
39	H	D	O	a
40	H	D	I	c
41	H	S	O	g
42	H	S	O	b
43	H	M	O	g
44	H	D	O	g
45	H	D	I	c
46	H	S	O	g
47	H	S	O	a
48	H	M	O	h
49	H	D	I	f
50	H	D	I	d
51	H	S	O	g
52	H	S	O	c
53	H	M	O	f
54	H	D	I	e
55	H	D	I	h
56	H	S	I	d
57	H	S	O	g
58	N	M	I	a
59	H	D	O	b

TABLE 36-Continued

(1) Case Number	(2) Tribe	(3) Village Population Density	(4) Land Use Preference	(5) Reason for Preference
60	H	D	I	e
61	N	D	I	a
62	H	S	I	d
63	H	S	O	g
64	H	M	I	a
65	H	D	O	b
66	H	D	I	e
67	N	D	I	a
68	H	S	I	a
69	H	S	O	g
70	H	M	I	b
71	H	D	O	a
72	H	D	I	b
73	N	D	I	d
74	N	S	I	a
75	H	S	O	g
76	H	M	I	a
77	H	D	O	a
78	H	D	I	b
79	N	D	O	h
80	H	S	I	c
81	H	S	O	f
82	H	M	I	e
83	H	D	O	a
84	H	D	I	c
85	N	D	O	a
86	H	S	I	c
87	H	S	O	a
88	H	M	I	b
89	H	D	O	a
90	H	D	I	c

TABLE 36-Continued

(1) Case Number	(2) Tribe	(3) Village Population Density	(4) Land Use Preference	(5) Reason for Preference
91	H	S	I	c
92	H	S	O	a
93	H	M	O	b
94	H	D	O	a
95	H	D	I	c
96	H	S	O	g
97	H	S	O	b
98	H	M	O	g
99	H	D	O	g
100	H	D	I	c
101	H	S	O	g
102	H	S	O	a
103	H	M	O	h
104	H	D	I	f
105	H	D	I	d
106	H	S	O	g
107	H	S	O	c
108	H	M	O	f
109	H	D	I	e
110	H	D	I	h

APPENDIX III

Notes for Appendices III and IV

The data presented in Appendix III form the basis for the analysis of Garun Gwanki village in Chapter VIII. The following information serves to explain the abbreviations used in Tables 37, 38, 39 and 40 as well as comparable tables in Appendix IV.

TABLE 37 BIOGRAPHICAL DATA PERTAINING TO HOUSEHOLD HEADS IN GARUN GWANKI VILLAGE

Column (1) Household Number

Arbitrary number assigned to each household in village.

Column (2) Tribe

Reported tribe of household head. Abbreviations used are:

H= Hausa
P= plateau origin (Jos region)
O= other tribal affiliation

Column (3) Age

Reported age of household head. Ages taken at face value; no effort made to determine accuracy.

Column (4) Education

Highest level of education attained by household head. Abbreviations used are:

K= Koranic schooling
P= Primary School education (1 to 5 years)
PL= Primary School leaver (6 years)
S= Secondary School education (signifies attendance only, not necessarily completion)
A= Adult education classes

Column (5) Master Farmer

Designated master farmer by Nigerian Tobacco Company. (See Chapter V for explanation.) Abbreviation used is:

M= master farmer

Column (6) Residence Status

Indicates the length of residence of household head in present village. Abbreviations used are:

LR= lifelong resident of village: i.e. born in present village
I= in-migrant (more than 20 years ago)

RI= recent in-migrant (between 6 and 19 years since arrival in village)
RA= recent arrival (less than 5 years since arrival in present village)

Column (7) Status

Indicates title holder (religious, hereditary or administrative) or member of nobility (sarauta).
Abbreviation used is:

N= member of nobility

Column (8) Secondary Occupation

Secondary Occupation, if any, pursued by the household head. Abbreviations used are:

DS= secondary occupation during dry season only
YR= year round secondary occupation
S= salaried employment such as government position

Column (9) Type of Secondary Occupation

The type of secondary occupation, if any, pursued by household head. Symbols used are:

