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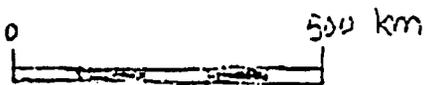
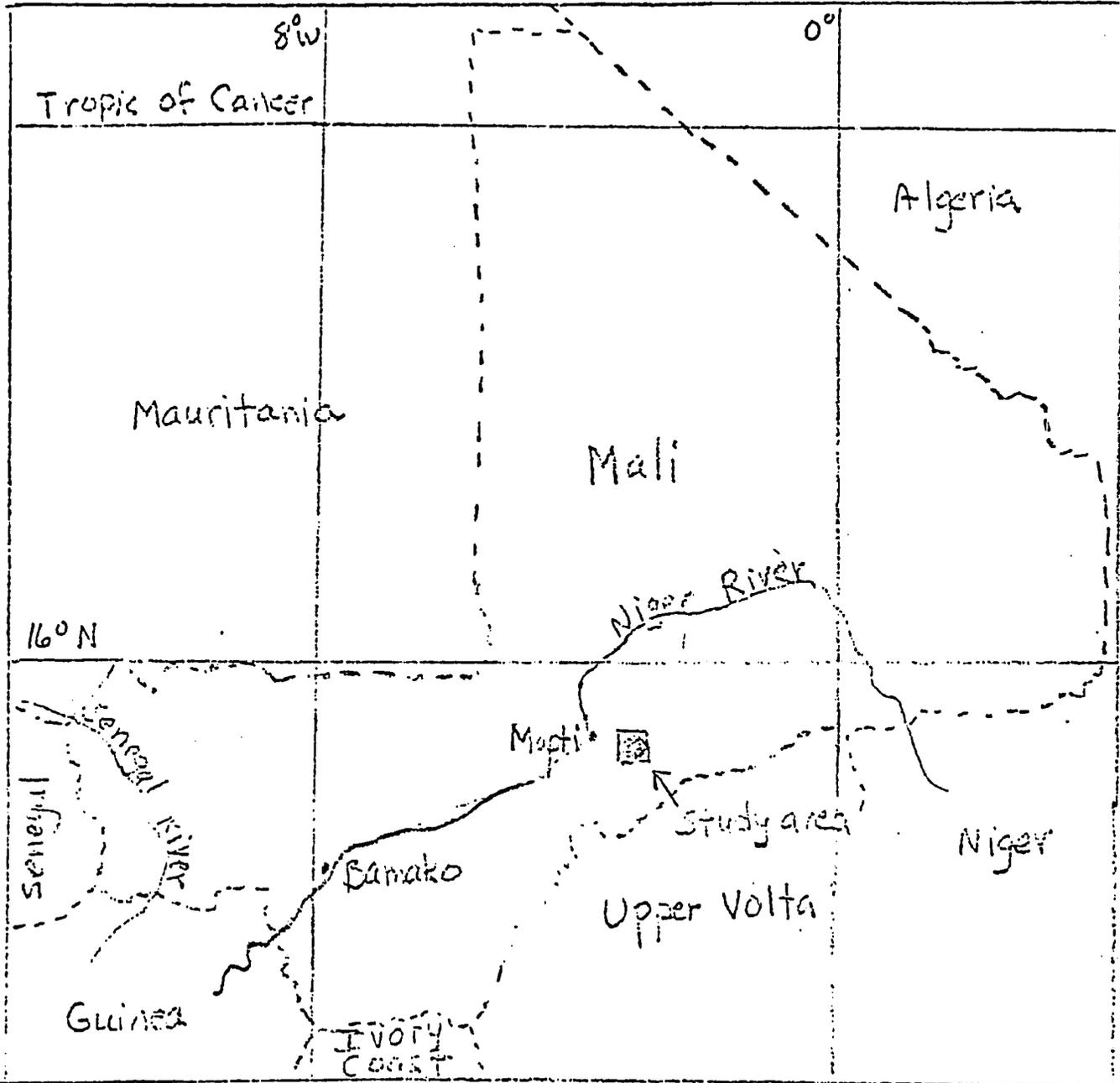
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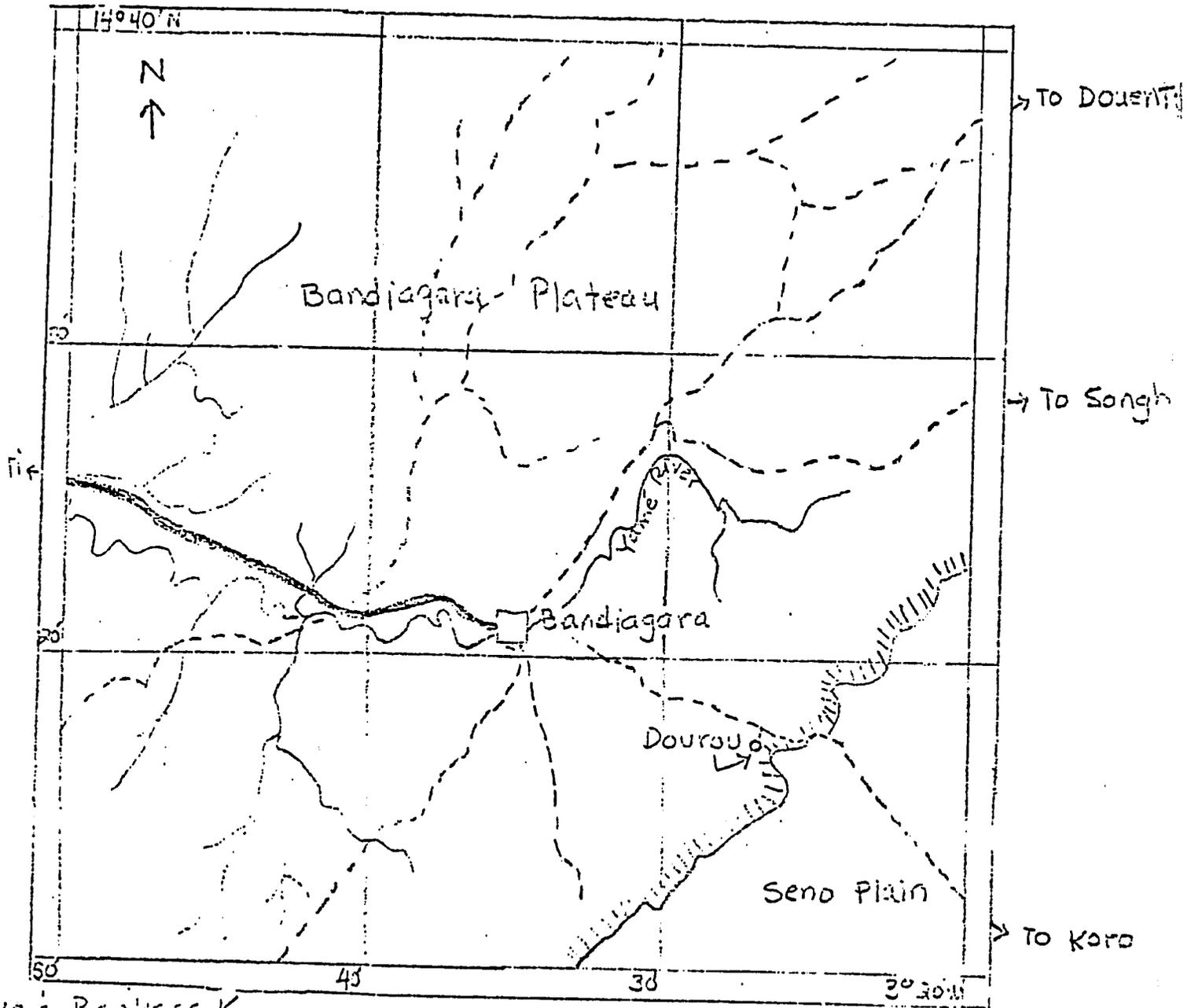
Figure 1.
MALI REPUBLIC
WEST AFRICA



☐ District of Bandiagara.
(Study area)

--- National boundaries
~ Major rivers

Figure 2.
 DISTRICT OF BANDIAGARA
 MALI REPUBLIC



10 Bankass ←

- laterite road
- secondary trail
- streams
- escarpments
300-350 m. height

- Town of Bandiagara
- Dourou
(Field work site)

Dogon Agricultural Systems

1. Introduction

This report, as those preceding it,¹ represents the sociological phase of an interdisciplinary research project on the agricultural systems of the Dogon peoples of the Republic of Mali. Originally designed as a team effort between an agricultural economist and a sociologist-anthropologist, the project as envisioned was unavoidably and regrettably delayed. Field work, therefore, began with the sociological phase alone.