1= blacksmith
2= carpenter
3= leatherworker
4= potter
5= tailor
6= weaver
7= barber
8= butcher
9= Koranic teacher
10= village head
11= petty trader
12= beggar
13= hunter
14= washerman
15= musician
16= public official
17= buying agent
18= fisherman
19= dyer
20= salaried employment
21= grinder
22= craftsman
23= messenger
24= bicycle mechanic
25= roofing/wall repair
26= sweeper
27= shopkeeper
28= mechanic
29= herder/donkey transporter
30= laborer
31= sugar maker

TABLE 38 DEMOGRAPHIC DATA PERTAINING TO HOUSEHOLDS IN GARUN GWANKI VILLAGE

Column (1) Household Number

Arbitrary number assigned to each household in village.

Column (2) Adult Males

Total number of adult males (over 16 years of age) residing in household including the household head.

Column (3) Adult Females

Total number of adult females (over 16 years of age)

residing in household including wives, mother etc.

Column (4) Large Male Children

Total number of older male children (between 9 and 15 years of age) residing in household.

Column (5) Large Female Children

Total number of older female children (between 9 and 15 years of age) residing in household.

Column (6) Small Male Children

Total number of young (under 9 years old) male children residing in household.

Column (7) Small Female Children

Total number of young (under 9 years old) female children residing in household.

Column (8) Farmworkers

Total number of individuals resident in household, including household head, who labor regularly on household farms.

Column (9) Gandu Members

Members of gandu, if any, resident in household. Abbreviations used are:

SG= small gandu (1 or 2 members)
MG= medium gandu (3 or 4 members)
LG= large gandu (5 or more members)

TABLE 39 DATA PERTAINING TO HOUSEHOLD TOOLS, TRANSPORT, AND FACILITIES IN GARUN GWANKI VILLAGE

Column (1) Household Number

Same as tables 37 and 38 above.

Column (2) Transport Owned

Means of transport owned by a resident member of household. Abbreviations used are:

B= bicycle owned by a householder
M= motorcycle owned by a householder
B/M= both bicycle and motorcycle owned in household

Column (3) Tools Owned

Farm tools owned by householders. Tools listed in this question were as follows: 1. Large hoe (garma), 2. small hoe (fartanya), 3. axe (gatari), and 4. a reaper (magirbi) Abbreviations used are:

H= at least half of listed tools owned by members of household
A= all tools listed owned by members of the household

Column (4) Livestock

The number and type of livestock owned by members of household. (Probably does not include goats and sheep owned by wives of household head.) Abbreviations used are:

F= fowl only in household
G= goats
S= sheep
D= donkeys
C= cattle
H= horse
C/G= cattle and goats

Column (5) Rooms in Compound

The total number of rooms present in householder's compound. This figure excludes the entrance hut (zaure), if any, but includes all other buildings in compound regardless of use. A circular hut equals 1 room. Rooms within larger rectangular buildings are counted separately.

Column (6) Storage Facilities

Storage facilities for farm products present in compound. Abbreviations used are:

R= rumbu or traditional storage granary (number of those present also given)
S= storage room in compound
n.a.= information not available

TABLE 40 DATA PERTAINING TO LAND USE IN GARUN GWANKI VILLAGE

Column (1) Household Number

Same as tables above.

Column (2) Land Use Class

Classification of field according to scheme utilized in study. Abbreviations are:

I= Infield land use
O= Outfield land use
F= Fadama land use

Column (3) Field Size

Calculated size of field expressed in acres or fraction thereof. Infield plots in Garun Gwanki village were mapped and acreages calculated by use of a planimeter. Outfield acreages were calculated by pacing and measurement of angles at each corner; hence, acreage figures for outfield farms are less precise than those for infield and fadama plots.

Column (4) Distance From Village

For Garun Gwanki village, the distance recorded here in years represents the calculated distance from the nearest residence (compound) to the closest corner of the field in question. For mapped infield area, this figure was measured directly from map. For outfield farms, distance figure was calculated by use of a measuring device attached to a bicycle wheel; hence, figure presented is actually the distance by footpath from the settlement to the farm.

Column (5) Tenure

The tenure or manner of receipt of farm plot. Abbreviations used are:

A= Allocation by village head from communal pool of land
G= Gift
I= Inheritance
L= Loan for which no payment is expected
S= Sharecrop
R= Rental or lease for which set payment is expected
P= Purchase of farm for set price

Column (6) Labor Used on Field

Indicates the types of farm labor used on the farm during the growing season. Abbreviations used are:

FA= farmer alone; no other assistance
F= farmer and farmer's family worked on plot
G= Members of gandu worked on plot
H= Farmer plus hired farm laborers
K= Hired farm workers (kwadago) only
C= Contract labor

Column (7) Fertilizer Applied

Indicates the fertilizer that has been applied to farm plot in recent past, not necessarily in most recent season. Abbreviations used are:

O= organic fertilizer applied
F= Fulani manures applied
I= Inorganic, commercial fertilizer applied
M= Mixture of organic and inorganic fertilizer

Column (8) Improvements to Field

Semi-permanent and permanent improvements found on plot. Abbreviations used are:

D= drainage ditch
F= fencing
H= temporary hut or shelter
W= well

Column (9) Frequency of Cropping

Actual or intended frequency of cropping of plot. Abbreviations used are:

RF= rotational fallowing regime
AC= annual cropping regime
T= field in transition; cropping regime uncertain

Column (10) Crop Combination

The crop or crop combination planted on the field during the 1973-74 farming season. Symbols used are:

1= sorghum	7= cassava	13= not available
2= maize	8= yams	14= potatoes
3= millet	9= bambara nuts	15= sugar cane
4= peanuts	10= onions	16= rice
5= cotton	11= vegetables	17= cocoyams
6= tobacco	12= cowpeas	18= other

21= millet/sorghum
22= maize/sorghum
23= maize/tobacco
24= sorghum/peanuts
25= sorghum/cowpeas
26= cotton/cowpeas
27= maize/cotton
28= maize/peanuts
29= maize/rice

31= millet/sorghum/peanuts
32= maize/peanuts/cowpeas
33= maize/cotton/cowpeas
34= maize/sorghum/peanuts
35= millet/maize/sorghum
36= sorghum/peanuts/cowpeas

Note: the crop combinations listed in this column represent the primary crops found on the plot, not necessarily all crops grown in the specified season on this plot.

(1) Household Number	(2) Tribe	(3) Reported Age	(4) Education	(5) Master Farmers	(6) Residence Status	(7) Status	(8) Secondary Occupations	(9) Type of Second. Occupation
G1	H	60	K	--	I	N	--	--
G2	H	20	K	--	LR	--	--	--
G3	H	45	K	--	I	N	--	--
G4	H	50	K	--	RA	--	--	--
G5	H	35	K	--	RI	--	--	--
G6	H	30	K	--	RI	--	--	--
G7	H	40	K	--	LR	--	--	--
G8	H	36	K	--	LR	--	DS	22
G9	H	35	K	--	LR	--	YR	13
G10	H	52	K	--	LR	--	YR	7
G11	H	33	K	--	LR	--	DS	6
G12	H	37	K	--	LR	--	YR	8
G13	H	33	K	--	LR	N	YR	11
G14	H	55	K	--	LR	--	YR	11
G15	H	30	K	--	LR	--	--	--
G16	H	60	K	--	LR	N	YR	9
G17	H	45	K	--	LR	--	--	--
G18	H	25	K	--	LR	--	--	--

TABLE 37 BIOGRAPHICAL DATA PERTAINING TO HOUSEHOLD HEADS IN GARUN GWANKI VILLAGE

(1) Household Number	(2) Tribe	(3) Reported Age	(4) Education	(5) Master Farmers	(6) Residence Status	(7) Status	(8) Secondary Occupations	(9) Type of Second. Occupation
G19	H	42	A	--	I	N	YR	10
G20	H	25	A	--	LR	N	DS	11
G21	H	40	K	--	I	--	YR	11
G22	H	27	A	--	LR	--	--	--
G23	H	30	K	--	LR	--	DS	23
G24	H	35	A	--	LR	--	YR	24
G25	H	40	K	--	I	--	--	--
G26	H	40	K	--	I	--	--	--
G27	H	35	K	--	LR	--	--	--
G28	H	20	A	--	LR	N	DS	11
G29	H	25	A	--	LR	N	--	--
G30	H	35	K	--	RA	--	YR	8
G31	H	35	K	--	LR	--	--	--
G32	H	30	K	--	LR	--	DS	11
G33	H	17	K	--	LR	--	DS	11
G34	H	37	A	--	LR	N	--	--
G35	H	37	K	--	RA	--	DS	11
G36	H	34	K	--	LR	--	--	--