The kind assistance of many individuals who helped in various ways during the period of field work is gratefully acknowledged here.² I especially wish to thank Dr. Michael M. Horowitz of the Department of Anthropology, State University of New York at Binghamton, who acted as Project Director.

1 The description and details of the physical environment, social organization, nutritional and health status, market gardening, the market system, and demography which were presented in the preceding five field reports will not be repeated here except in the briefest sketch where pertinent.

2 I wish to thank M. Moriba Sissoko, Directeur de Cabinet, Ministère du Développement Rural; M. Sidi Kinta, Commandant de Cercle, Bandiagara; M. Amadou Traoré, Chef d'arrondissement, Dourou; M. Lassana Soumaré and M. Amadou Touré, Directeurs de l'Opération Mils-Mopti; M. Tiemalo Bouaré, Directeur de l'Action Culture Maraîchère, Bandiagara; M. Mory Danioko, Adjoint au Directeur de l'Opération Culture Maraîchère; M. Check Soumaré, Directeur de Génie Rural, Sevaré; and Mr. Ronald D. Levin, CDC, AID/Bamako and his staff. My personal thanks go to Samuel Guindo, Bourema Traoré, Jerry and Leslie Johnson, Hans Guggenheim, and Rosalie Fanale. Without revealing their identities, I wish to thank finally, but perhaps most importantly, the many good and kind Dogons who took me into their lives.

1.1. Research Objectives

The areas to which this final report addresses itself include discussions of the following problems:

- (1) What are the strategies of production, distribution, marketing, and consumption that farmers employ in rainfed agriculture and in hand-irrigated gardening?
- (2) Comparisons of measured yields of grains and vegetable products to previous estimations.
- (3) What incentives and constraints exist to the expansion and diffusion of market gardening?
- (4) What development interventions would be appropriate? What are the social implications of existing development projects?
- (5) Could Dogon gardening techniques be practicable elsewhere?

1.2. Applicability of Research Findings

The information recorded here is oriented toward development workers and others interested in African rural producers. The approach is that of cultural ecology which studies populations in terms of their interrelationships with their environments.

The data presented here are of direct relevance to two development efforts, joint programs of the Malian government and USAID, which are currently underway in the Fifth Region of Mali: Opération Mils, which seeks to increase millet production, and Action Culture Maraîchère, which seeks to improve

market gardening on the Bandiagara Plateau.

This series of reports is based on observations made while living in a plateau village in close proximity to the cliffs and the Seno Plain. In this area, farming takes place on both the plateau and the plain. It is important to emphasize, however, that extremely diverse social and agricultural conditions exist; all observations made are not necessarily applicable to other areas of the plateau and plain.

2. The Agricultural Systems

The Dogon have long endured the rigors of living in a never certain Sahelian environment. Rainfall is irregular and unsure from year to year. Over time, some field areas are denuded and others are built up under the influence of water and wind. Dogons have come to understand the land as a changing, never static entity.

2.1. Rainfed Agriculture

In their dryland agricultural system of growing millet and sorghum, Dogons sow the grains immediately following the first substantial rain of the season. In the first of many strategies they employ to maximize production and to counter the vagaries of the climate, Dogons plant even if the rain seems premature. Less loss is perceived even if all the seedlings die, necessitating replanting, than if the risk is not taken and the rains become well-established without a guarantee of their duration.

In the traditional system of rainfed agriculture, grains are sown on hills which contain decaying organic matter from the weeding operations of the previous year.³ Plant spacing on the plateau (where manuring is possible and soils are said to hold nutrients better) is very close; on the plain and in certain similarly sandy areas of the plateau, plant spacing is much wider, and farmers state that plants will not develop if they are too crowded.

Farmers observe the leaf cover of trees and the stage of development of the Lannea acida fruit to schedule such farming operations as carrying manure and compost to the fields prior to the rains. Sometimes, however, as in the spring of 1977, the first rain can catch the population unprepared with seed millet unpounded, grain bins still under construction and unthatched, and mud house roofs not yet reinforced against heavy rains.⁴

Dogons attempt to retard erosion on the plateau and on the talus slopes of the cliffs by partitioning fields with stones and, in some cases, terracing steep slopes and valley bottoms.

Other strategies of production include the use of crop mix, interplanting, crop rotation, fallow periods, and the green manuring, regular manuring, and composting referred to earlier.

³ If during the previous year the land has been planted with fonio, a rice-like dryland grain, the soil is cultivated prior to sowing millet. If the land has been in fallow, underbrush and weeds are gathered into small piles throughout the field and are burned. The first year crop of cowpeas is planted among the ashes, and with weeding, hills of "green manure" are formed for the following year's millet.

⁴ The large numbers of dead birds visible following the rain storm were another indication of the untimeliness of the rain.

In addition, Dogons preserve the tree cover in their fields, a practice thought to enhance the fertility of soils.⁵

Farmers state that growing a mixture of crops--millet, sorghum, and fonio--provides variety in the diet and is a hedge against total crop loss if the rains fail. According to Dogon farmers, differential amounts of water are needed by these crops as individual grains are forming, but sorghum and fonio will survive drier conditions than will millet, increasing the likelihood of at least some yield.

The use of interplanting, crop rotation, and fallow periods⁶ balances maximal land use with cycles of replenishment.

2.1.1. Importance of Livestock

The keeping of livestock--sheep, goats, cattle, and donkeys--is an important adjunct to the strategies of production employed by Dogon farmers. The manure of these animals is mixed with composted household refuse⁷ and carried to the fields of the plateau. Obviously, farmers who keep a number of animals are at an advantage

⁵ See, e.g., Jean Gallais, "Le paysan dogon," Cahiers d'Outre-Mer, 1965, Vol. 18, pp. 126-127.

⁶ On the Seno Plain, a fallow period of 8-10 years is followed by a crop rotation beginning with cowpeas (1 year), millet interplanted with cowpeas and/or sorrel (2-4 years), and fonio (1 year), after which the land returns to fallow again. The plateau crop rotation is of millet interplanted with sorghum and/or cowpeas (1-3 years) followed by fonio (1 year); the land is generally under continuous cultivation with the help of manuring.

⁷ This consists primarily of human and animal urine-soaked straw, poultry droppings, and household ashes. Given the conditions of scarcity of village life, there is no food refuse. Vegetables (with the exception of onions as flavoring) are not consumed as a part of household meals, so vegetable peels, etc., are seldom a part of compost. Fruits are consumed where they are found in the bush or at the market; peels are dropped in and around the village and are eaten by animals rather than being composted. Millet chaff is also eaten by animals and poultry but some may be added to compost. No use is made of night soil.

when it comes to manuring fields. However, animals are not penned in the household compound except at night due to lack of forage. A goodly amount of manure, then, is scattered about the village and its perimeters as animals roam at will, seeking food where they can find it. This manure is gathered by anyone wishing to do so.⁸

2.2. Gardening

The Dogon system of gardening is nothing so much as a reduced and refined version of the dryland agricultural system. Dogons have brought their keen knowledge of environmental conditions to bear on problems of soil management and water resource utilization associated with vegetable production. The methods of erosion control, terracing, and soil enrichment which Dogons have long employed in growing rainfed grain crops have been adapted to a smaller scale. Individual garden plots are generally small squares measuring about 1 m by 1 m, although garden sizes and shapes vary. Gardens are constructed on a number of differing sites depending on the topography surrounding water sources⁹ and are hand watered. The most important vegetable crop is that of small, many-cloved onions which appear to be of a local shallot

⁸ Children are often sent out to gather manure but it is gathered also by adults. Women gather dried cow manure to use as cooking fuel.

⁹ Gardens are constructed on flat soil or rock surfaces, on rock inclines, along the margins of streambeds and dams, and on terraced soil banks. As the rock plateau has no water table, rain water is the sole water source; it is collected from seasonal streams, fissures in the rock, dug holes in the soil, and dam reservoirs.

variety.¹⁰

2.2.1. History of Gardening

It is not known exactly when or how gardening began on the Bandiagara Plateau. Colonial accounts indicate that onions were a trade item in Bandiagara in the 1890s.¹¹ Elderly villagers state that their grandfathers cultivated onions; linguistic evidence suggests that onions predate the colonial era when many vegetable trials were conducted in the Bandiagara area.¹²

It is interesting to note that the Dogon are not the only peoples of Mali to grow onions in small, hand-watered square plots or to dry them for export. An agricultural report of 1905 describes these very same practices in Bobo villages of Fakala and adds that these onion gardens provide the principal wealth of the area.¹³ In present day Mali, similar gardens exist among Bobo peoples between Ségou and Mopti. As informants state that onion holdings in the early part of the century were very limited on the Bandiagara Plateau--perhaps four to five garden plots per

10 Other vegetables grown are tomatoes, aubergine indigène, or nightshade (Solanum aethiopicum), hot peppers, sweet potatoes, sorrel (Hibiscus sabdariffa), and in very limited quantities, winter squash and okra. Dogons also grow sesame, groundnuts, and Bambara nuts (Voandzia subterranea) in some areas, as well as raising fruit trees, cotton, and tobacco.

11 "Mercuriale indiquant les prix des Aeurés et objets existant sur le marché de Bandiagara," Oct. 1, 1897, Soudan Français. Unpublished report in the National Archives, Bamako.

12 "Bulletin Agricole et Commercial, Poste de Bandiagara," 1893-1905, Soudan Français. Unpublished reports in the National Archives, Bamako.

13 "Rapport Agricole," Sept. 30, 1905, Soudan Français. Unpublished report in the National Archives, Bamako.

farmer, the equivalent of 4-5 square meters--it could be surmised that information about gardening diffused from one area to another, perhaps during historical migrations, but that expansion of gardening was unfeasible on the plateau until later times. Colonial taxation undoubtedly was a stimulus to production. Informants state that environmental factors played a role in increasing onion production; following a severe drought prior to 1920, farmers are said to have begun planting more onions so that they might buy millet.

The construction of the first concrete dam on the plateau, in the area of Sangha, in the late 1940s was an important landmark in the diffusion of gardening. Being the best known of Dogon areas, Sangha profited early from a road and a school and exposure to a larger world. The remarkable gardens that grew up in Sangha showed other Dogons the possibilities of cash cropping in their areas, and the expansion of the road system in the 1950s stimulated a growth of gardening which continues throughout the region today. The construction of more than 20 small dams on the plateau has contributed to this growth.

The availability of markets for produce as an incentive to production cannot be overlooked. Historically, marketing in the Dogon area has been a case of buyers coming to the crop rather than the crop being sent to market. The Mossi peoples of Upper Volta, for example, had long come to the Bandiagara Plateau to trade¹⁴ and, according to villagers, to take back donkey loads

of dried onions. Such trade is now largely restricted by the Malian government. Current market practice involves buyers coming to buy onions in larger village marketplaces on the plateau or at intermediary points on the road; onions are then shipped to urban areas by truck. An innovation of recent times is that of farmers, themselves, banding together with larger traders to rent space on trucks to ship their own onions to the capital city where they can sell them at higher prices. However, as the distance to the capital city is some 600 km, trade of this sort is not possible for farmers on a regular basis.

Market demand for onion products has increased on a national and even on an international scale. Moreover, it appears that the nationalizing influence of the state religion, Islam, which Dogons are increasingly adopting, is in part responsible for the direct participation of long-isolated Dogons in a wider market system.

3. Social Organization and Land Allocation

The Dogon are organized into patrilineal groups which are exogamous, and residence is patrilocal. All land, including rock surfaces, is owned by lineages, and ownership crosscuts village boundaries. Disproportionate land areas are controlled by some lineages but usufructuary rights are available to all farmers merely for the asking. Use rights may be permanent or temporary, and aside from verbal thanks, no recompense is paid for land use.

¹⁴ "Bulletin Agricole et Commercial, Poste de Bandiagara," June 1893. Unpublished report, National Archives, Bamako.

On the plateau, inheritance and control of rainfed cropland is mediated through the ginna, or "great house" system of Dogon society. Elder males who occupy the "great house" of each lineage control land ownership and the redistribution of land rights among lineage males. The general consensus of farmers is that they have enough land to farm. Those farmers controlling large areas they cannot possibly exploit are under no compulsion to lend it all out to other farmers. A survey of the total land holdings of 26 farmers indicated that on the plateau, 89% of the land surveyed was under cultivation while 11% was in fallow; on the Seno Plain, 37% of the land surveyed was under cultivation while 63% was in fallow.

For subsistence grain crops, the land tenure system is not a constraint to increased production; inherited land is secure and usufructuary rights are easily obtainable without cost.¹⁵⁻¹⁶

3.1. Land and Water Rights in Gardening

As onion gardening can only take place near water sources, land tenure in gardening takes on the added dimension of water rights in some areas. In garden areas of the plateau, land use rights are accorded by the owner on a temporary or a permanent basis but only for the gardening season; the owner retains use

¹⁵ Women participate in agricultural work but have no rights in land ownership or inheritance.

¹⁶ There is no evidence here of the practice of land inheritance reported elsewhere on the plateau in which all the land of a deceased male is kept by the individual's brother, forcing male children to leave the village in search of land elsewhere, usually on the Seno Plain.

of the land for planting rainy season millet. In the village studied, access to gardening land at the dam site was on the basis of geographical proximity and historical land use; farmers from the closer of the two major village quartiers gardened at the dam site where they had always had their gardens, while farmers in the more distant quartier--essentially a separate village--gardened along a stream and a series of faults.

Along dam sites and flowing water sources, water rights are communal. At sites where water holes have been dug or sub-surface water has been located in rock fissures and walk-in wells have been created, water rights belong to the individual or the group responsible for exploiting the source. During periods of water shortage when some wells are dry and other wells continue to receive water through seepage, water rights are stringently guarded and other farmers are refused access to this water for watering their gardens. Village drinking water supplies, however, are exempted from such policies.

The major constraint to the expansion of gardening is said by farmers to be the inadequate water supply; access to land is not an important consideration in itself. Under present conditions at the two major gardening areas identified above, 79% of all males age 15 and above (N=309) are active in gardening.¹⁷

¹⁷ Women in this area of the plateau are not active in gardening as they are elsewhere where water supplies are more ample.

4. Organization of Work

Rainfed grain crops are cultivated by communal work groups composed of closely related households (e.g., a father, his sons, and their respective households or an uncle and his nephew) directed by the oldest male as well as by individual household units (i.e., a male and the women and children in his household).

In the communal system, households join together during the rainy season when agricultural work begins. During this period, the households concerned also prepare food at a single hearth, and the millet for this purpose comes from granaries where previous communal harvests are stored under the control of the oldest male. In addition to working in collective fields, younger farmers and their wives and children maintain smaller fields of their own; the harvest from these fields is retained by the individual household unit.

Individual farming units evolve as elders die, leaving a single son as a survivor (or if other sons have migrated), or as adult sons split off from the communal group to farm alone. In the village studied, communal agricultural groups were composed of two or three households but not more—even though an elder had additional sons in the village who conceivably could have been part of the communal group. Villagers attribute the splitting off of older sons from the communal group to personal disputes between father and son or among wives, but demographic evidence suggests that the reasons may be related to the total

numbers of people involved. A young farmer with more than one wife and a growing number of children not only is a drain on communal grain stores but also cannot hope to produce enough grain in his own small field to feed his household during the rest of the year; hence, the social mechanism of splitting off from the communal agricultural group.

4.1. Strategies of Production, Storage, and Consumption

The social organization of work reflects important strategies of production, storage, and consumption among the Dogon. These same strategies also relate to the maintenance of social control through the authority of the elders, an important consideration in terms of development interventions.

Strategies of production include farming millet in two disparate locales--the plateau and the plain. Under communal farming arrangements, older farmers can tend fields on the plateau close to the village while sending their sons to farm the distant fields on the Seno Plain, thereby decreasing risk of total crop failure while taking into account limitations of age. Elders, nevertheless, retain control of production, and the grain harvested is stored in their granaries.¹⁸

Seasonal agricultural work is accompanied by sharing of communal grain stores; during the rest of the year, each individual household provides its own grains. Millet stored in communal granaries is not consumed or the granaries even opened

¹⁸ At harvest, one or two bundles of millet are distributed to each adult worker and to religious functionaries if the group is Muslim. Traditionally, women receive rights to the cowpeas which are interplanted with millet.

if it can possibly be avoided until the following rainy season. Stored grain, then, represents neither prodigious yields nor an actual society-wide surplus above and beyond the consumption needs of the population; stored grain is just another of many agricultural strategies mediated through the social system which seeks to diminish risk--in this case, the risk of famine.