TABLE 37 - Continued

(1) Household Number	(2) Tribe	(3) Reported Age	(4) Education	(5) Master Farmers	(6) Residence Status	(7) Status	(8) Secondary Occupations	(9) Type of Second. Occupation
G37	H	20	K	--	LR	--	YR	5
G38	H	22	K	--	LR	--	YR	5
G39	H	20	K	--	LR	--	--	--
G40	H	25	K	--	LR	--	--	--
G41	H	32	K	--	LR	--	--	--
G42	H	50	K	--	I	--	DS	25
G43	H	50	K	--	I	--	--	--

TABLE 37 - Continued

(1) Household Number	(2) Adult Males	(3) Adult Females	(4) Large Male Children	(5) Large Female Children	(6) Small Male Children	(7) Small Female Children	(8) Farm-workers	(9) Gandu Members
G1	6	2	--	--	--	--	1	--
G2	2	1	--	--	2	1	3	SG
G3	8	3	3	3	1	1	4	MG
G4	1	3	4	--	--	1	4	MG
G5	1	1	--	--	3	2	2	SG
G6	1	2	1	--	2	2	3	MG
G7	2	2	--	3	4	1	4	MG
G8	2	1	--	--	1	2	1	--
G9	1	1	--	--	2	2	2	SG
G10	1	1	--	--	2	--	2	SG
G11	1	1	--	--	2	1	2	SG
G12	1	2	--	--	3	2	4	MG
G13	1	2	--	--	1	3	2	SG
G14	6	4	--	1	4	6	6	LG
G15	1	1	1	--	1	1	1	--
G16	5	4	1	1	--	--	4	MG
G17	2	3	1	--	--	--	3	SG
G18	3	4	--	--	--	--	2	SG

TABLE 38 DEMOGRAPHIC DATA PERTAINING TO HOUSEHOLDS IN GARUN GWANKI VILLAGE

(1) Household Number	(2) Adult Males	(3) Adult Females	(4) Large Male Children	(5) Large Female Children	(6) Small Male Children	(7) Small Female Children	(8) Farm-workers	(9) Gandu Members
G19	4	4	3	--	3	1	4	MG
G20	1	3	--	--	2	2	2	SG
G21	1	3	6	1	--	--	3	MG
G22	1	2	1	--	--	1	2	SG
G23	1	2	--	--	4	1	2	SG
G24	2	3	1	1	1	2	6	LG
G25	3	3	--	1	1	1	3	SG
G26	1	3	2	3	3	1	4	MG
G27	1	2	--	--	1	1	1	--
G28	1	2	--	--	2	--	2	SG
G29	1	1	--	--	2	--	1	--
G30	1	1	1	--	2	1	2	SG
G31	1	3	1	--	1	1	2	SG
G32	1	2	1	--	2	--	2	SG
G33	3	2	--	--	1	--	3	SG
G34	2	2	--	--	1	4	1	--
G35	1	1	--	--	1	1	1	--
G36	1	1	--	--	1	1	1	--

TABLE 38 - Continued

(1) Household Number	(2) Adult Males	(3) Adult Females	(4) Large Male Children	(5) Large Female Children	(6) Small Male Children	(7) Small Female Children	(8) Farm-workers	(9) Gandu Members
G37	2	2	--	--	1	1	2	SG
G38	1	3	--	--	2	--	1	--
G39	1	2	--	--	1	--	2	SG
G40	1	2	--	--	1	--	2	SG
G41	2	1	--	--	1	1	3	SG
G42	2	3	4	1	--	2	4	MG
G43	1	1	--	--	--	--	1	--