Aside from communal stores, the amount of grain that can be carried over from year to year by individual farmers¹⁹ is dependent on a number of factors, among them yields of the farmers, themselves, and yields of other producers from whom they seek to buy millet to augment their own supplies; in drought years, prices may be prohibitive. Yields, in general, are of course dependent on environmental factors (e.g., distribution and amount of rainfall, land fertility, crop deprecations) as well as on demographic factors such as how much labor can be mobilized for agricultural work. The amount of grain that can be carried over is directly related to the availability of cash during the year to purchase millet. One farmer summarized the situation succinctly, stating "If you have cash, you buy millet; if you don't, you eat what is in the granary."

In addition, combined strategies of production and con-

19 Of a group of 84 farmers, just over half (52%) farmed alone with their wives and children and were not affiliated with a communal agricultural group.

consumption include growing fonio, a much underestimated grain,²⁰ and cowpeas, the bases of two important local dishes, which farmers say serve to extend the household millet supply.

4.2. Organization of Gardening

In contrast to the growing of grain crops, gardening is an individual pursuit; in the geographical area studied, it is solely a male pursuit, women being excluded due to inadequate water supplies and, secondarily, to the patriarchal system which assumes that economic gain is rightfully the prerogative of males.

In gardening, work may be shared, but proceeds are strictly individual. A group of friends or relatives (brothers, father and son, etc.) may work together planting onion sets for each member of the group, for example, and such activities as watering gardens and pounding onion tops may be jointly undertaken. Male children provide a portion of the labor; boys 14-15 years of age begin to establish their own garden plots.

4.3. Implications of Social Organization and Work Organization

Dogon society is essentially nonstratified, one Dogon existing as precariously on the edge of subsistence as another. Few social and economic differences are apparent, and political power is diffused rather than concentrated. This grand societal design, however, denies the important contradictions and tensions

²⁰ Some observers suggest that fonio (Digitaria exilis) continues to be cultivated as it is the basis of historical rituals (Gallais, op. cit., p. 142). This view overlooks the fact that fonio will grow in poor soils which will not support millet (and so is planted during the final year of crop rotation before fallow) and is said to be more drought resistant than millet. In addition to being a delicious food, fonio provides a percentage of protein equivalent to an equal volume of polished rice or milled millet. It also provides more calcium than millet, sorghum, or rice and more iron than rice or maize. See, e.g., Toury et al, Aliments de l'Ouest Africain, O.R.A.N.A., Dakar, 1967.

which underlie Dogon society; at the root of these problems is perhaps the fact that hunger is an ever present fear. People ostensibly have enough food for subsistence, but hunger is never far from the surface of consciousness and appears to manifest itself in social relations.

The contradiction in the society is that any gain made by an individual is likely to be countered with jealousy and bitterness on the part of others--even fathers are jealous of sons and vice versa. Such tensions would seem to have as their origin deep-seated anxieties regarding one's own ability to procure what ultimately is reducible to food; on a number of levels this is intertwined with tensions between young and old, between lineage authority and impulses toward individualism, and between those felt to have more material wealth and those without.

On the one hand, Dogon society dictates that one should be scrupulously egalitarian, meaning that one should not demonstrate one's wealth if only to escape social censure, yet the circumstances of scarcity dictate that one must try to acquire personal gain in any way possible. In the Dogon milieu, the egalitarian concept is one of form rather than content.

These tensions are reflected in the farming systems as farmers balance participation in collective labor groups with their own subsistence grain farming and cash cropping activities. The communal work groups that exist are far from the close-knit community effort that the term would imply. Collective work is a strictly regulated affair more often than not characterized by

tense interpersonal relations, extreme envy, and begrudging deference to age.

In terms of development interventions, it can be said that although communal work groups exist, they do not represent cooperative community efforts. Villagers, in fact, appear to be reluctant to perform cooperative labor as in road maintenance, for example, even though it is clearly in the local population's best interests to keep the road in some semblance of repair to keep the onion trade moving. In some villages where dams have been built, the dams have become partially or totally silted in, and communities have not acted to remove the silt which would be to their advantage. The reasons for this are unclear as villagers readily proclaim themselves prepared to work on any proposed dam building projects on the plateau. Undoubtedly, the anticipated wages involved play a part in this seeming contradiction, but it appears also that some of the explanation lies in the colonial overtones of the relationship between villagers and the governmental administration which oversees and, in fact, decrees such work as road maintenance.²¹ There is also the simple lack of community organization needed to coordinate such work.

There is, however, the added dimension that Dogons tend to have what might be called a deus ex machina view of European intervention--that their difficulties and problems will be, and somehow should be, solved without much involvement on their part.

²¹ Villagers are regularly called upon to provide free goods and services to civil servants. In exchange for their taxes, Dogons receive little in the way of services. Villagers subsidize the visits of all health teams and official delegations to the area and are harassed at their own local markets by police from distant administrative posts.

This attitude is perhaps as much a remnant of the colonial experience as it is a by-product of increased exposure to Europeans (and their very obvious material wealth and technological wizardry) through migration, increased tourism in the area, and the dam building projects which have been seen on the plateau.

Dogons have not survived their history without being shrewd and pragmatic tacticians. It would be to underestimate the Dogon as a people to conclude that their lack of concern about road and dam maintenance, for example, is a measure of their capacity for change and dynamic involvement in agricultural innovation and community development. It is more likely that Dogons have never seriously been included as communities in these sorts of projects and do not conceive of them as their responsibility. Moreover, the historical experience of forced labor, as in the road building projects, has not been forgotten by the people.

4.3.1. Existing Village Resources and Information Networks

In the village setting, existing resource persons and groups that could be approached while planning development projects include the village chief, the village councilors in each quartier, the ginna, or "great house" occupants who wield lineage authority, and mosque and church membership groups. Women are excluded from all village decision-making and political processes, and they are, of course, barred from the mosque. Local women's groups do exist under the auspices of the National Women's Organization, but they are poorly organized in rural areas and have no

activities other than those designated by local governmental officials. Women are best approached initially through their husbands in the mosque and church groups.

Information networks are wide-flung among the Dogon. Extensive travel takes place in the region; villagers travel to distant markets as well as to the regional capital of Mopti--some make periodic trips to the national capital.

Farmers are well aware of farming practices in other areas. They hear, for example, how rainfall has been or how the millet is coming along in other areas of the plateau or the plain, and they are keenly aware of market prices--even of commodities they would never buy, themselves. Farmers know the details of irrigation channelling in the unique topographical sites where it is practiced,²² even though it is not practicable in their own village settings. Farmers know all about the hand-operated pumps available through the Catholic Mission in the town of Bandiagara²³ and are even attuned to agricultural trials conducted at the IRAT station at Koporokénié-Pé on the Seno Plain.

Moreover, Dogon farmers are interested in agricultural innovation--a finding which runs counter to "traditional knowledge" about the conservatism and resistance to change which supposedly

22 The village of Kassa, located in a northern area of the falaise, is particularly well-known for its abundant water sources and gravity-fed water channels from which gardens are hand watered. Very minor and site-specific irrigation schemes can be found in other areas.

23 In the village studied, farmers are of the opinion that water supplies are inadequate to justify the purchase of a pump; the one farmer with a pump, who is also the local catechist for the Mission, abandoned its use after part of a season and plans to sell it in another village where water supplies are greater.

characterize subsistence farmers. They are tremendously interested in seeds and the possibility of growing new varieties of vegetables and fruits and say that they would certainly raise more were it not for the limited water supplies. Onions, however they may have been introduced into the area, just happen to be perfectly adapted to local conditions as they exist.²⁴

It has often been remarked that agriculture represents one of the longest standing human experiments, and, in fact, farmers do experiment. Examples include the farmer who had heard of other farmers along the falaise replanting freshly harvested onions after only minimal drying and who decided to try it for himself (and with good success). Other farmers were known to experiment with fertilizers they had obtained through the market system, varying the amounts and determining the associated water needs; farmers also experiment with compost and vary the ingredients for rainfed crops and garden crops.²⁵

These and many other accounts attest to the skill, resourcefulness, and ingenuity that Dogons bring to farming. If through accumulated wisdom more "scientific" methods can be introduced to the Dogon, there is no reason to expect that they will not be tried

24 The growing of fruit trees is an example of the innovativeness of the Dogon; most have been introduced to the area by Dogons returning from migrations to other countries where papayas, bananas, oranges, lemons, guavas, and mangoes were more abundant. Many fruit trees, however, were lost during the drought years.

25 Farmers are not accustomed to working with fertilizers; one farmer was observed applying phosphate fertilizer to millet plants in the same manner as compost is applied--as a mulch, rather than working it into the soil at the root level. Farmers rank animal manures, considering sheep manure the best (other than bat manure which is hard to get), but avoid heavy manuring of garden soils as opposed to millet fields, preferring a lighter soil texture. Certain wild leaves are dried and added to garden compost.

and, if proven successful, accepted. But it would be to underestimate the Dogon to conclude that change and agricultural innovation can only come through development interventions.

5. Livestock Production

In the Dogon milieu, the raising of livestock is an important complement to farming. The strategies of livestock production relate to environmental and economic factors. As elsewhere in the Sahel, animal keeping, itself, raises important environmental issues.

The animals raised are sheep of the long-legged West African Fulani type,²⁶ goats of a similar long-legged desert ecotype, Zebu or humped cattle, and donkeys. Small numbers of chickens are also kept.

Sheep and goats provide meat for market consumption and ceremonial purposes (regular home consumption is nonexistent) and, of course, manure; they also represent an investment and a source of cash when it is needed. Local beef consumption is extremely low; cattle are primarily an investment and a source of manure. Donkeys are utilized as riding and pack animals.

The numbers of animals that Dogons keep on the plateau is one of the more closely guarded secrets of the society. Animals are taxable, and villagers are quite unwilling to reveal the numbers they own. Moreover, for reasons discussed earlier, Dogons do not care to make public what wealth they might possess.

²⁶ George B. McLeroy, personal communication. See also McLeroy, "The Sheep of Sudan: Ecotypes and Tribal Breeds," The Sudan Journal of Veterinary Science and Animal Husbandry, Vol. 2, No. 2., 1961.

It appears that some farmers have their animals, particularly cattle, kept in other villages; informants suggest that a man will not even reveal this information to his wife, let alone other villagers--as he grows older, he will confide the information to a son.

Counting animals is difficult as they are not penned and have free run of the village and its environs, spending only the night in the household courtyard. In the phase of field work which engendered the most ill will, accurate counts of the livestock in 29 households were obtained. The households could not be chosen randomly but are felt to be representative of the village.

Table 1.
Mean Numbers of Livestock per Household, Dourou, 1977.
N=29

Sheep	Goats	Cattle	Donkeys	Chickens
3.4	5.1	1.9	0.7	2.5

In the course of a demographic survey, villagers were asked how many animals they kept (with all due assurances of anonymity). As anticipated, the responses were of questionable accuracy with seeming underreporting the rule, the exception being that the numbers of donkeys reported appeared quite accurate. Of 240 households surveyed, 68% reported that they kept livestock and 32% stated that they had no animals. Some respondents were unwilling to differentiate between numbers of sheep and numbers of goats, so combined figures are presented here. However, goats outnumber

sheep where they are differentiated.

Table 2.

Mean Numbers of Livestock per Household as Reported by the Population, Dourou, 1977.

N=240

Combined Sheep & Goats	Cattle	Donkeys	Horses
3.7	0.6	0.5	0.01

It must be assumed that some error from underreporting exists in Table 2. At the same time, some error is likely in Table 1 due to the small sample size.

A rough estimation of the ratio of livestock to humans can be made by comparing the two sets of data collected. Raw survey data and extrapolation of data from Table 1 using actual population figures yield the following ratios.

Table 3.

Ratio of Livestock to Humans, Dourou, 1977.

	Reported by Population	Computed from Sample
Sheep & Goats	0.8:1	1.2:1
Cattle	0.1:1	0.3:1
Donkeys	0.1:1	0.1:1
Horses	0.003:1	-

The numbers of animals are subject to seasonal fluctuation, especially with regard to sheep and goats. The dry season figures reported here are likely to be lower than rainy season figures. Most lambs and kids appear to be born during the rainy season, and more forage exists for animals at this time. Assuming a range of not more than 4 km² for all village animals, approximate

animal densities can be estimated on the basis of combined data as follows.

Table 4.
Animal Density per Square Kilometer by Species, Dourou, 1977.

	Density/km ²
Sheep & Goats	288
Cattle	58
Donkeys	29
Horses	0.9

5.1. Strategies of Raising Livestock

Animal production on the plateau is limited by lack of adequate forage and, to a lesser degree, inadequate water supplies. Disease causes periodic animal loss (although sick and dying animals are consumed) and is particularly important in terms of poultry.²⁷

Dogon strategies of raising livestock relate directly to environmental factors and are centered around the scarcity of forage for animals. Cattle are herded year-round,²⁸ but the more numerous sheep and goats are herded by children only during the millet growing season to prevent incursions into fields. However, it is also during this season that the majority of new animals are born; the young herders who are responsible for an entire

²⁷ Village chicken populations are regularly wiped out by disease (and some are lost to the ever watchful chicken hawks). Although eggs are never consumed, chickens are a more accessible source of protein to women and children, an important consideration in improving women's health and infant mortality. The meat of sheep and goats is consumed primarily by men as they can afford to buy it whereas women cannot.

²⁸ As village houses are tightly clustered on rock outcrops with no space between compounds, there is little room for cattle. They are bedded in corrals outside the village and tended by one household. Individual animals and calves, however, are kept in household compounds as are donkeys.

quartier's animals are kept busy caring for the newborns, often hand carrying them back to the village at the end of the day. In this way, Dogons can keep animals at sufficient distances from the village and the adjoining fields while safeguarding the new animals.

Following the growing season, animals are allowed to browse at will on stalks and other crop residue in the fields. The direct beneficial effect of manure dropped in the fields by grazing animals, however, appears minimal as the manure is gathered for shredding and inclusion in compost and sometimes for cooking fuel. What manure is left dries up in the sun, leaving its organic matter resting on top of the hard-baked soil.

During the cool and dry seasons which follow the rainy season, animals roam free, eating any available ground cover, leaves, fallen fruits, tree pods, and tender twigs. Animals suffer a great deal at this time, many becoming emaciated and too weak to stand. At the same time as the ground cover has been stripped by animal grazing and the effects of the intense sun, the dry season winds blow the dry soil in great clouds of dust.

Dogons have little recourse but to allow their animals to consume what they can find in the sparse environment. Farmers provide what fodder they can from crop residues and gather leaves and dry grasses for animals to eat while they are confined in the compost area of the household compound at night. During the dry season, household members gather pods of the Acacia tree

species to feed to animals which may play a role in animal nutrition related to reproduction.²⁹ In addition, farmers conserve the piles of fonio hay left over after threshing and feed this to animals,³⁰ further demonstrating the complementary nature of farming and animal husbandry.

In farming, the ability to keep animals is also important in terms of transport. A great deal of farming energy is expended in traveling to distant and fragmented fields and in transporting the harvest to the village; a donkey makes the work load significantly lighter. The timing of farming operations on the plateau requires a farmer to divide his energies between grain crops and garden crops at peak work periods. A means of transport (which also conveniently provides manure) facilitates the coordination of these two activities. Donkey transport is also useful in marketing produce and in carrying on trade of other sorts.

It is likely that population growth (currently estimated to be approximately 3% per year) has increased the numbers of animals kept by the Dogon on the plateau. The environmental degradation associated with the keeping of large numbers of animals--

29 McLeroy, op. cit., p. 115, suggests that for sheep of the desert ecotype whose main breeding season is at the middle of the dry season, conception and prenatal lamb development may be significantly influenced by the consumption of leaves and seed pods of the leguminous Acacia species. Dry season pasture is low in both protein and vital vitamin A, nutrients which are pointed out as being essential to conception and development; both are probably obtained from Acacia species.

30 Fonio hay is also burned to provide potash for cooking and local soap. The hay is used also as a binder in mud bricks and plaster used in house and granary construction, and it is an important component of household compost, absorbing liquid wastes. As indicated earlier, fonio's very practical role in the society should not be overlooked.

especially goats which Dogons keep in larger numbers than any other animal--cannot be overlooked.

At the same time, it should be observed that the ability to purchase and to keep increased numbers of animals without having to sell them has probably been enhanced by the cash obtained from onion sales. In this sense, expanded cash cropping in the absence of other forms of saving or investment than animal purchase raises the possibility of further environmental degradation and the obvious repercussions for agriculture in general.³¹

6. Population Active in Agriculture

Demographic data indicate that of the total village population, excluding nonlocal administrative personnel (N=1234), 50% are active in the cultivation of rainfed grain crops. Of the total population age 15 and above (N=680), 82% are active in subsistence farming; totals by sex are shown in Table 5.

Table 5.
Population Age 15+ Active in Subsistence Farming by Sex,
Dourou, 1977.