TABLE 38 - Continued

TABLE 39

DATA PERTAINING TO HOUSEHOLD TOOLS, TRANSPORT, AND FACILITIES IN GARUN GWANKI VILLAGE

(1) Household Number	(2) Transport Owned	(3) Tools Owned	(4) Livestock Owned	(5) Rooms in Compound	(6) Storage Facilities
G1	B	A	50S/1D	6	4R
G2	B	A	F	6	6R
G3	B	A	F	22	6R
G4	B	A	2G/1D	3	--
G5	B	A	F	5	--
G6	B	A	---	8	n.a.
G7	B	A	2G	5	n.a.
G8	--	A	4S	3	2R
G9	--	A	---	4	2R
G10	B	A	3G	4	n.a.
G11	--	A	F	5	2R
G12	B	A	2G	3	n.a.
G13	B	A	---	6	2R
G14	B	A	6G/3S/1D	17	6R
G15	B	A	7G	2	2R
G16	B	A	---	6	4R
G17	B	A	---	14	--
G18	--	A	F	3	2R
G19	B/M	A	H	10	4R
G20	B	A	10G/8S/2D	10	4R
G21	B	A	---	6	2R
G22	B	A	---	4	4R
G23	--	A	2G/2D	6	2R
G24	B	A	F	6	2R
G25	B	A	---	5	4R
G26	B	A	C	12	n.a.
G27	B	A	F	3	2R

TABLE 39 - Continued

(1) Household Number	(2) Transport Owned	(3) Tools Owned	(4) Livestock Owned	(5) Rooms in Compound	(6) Storage Facilities
G28	B	A	C/3G/4S	3	2R
G29	B	A	---	3	2R
G30	B	A	---	3	n.a.
G31	B	A	3S	8	2R
G32	B	A	F	7	4R
G33	B/M	A	F	3	4R
G34	---	A	F	3	2R
G35	B	A	1G	2	2R
G36	B	A	2D	3	2R
G37	B	A	F	5	2R
G38	B	A	F	7	2R
G39	B	A	---	2	2R
G40	B	A	---	3	2R
G41	---	A	2G	7	2R
G42	B	A	4S	16	--
G43	---	A	F	2	2R

(1) Household Number	(2) Land Use Class	(3) Field Size	(4) Distance from Village	(5) Tenure	(6) Labor used on Field	(7) Fertilizer Applied	(8) Improvements to Field	(9) Frequency of Cropping	(10) Crop Combination
G1	I	1.85	320	A	H	I	--	AC	21
	I	.42	260	A	H	I	--	AC	21
	I	1.00	160	A	H	F	--	AC	22
	I	.63	240	A	H	-	--	AC	21
	I	.22	5	A	H	-	--	AC	34
	I	1.01	80	A	H	O	--	AC	21
	O	4.50	2640	A	H	-	--	RF	05
	F	.31	320	A	H	O	--	AC	16
G2	I	.34	160	I	H	I	--	AC	21
	I	.82	630	I	H	I	--	AC	22
	O	7.00	5280	I	H	I	--	RF	27
	O	5.00	4400	I	H	I	--	RF	21
	F	.35	4400	I	H	I	--	RF	16
	F	.25	4400	I	H	I	--	RF	16
G3	I	3.48	210	A	H	O	D	AC	31

TABLE 40 DATA PERTAINING TO LAND USE IN GARUN GWANKI VILLAGE

(1) Household Number	(2) Land Use Class	(3) Field Size	(4) Distance from Village	(5) Tenure	(6) Labor used on Field	(7) Fertilizer Applied	(8) Improvements to Field	(9) Frequency of Cropping	(10) Crop Combination
(G3)	I	.72	160	A	H	-	--	AC	06
	O	3.00	1320	A	G	I	--	RF	21
	O	3.00	1320	A	G	I	--	RF	05
	F	.25	1320	A	G	I	--	AC	16
G4	I	.30	400	R	G	-	--	AC	02
	I	1.44	260	R	G	-	--	AC	18
	I	.22	300	R	G	O	F	AC	07
	O	3.00	3520	A	G	-	--	RF	21
	O	1.50	3520	A	G	-	--	RF	05
G5	I	.58	318	A	FA	O	--	AC	21
	I	.50	185	A	FA	-	--	AC	21
	I	.20	130	A	FA	-	--	AC	35
	O	2.00	1760	A	FA	-	--	RF	21
	O	2.00	2100	A	FA	-	--	RF	05
G6	I	.32	100	A	F	-	--	AC	34
	O	5.00	3520	A	H	-	--	T	21
	O	6.50	3520	A	H	-	--	T	27