	Active	Not Active	Total
Males	280 (91%)	29 (9%)	309 (100%)
Females	276 (74%)	95 (26%)	371 (100%)
Total	556 (82%)	124 (18%)	680 (100%)

³¹ Dogons are increasingly adopting Islam. A corollary of this is that the Islamic religion requires more ritual sacrifices of animals than the Animist tradition. Each Muslim baptism, e.g., requires an animal sacrifice. As demographic evidence suggests an association between Islam and higher birth rates per woman, it would seem to follow that increased numbers of animals would be required society-wide but also that a steady turnover of animals would occur.

Of the total population active in farming (N=620), 78% work on both the plateau and the plain, 21% work only on the plateau, and 1% works only on the plain.

6.1 Participation in Gardening

In the area studied, it is only males who garden; active gardeners represent 20% of the total population. Of all males in the village (N=591), 42% garden. Of males age 15 and above (N=309), 79% are active in gardening.

In general, all males garden except the artisan caste groups represented in the village and those who are too infirm.

7. Areas Cultivated and Crop Yields

The total land holdings on both the plateau and the plain were measured for 26 farmers. On the plateau, 89% of the area surveyed was found to be cultivated and 11% was in fallow. On the plain, 37% of the land surveyed was under cultivation while 63% was in fallow. The results of the survey are tabulated below.

Table 6.

Average Area in Hectares Cultivated per Farmer by Crop,
Bandiagara Plateau, 1976.
N=26

Millet or Millet/Sorghum	Sorghum only	Fonio	Rice	Sesame	Total Cultivated Area	Non- Cultivated
0.7 (69%)	0.006 (<1%)	0.2 (1.3%)	0.004 (<1%)	0.0005 (<1%)	0.9 (89%)	0.1 (11%)

Table 7.
Average Area in Hectares Cultivated per Farmer by Crop,
Seno Plain, 1976.
N=26

Millet	Fonio	Cowpeas	Sorrel	Total Culti- vated Area	Noncultivated Area
1.6	0.3	0.2	0.01	2.1	3.5
(28%)	(5%)	(4%)	(<1%)	(37%)	(63%)

Between plateau and plain, then, an average farmer might have approximately 3 hectares of land under cultivation, of which approximately 2 ha would be in millet and sorghum. Table 7 indicates that 4% of the land cultivated was planted in cowpeas, indicating that this land had come out of fallow this crop year. Similarly, 5% of the land surveyed was planted in fonio, indicating that this was the final year of the crop rotation before the land was returned to fallow. This low rate of land turnover in the bush fallow system and the relatively large proportion of noncultivated land on the Seno Plain would seem to confirm farmers' statements that they do not lack for land but are more constrained by lack of adequate labor.

These figures, however, must be treated with caution. Farmers who inhabit the plateau but descend to the plain as part of their farming activity exploit a perhaps atypical region of the vast Seno Plain. Largely uninhabited, the band of the Seno which runs along the falaise is not typical of the more populous areas which surround towns in other regions of the plain. Satellite imagery, in fact, suggests that areas of the plain may be

seriously overcultivated.³²

The very fact that villagers farm on both the plateau and the plain is in itself environmentally protective of the plain, allowing continued fallow periods of adequate duration as long as a part of the food supply can be grown on the plateau. Population growth can only erode this important balance and will undoubtedly lead to further utilization of the plain. The importance of cash cropping is evident here--cash income can buy millet which would otherwise need to be grown to support a growing population. However, it is clear that cash cropping is only a short term solution; the land simply cannot support unlimited human growth.

7.1. Millet Yields

Millet yields were calculated on the basis of actual counts of millet by basketload and by tied bundle for 30 farmers on the plateau and 22 farmers on the plain. It was not possible to select these farmers randomly, but on the basis of rankings of millet producers by village elders, the farmers represented here are a cross-section of large, average, and small producers of varying ages.

In each case, the exact land area from which the grain was harvested was measured. It was not possible to weigh the basketloads and bundles at the time they were counted, and farmers and their wives were understandably unwilling to thresh such extensive

³² See Rosalie A. Fanale, "Utilization of ERTS-1 Imagery in the Analysis of Settlement and Land Use of the Dogon of Mali," unpublished dissertation for the M.A., Catholic University, 1974.

amounts of grain which are ordinarily stored on the head in grain bins to protect against insect infestation. Random counts of the numbers of millet heads per basketload and bundle revealed a pattern of uniformity despite the varying sizes of individual baskets and bundles. Over a period of months, then, women were asked to allow us to weigh with a hanging scale the millet they threshed by pounding in a mortar. In general, millet of the plateau is transported in baskets and piled on rooftops for drying; grain from the plain is transported in bundles tied with fresh tree bark and is left attached in the bundles as it dries. Women, therefore, were asked to pound the loose plateau grain heads by basketloads typical of those carried from the fields. Access to bundles while they were still attached before being put in grain bins was accomplished by weighing the women's share of the harvest which is in every way identical to the rest of the harvest, but which is not stored but processed for market trading. In addition, an arrangement with one of the Muslim religious functionaries allowed us access to a wide variety of village grain contributed as a tithe. While the possibility exists that these millet heads were of poorer quality and quantity, the bundles did not appear atypical.

For 37 basketloads, the weight of the threshed grain was found to average 15 kg in rounded figures; for 35 bundles, the average rounded weight was 16 kg.

Calculated on the basis of these weights, the average yield on the plateau is 630 kg per hectare, or 0.6 metric tons/ha.

On the plain, the average millet yield is 342 kg per hectare, or 0.3 metric tons/ha.

The distribution of yields is as follows.

Table 8.
Distribution of Millet Yields in Kilograms per Hectare by Farmer on the Plateau and the Plain, Dourou, 1976.

	0-500 kg/ha	501-799	800+	Total
Plateau (N=30)	37%	50%	13%	100%
Plain (N=22)	77%	18%	5%	100%

The same figures indicate that the individual farmer cultivated an average area of 0.5 ha on the plateau and harvested an average of 312 kg of millet; on the plain, the average area cultivated was 1.7 ha with an average harvest of 583 kg per farmer. Had the two samples been the same, the average farmer would have realized 895 kg of grain as a total.

In comparison, mean yields per hectare if combined with data on mean areas cultivated in Tables 6 and 7 would give harvest figures of 441 kg per farmer on the plateau and 547 kg per farmer on the plain, totaling 988 kg of millet. In either case, total yield per farmer is less than one metric ton.

Estimates of yields by agricultural personnel working in the region and by Opération-Mils range from 500-650 kg/ha for

the plain; other estimates place the yield at 400-500 kg/ha. Estimates for the plateau range from 600-700 kg/ha.³³ The productivity of different areas is undoubtedly variable, but for the plain, yields would appear to be overestimated. A study conducted in 1967 states that the Seno is known, whether rightly or wrongly, as the "breadbasket" of Mali, but that yields barely attain 500 kg/ha.³⁴ In light of the data gathered, even the figure of 500 kg seems unrealistically high.

7.1.1. Storage Capacities

On the plateau, it does not appear that vast stores of grain exist. Elders may have larger stores in reserve, but the quantity is variable from year to year and is dependent on the careful strategies of production and consumption which the Dogon employ. Accumulated grain does not represent an actual surplus after the subsistence needs of the population have been met, but, rather, represents an agricultural strategy which has as its objective the staving off of possible famine.

Younger, individual farmers who do not take part in communal storage arrangements have little grain left in their granaries as the new crop year approaches.

Households do not have more than 1 to 2 granaries of the large size (see Plate 12 in the appendix) in which millet is stored; elders may have 2 or 3 granaries. Smaller granaries are used for the

³³ Personal communications, agricultural reports on file at SDR office, Bandiagara, and H.L. Turlin, "Opération Régionale du Pays Dogon, IIIa," unpublished report, Institut d'Economie Rurale, Bamako, 1967, p. 30.

³⁴ Turlin, op. cit., "Document de Synthèse," p. 6.

storage of threshed fonio, sorghum, cowpeas, and nonfood items; other "granaries" hold ritual objects and have no agricultural significance.

Farmers state that the large granaries where millet is stored on the head can hold from 60-80 bundles of grain, the equivalent of 960-1280 kg of threshed grain. In an exceptional year, a communal group might be able to fill 3 large granaries--2 from the plateau and 1 from the plain.

According to farmers, millet heads from the plateau can safely be stored for 5-6 years as the individual grains in these heads are smaller and harder and resist insect damage better than the larger grains which form on the sandy soils of the plain. It is said that millet from the plain can only be stored for 3-4 years.