TABLE 40 - Continued

(1) Household Number	(2) Land Use Class	(3) Field Size	(4) Distance from Village	(5) Tenure	(6) Labor used on Field	(7) Fertilizer Applied	(8) Improvements to Field	(9) Frequency of Cropping	(10) Crop Combination
G7	I	.6	150	I	G	-	--	AC	21
	I	.1	130	I	G	O	--	AC	28
	O	3.0	4400	A	G	-	--	T	21
	O	3.0	4400	A	G	-	--	T	27
G8	I	.51	50	I	H	O	--	AC	22
	O	2.5	1300	A	H	-	--	RF	21
	F	.25	500	A	H	-	--	RF	16
G9	I	.7	185	I	FA	-	--	AC	22
	O	3.0	1760	A	FA	-	--	RF	21
G10	I	1.19	108	A	H	O.	--	AC	22
	I	1.4	150	A	H	O	--	AC	34
	I	.58	545	A	H	-	--	RF	28
	O	4.5	2640	A	H	-	--	RF	21
	F	.3	400	A	H	-	--	RF	29
G11	I	2.11	370	I	F	-	--	RF	21
	O	5.0	1050	I	F	-	--	RF	01
	F	.26	500	I	F	I	F	RF	16

TABLE 40 - Continued

(1) Household Number	(2) Land Use Class	(3) Field Size	(4) Distance from Village	(5) Tenure	(6) Labor used on Field	(7) Fertilizer Applied	(8) Improvements to Field	(9) Frequency of Cropping	(10) Crop Combination
G12	I	.68	265	I	G	-	--	AC	28
	I	.36	150	I	G	O	--	AC	21
	I	.15	1	I	G	O	--	AC	22
	I	.61	370	I	G	-	--	AC	34
	O	8.00	4400	A	G	-	--	T	21
	O	4.00	4400	A	G	-	--	T	27
	F	.33	4400	A	G	-	--	T	16
G13	I	.25	210	I	FA	-	D	AC	22
	O	15.00	4400	A	H	I	--	T	21
	O	9.00	4400	A	H	I	--	T	27
	F	.30	4400	A	H	I	--	T	16
G14	I	1.72	100	A	G	-	--	AC	35
	I	1.16	185	A	G	I	--	AC	28
	O	7.00	4400	A	K	F	--	RF	22
	O	4.00	4400	A	K	F	--	RF	22
	O	4.00	4400	A	G	F	--	RF	27

TABLE 40 - Continued

(1) Household Number	(2) Land Use Class	(3) Field Size	(4) Distance from Village	(5) Tenure	(6) Labor used on Field	(7) Fertilizer Applied	(8) Improvements to Field	(9) Frequency of Cropping	(10) Crop Combination
G15	I	.33	90	I	F	0	--	AC	21
	I	.05	400	I	F	-	--	AC	21
	O	2.00	1760	A	F	-	--	RF	21
	O	4.00	1760	A	F	-	--	RF	05
	F	.25	500	A	F	-	--	RF	16
G16	I	.57	150	A	G	-	--	AC	21
	I	.14	100	A	G	0	--	AC	21
	F	.10	390	A	G	-	F	AC	07
	O	5.00	3520	A	G	F	--	T	21
	O	11.00	4400	A	G	F.	--	RF	05
	O	8.00	5200	A	G	F	--	RF	21
	O	7.00	4400	A	G	F	--	RF	21
G17	I	.36	265	I	H	-	--	AC	28
	O	10.00	5000	A	H	-	--	RF	21
	O	8.00	1760	A	K	-	--	RF	27
	F	.28	1760	A	K	-	--	RF	16

TABLE 40 - Continued

(1) Household Number	(2) Land Use Class	(3) Field Size	(4) Distance from Village	(5) Tenure	(6) Labor used on Field	(7) Fertilizer Applied	(8) Improvements to Field	(9) Frequency of Cropping	(10) Crop Combination
G18	I	.34	185	I	G	-	--	AC	34
	I	1.00	75	I	G	-	--	AC	21
	O	8.00	4400	I	G	-	--	RF	21
	F	.25	3800	I	G	-	--	RF	16
G19	I	.57	212	A	H	O	D	AC	35
	I	9.19	380	A	H	-	--	AC	21
	I	1.28	50	A	K	I	--	AC	22
	O	10.00	1200	A	K	F	--	RF	27
	O	7.00	2200	A	K	F	--	RF	21
	F	.26	2200	A	K	I	--	RF	16
G20	I	.27	185	I	H	-	--	AC	21
	I	.20	150	I	H	O	--	AC	35
	O	12.00	2200	A	H	I	--	RF	21
	O	2.00	2200	A	H	I	--	RF	05
	O	9.00	2200	I	H	I	--	RF	21
	F	.20	2200	I	H	I	--	AC	16
	F	.20	2200	I	H	I	--	AC	15

TABLE 40 - Continued

(1) Household Number	(2) Land Use Class	(3) Field Size	(4) Distance from Village	(5) Tenure	(6) Labor used on Field	(7) Fertilizer Applied	(8) Improvements to Field	(9) Frequency of Cropping	(10) Crop Combination
G21	O	1.61	160	I	G	-	D	AC	28
	I	.42	150	A	G	-	--	AC	28
	O	4.50	5300	A	G	-	--	RF	21
	F	.23	370	A	G	-	--	AC	16
G22	I	.67	265	I	G	O	D	AC	28
	I	.19	160	I	G	-	--	AC	21
	O	10.00	4400	A	G	-	--	RF	21
	O	3.00	4400	A	G	-	--	RF	27
	F	.25	4400	A	G	I	--	RF	16
	F	.22	4400	A	G	I	--	RF	16
G23	I	1.02	130	I	G	F	--	AC	28
	I	.42	240	I	G	F	--	AC	02
	I	.43	300	I	G	-	--	AC	23
	I	.85	350	I	G	-	--	AC	21
	O	3.00	4400	A	G	I	--	T	03
	O	3.50	4400	A	G	I	--	T	21
	F	.18	350	A	G	I	--	RF	16

TABLE 40 - Continued

(1) Household Number	(2) Land Use Class	(3) Field Size	(4) Distance from Village	(5) Tenure	(6) Labor used on Field	(7) Fertilizer Applied	(8) Improvements to Field	(9) Frequency of Cropping	(10) Crop Combination
G24	I	2.30	200	I	H	-	--	AC	28
	I	.24	180	A	H	I	--	AC	21
	O	5.00	4400	A	H	-	--	T	21
	O	5.00	4400	A	H	-	--	T	27
	F	.20	500	A	H	I	--	AC	16
	F	.20	500	A	H	I	--	AC	16
G25	I	.34	370	A	G	-	--	AC	21
	I	.63	185	A	G	O	D	AC	35
	O	5.00	1300	A	G	-	--	RF	21
	O	4.50	1300	A	G	-	--	RF	27
G26	I	.67	240	I	H	-	--	AC	21
	I	.25	130	A	H	O	--	AC	22
	O	13.00	3500	A	H	-	--	RF	21
	O	5.00	4400	A	H	-	--	RF	21

TABLE 40 - Continued

(1) Household Number	(2) Land Use Class	(3) Field Size	(4) Distance from Village	(5) Tenure	(6) Labor used on Field	(7) Fertilizer Applied	(8) Improvements to Field	(9) Frequency of Cropping	(10) Crop Combination
G27	I	.91	200	I	FA	I	--	AC	28
	O	2.50	4400	A	FA	F	--	RF	05
	O	2.00	1760	A	FA	I	--	RF	21
	F	.20	500	A	FA	I	--	AC	16

TABLE 40 - Continued

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