Worms are said to cause damage to grains in granaries, but cleaning of the granaries prior to the storage of new millet is minimal. Farmers say that a layer of ash in the bottom of the grain bin is useful as an insecticide, but nothing more than a cursory sweeping has been observed. Sorghum mixed with ashes is said to last up to 10 years, and ashes (sometimes mixed with hot pepper) are applied to the leaves of the few squash plants grown around the village. Cowpeas are buried in red sand for storage (this is one of several types of sand in the area). The small granaries are partitioned inside--usually into four parts with an upper trough-like shelf--for the storage of these various foods.

When millet heads are finally ready for storage in grain bins, few perfect heads remain. In the fields, millet is attacked

by smut, borer-like worms, birds, monkeys, and diseases which transform the head into other shapes and forms. Transport from distant fields and the mere act of attaching the bundles with tree bark strips further damages the heads. While the grain is drying, it is subject to incursions by rodents, domestic animals, and more birds.

Once inside the granary, however, the grain is relatively secure. The entrances to the granary are sealed with mud, and granary design is such that the bin is raised off the ground, preventing waterlogging. The molded walls are impenetrable by gnawing rodents, and the roof is convex, obviating the need for roof beams as well as providing air space for interior circulation and facilitating water runoff under the straw thatch.

8. Gardening Areas and Yields

The garden areas studied were located along natural water sources. The scarcity of water at these sites obligates farmers to plant very early; in 1976, onion gardens were planted as early as late August as the rainy season waned. Some heavy rains inundated several poorly drained gardens. Farmers at these sites set out their onions in a staggered order, so that it is not so much one or two distinct crops as it is a continuous 60-70 day cycle of planting and replanting. The major constraint is the inavailability of water. In the area studied, onions were the only vegetables grown with the exception of a very few hot peppers.

A survey conducted at the beginning of the gardening period indicated that for 75 farmers whose total garden holdings were

measured, the average size was 166 m². The distribution of garden areas is shown in Table 9.

Table 9.
Distribution of Onion Garden Areas in Square Meters, Dourou,
1976.
N=75

<100m ²	100-199m ²	200-299m ²	300+ m ²	Total
36%	35%	20%	9%	100%

To calculate onion yields, each of 139 individual garden areas were measured at the time of harvest; weights were obtained at the marketplace as the onions were sold. Cwing to the propensity of onion merchants to maximize their profits at the expense of the farmer, some weights were undoubtedly understated, and the volume of sales taking place simultaneously at some 15 different standing scales and assorted hanging scales precluded verification of each individual weight. However, figures are believed to be reasonably accurate.

Mean onion yields were found to be 2.4 kg/m², or 24 metric tons/ha.

Onion tops are also sold in the form of balls measuring 20-25 cm in circumference. The average number of leaf balls produced was 6.5 per square meter, or approximately 65,122 per hectare.

Yields have previously been estimated at 12.5[±]3 tons/ha³⁵

35 Turlin, op. cit., IIIa, p. 28.

and at 25 tons/ha.³⁶ Projections made by Action Culture Maraîchère, which is a sub-activity of Opération-Mils, assume a baseline yield of 30 tons/ha in the Dourou area which can be increased by the introduction of "modern methods" to 60 tons/ha by the third year of the operation which began in 1976.³⁷

Such projections would appear to be based more on optimism than on actual measured yields. At the time of this study, no known empirical measurements of onion yields existed. In a cogent analysis of the development problems involved in expanding onion production, Johnson (1977) observes that "there is no trick of modern agriculture that can be immediately implemented by local agriculture agents that will result in greater productivity."³⁸

8.1. Watering Requirements

Central to the issue of increasing onion production on the plateau is the quantity of water required by the crop. Discussion has centered around Turlin's observation (1967) that water usage on the plateau is excessive and wasteful; Turlin estimates a seasonal water use for onions of 22,000 m³/ha, assuming an 80 day growing period and application of 27 liters of water per day.³⁹

³⁶ Hans Guggenheim and Rosalie Fanale, Guggenheim 1975 Mali Project, The Wunderman Foundation, 1975, p. 106.

³⁷ Direction Opération-Mils-Mopti, "Aspect Economique du Projet de Développement de la Culture Maraîchère sur le Plateau Dogon," no date, p. 2.

³⁸ Jerry J. Johnson, "Market Gardening on the Dogon Plateau: Action Culture Maraîchère, An Analysis," report to USAID/Mali, 1977, p. 13.

³⁹ Turlin, op. cit., IIIa, p. 23.

The 1975 study by Guggenheim and Fanale estimates seasonal water use at 15,000 m³/ha, based on a 70 day growing period and varying daily doses of water.⁴⁰ In 1965, Gallais estimated water use at 4-5 l/m², or the equivalent of 50 m³/ha at the maximum;⁴¹ this daily application multiplied by the 80 days of Turlin's computations would yield a seasonal figure of 4,000 m³/ha.

An F.A.O. horticulturalist working in Senegal calculated the water requirements of a different variety of onion (140-170 growing days) as 6440-8100 m³/ha under obviously different environmental conditions and using sprinkler irrigation.⁴²

In the course of field work, it was possible to observe and measure precisely 74 separate applications of water by 27 gardeners. The exact garden areas were known, and the exact capacity of each gardener's watering calabash had been measured. For 64 calabashes measured, the average capacity was 14 liters. In the occasional instance that a farmer broke his calabash and borrowed someone else's which could not easily be tracked down for measuring or that passersby stopped to give a hand with watering while chatting with the farmer and their calabash capacities were not known, the figure of 14 liters was used in calculations. Obviously, some

⁴⁰ Guggenheim and Fanale, op. cit., p. 102.

⁴¹ Gallais, op. cit., p. 136. Although published in 1965, this report is based on field observations made in 1958.

⁴² W.O. Baudoin, "Considérations sur l'Irrigation des cultures maraîchères au Sénégal, Tome I," Centre pour le Développement de l'Horticulture, Camberene, Sénégal, 1975, quoted in Johnson, op. cit., p. 8.

spillage occurs as farmers carry the heavy calabashes from the water source to the gardens--in the area studied, a distance of up to 40 meters, some of it moderately inclined--but no workable solution was found for this problem.

The average amount of water applied to onion gardens per watering was 9.4 liters/m², or 94 m³/ha. Depending on water supplies, gardens were watered once or twice a day.

Calculated on the basis of 80 days for comparison with Turlin's data, one watering per day would yield a figure of 7,520 m³/ha; two waterings a day would yield a total of 15,040 m³/ha per season. However, the growing period is more on the order of 120 days in the area studied; calculated on this basis, the total water requirement for two crops would range from 11,280-22,560 m³/ha and would average 16,920 m³/ha.

In the absence of other comparative data, little conclusion can be drawn from these figures. Observers suggest that water usage by the Dogon is overly high, but horticulturalists observe that high consumption of water per unit area may be necessary due to the shallow soil depth of many gardens which does not permit the accumulation of a reserve of water in the soil.⁴³ It is clearly an area which merits further empirical research.

8.2. Gardening Revenues

On the basis of figures presented here, the average gross income from onion gardening might be calculated as follows. Assuming an average garden area of 166 m² and a mean yield of

⁴³ Johnson, op. cit., p. 9.

2.4 kg/m², a harvest of 398.4 kg would result. At the average local selling price of 80 MF,⁴⁴ this would give the farmer approximately 31,875 MF. The sale of leaf balls (6.5 balls/m² X 166 m² = 1079) at the average selling price of 4.4 MF per piece would add an additional 4,750 MF for a total gross income per crop of 36,625 MF, or approximately \$81.39.

Although farmers try to achieve a second crop, it would be hasty, for reasons which will be discussed here, to assume that the figures presented above can merely be doubled to determine gross seasonal income.

How much of the second crop actually gets to market is dependent on water supplies, weather conditions (how hot or overcast it has been), and the farmer's financial status (i.e., how much immediate cash he needs). Environmental conditions may leave the farmer no choice-lack of water or lack of access to what water remains means that some onion plots will have to be harvested before maturity; some farmers choose not to plant a late-maturing crop at all. A strategy employed by farmers at this time is to pound and dry the immature bulbs and, if possible, to defer sale until dried onion prices are higher later in the year. If farmers can afford to defer profits, they may dry a portion of the harvest they would ordinarily sell as fresh onions. One such farmer took his harvest to the marketplace, had it weighed, and then decided not to sell; the 52 kg of fresh onions, when dried, yielded 8 kg. Sold at 500 MF/kg, the dried onions netted the farmer 4,000 MF.

⁴⁴ Approximately 450 Mali francs (MF) equal \$1 U.S. All figures are rounded to the next whole 5 francs as no 1 franc piece exists in Malian currency.

Had the farmer sold the fresh onions at the offered price of 75 MF/kg, he would have earned slightly less, or 3,900 MF; on the other hand, had he waited until later in the year (e.g., July), he might have gained about 1,000 MF additional profit by selling the dried onions at 600+ MF/kg.

Some portion of the second crop is often retained by the farmer for consumption and for seed bulbs for the following crop year. The scarcity of water precludes farmers from planting onions from seed which would be less expensive and which is done in some villages. Similarly, the scarcity of water precludes farmers from producing enough onion sets to suffice for the next year, so farmers must purchase these on the market.

The primary cost in gardening is the price of seed bulbs purchased.⁴⁵ Farmers try to buy onion sets the year before when prices are still relatively low. During the crop year as growing conditions can be assessed, farmers buy more sets according to their needs. Expenditures during the onion season must be balanced in terms of how yields have been, what market prices have been, and the amount of millet that must be purchased simultaneously (when prices are lowest) to augment granary stores.

The sale of animals during the rainy season when animals are at their best weight and the best prices can be obtained

⁴⁵ The cost of onion sets for 16 farmers interviewed ranged from 3100 to 34,000 MF, or on the average, 14,785 MF, but it was impossible to verify these figures, purchases having largely occurred the year before. Moreover, farmers were in many cases unable to recall exact figures or how the sets had been allocated over the growing season.

appears to be an important adjunct to gardening strategies. Gardening begins toward the end of the rainy season, and millet is harvested sometime thereafter. With the cash obtained from animal sales ⁴⁶ and early onion sales, farmers can judge conditions and buy additional onion sets as well as grain.

The marketing strategy is to get onions to market as early in the season as possible to take advantage of the higher prices at this time. During the 1976-77 season, this strategy was adopted by so many farmers in the region that the market was absolutely glutted, driving prices down.

Additional costs of gardening include any fertilizer purchased, tools and equipment (hoes, knives, sledgehammers, wedges, calabashes, baskets, sacks), and costs of transport if the onions are shipped to cities by the farmers, themselves, rather than being sold locally. Hired labor is not a feature of gardening in the area studied.

During the gardening season, also, farmers must pay their taxes ⁴⁷ and sell a quota of their grain to the government program of commercialization which redistributes the grain to other areas of Mali. Many farmers on the plateau attempt to purchase this grain from other Dogon farmers on the plain rather than jeopardizing their own subsistence base by giving up their

⁴⁶ Generally the male animals are sold while the females are kept for reproductive purposes. A goat might be sold for 6,000-10,000 MF, a sheep for about 12,000 MF.

⁴⁷ Current taxes are about 2,000 MF per person age 14-59. Women with 4 or more living children are not taxable, nor are those who are blind, leprous, disabled, or incurably ill.

stored grain. As market prices are generally higher than the price paid by the government for millet,⁴⁸ farmers attempt to buy grain in November when it is at its lowest price; the commercialization period occurs some months later. If farmers do not have sufficient cash on hand at this crucial period in November--which coincides with the need to purchase additional onion sets for the second crop as well as grain for personal consumption--they end up selling their grain to the government at a loss.

9. Women's Participation in Agriculture

Of all women in the population age 15 and over, 74% are active in the cultivation of subsistence grain crops; women's labor contributes importantly to agricultural activities. In Dogon society, however, women are denied rights of land ownership and rights to inheritance of any kind; they are, furthermore excluded from all economic decision-making and from any political participation, including election of village officials. Indigenous women's organizations have been outlawed by the national government in favor of the National Women's Organization.

Accounts of Dogon women being "economically independent" belie the fact that although they participate in the market system (often by marketing their husbands' produce, not neces-

⁴⁸ The market price of millet in November 1976, e.g., was 3600 MF/100 kg; by March 1977, the price was 4400 MF/100 kg. At the same time, the price paid by the government was 32 MF/kg, or 3200 MF/100 kg, the same price that had been paid the year before as well.

sarily their own), they are the poorest segment of the society.

Women have no control over the millet they have helped to produce, not even access to the granaries where it is stored; granaries are kept locked, and men dole out portions of millet as needed for women to pound and prepare. For their participation in agricultural work, wives are accorded one bundle of millet from the total harvest.

As women are excluded from inheritance in the patrilineal system, widows without surviving male children to care for them exist in extreme poverty in old age. Women too old to bear children are not considered worthy of remarriage and are virtually discarded by the deceased husband's lineage. Elderly widows farm their own millet fields (the land is loaned to them) for as long as they can walk to the fields to work. Surviving female children, having married into other lineages, cannot assume responsibility for their mothers. In extreme old age, widows without male children return to their natal villages to have a modicum of security from their fathers' lineages.

In contrast, elderly males, widowed or not, are at the peak of their influence in the society. They are accorded respect and their granaries are filled with the products of the agricultural labor of their children, even when they, themselves, are no longer able to work.

In addition to the elderly women who farm alone (sometimes with the help of children), young women whose husbands have migrated for extended periods to coastal countries cultivate their

own fields as well as participating in communal agricultural labor. For 3 women (2 old and 1 young) whose land holdings were measured, the average size of their holdings was 0.2 ha.

9.1. Implications of Differential Economic Status

Women participate in agricultural activities where it is of economic advantage to men and to patrilineages for them to do so. Where women's labor is not needed, as in gardening, they are excluded from participation while boys as young as 14 years of age are allotted their own garden space. As women do not participate in gardening activities, men feel no responsibility to share their proceeds with their wives or children.

The differential economic status of males and females is reflected in access to food which, symbolically, is the most important item in the society. Meat is the desired food, and meat eating is possible only with money, as evidenced by the curt appraisal of someone: "He has money--he eats meat." Men consume large portions of grilled meat on every market day possible (once every five days), but women can seldom afford meat for themselves or for their children.

As it is wholly incumbent on women to provide all other foodstuffs other than grain for their children and themselves, women's and children's diets and their attendant health status are directly related to women's economic position in the society. It is also the responsibility of women to provide for the entire household the ingredients for the sauce which accompanies the dry, cooked millet paste which is the staple diet. Women achieve

this economic contribution to the household through a combination of gathering wild products and petty market trading, but they are by no means "economically independent."⁴⁹

The poorer diet of women and children is based on economics and traditional asymmetrical sex roles in the society. It is also a function of dietary ignorance; there is no knowledge of the importance of protein, minerals, and vitamins for pregnant and lactating women and developing children. In the patrilineal system, men are assumed to be more important and thus to deserve the better portion of any food.

Women's prime role in Dogon society is considered to be child-bearing. Children are valued for providing labor and old age security and for perpetuating the lineage structure, but children are considered to be women's affair and women's responsibility. Ironically, the social mechanisms which confer different status on males and females act to diminish the chances of survivorship of the infants which are so desired. The implications for development interventions are the continuing nature of the cycle of under-nutrition, ill health, and infant and child mortality and the depletion of women's health through continual childbearing. Without long-term education and fundamental social change, women's and children's diets and health can only be improved by improving women's own economic status.

⁴⁹ In areas of the plateau where women do have their own gardens, their economic contribution to the household is accordingly increased; they must buy grain for half of the year, provide the sauce and other foods for children for the whole year, and work in the fields to help produce the grain which is stored in the granaries.

9.2. Impact on Women of Development Programs

Current development projects in the Dogon area address themselves to men, but recent inquiries have been conducted into the possibilities of involving women in development.⁵⁰ Clearly, it is a difficult and challenging proposition to involve women--who in their own societies are so overlooked--in important ways in the development effort.

In the Dogon milieu, it cannot be assumed that the betterment of males' economic status will automatically benefit the entire household.

Whenever possible, women must be included in the dissemination of information about new agricultural methods and in the accompanying adult literacy programs. Every effort must be made to increase the numbers of girls entering and remaining in school.⁵¹ It would seem an appropriate condition of financing dam building projects, for example, that some garden areas be reserved for women with training programs to teach women the necessary methods. It would seem entirely feasible, at the same time, to provide simple milling devices to diminish the household burdens of these women. Perhaps women, themselves, could be organized to operate small milling concerns at the village level.

⁵⁰ See e.g., the survey by Barbara Skapa-Spicer (1977) on involving women in community development in the Fifth Region of Mali. The final report to USAID was unavailable at this writing.

⁵¹ Opened 5 years ago, the primary school at Dourou had an enrollment of 244 students for the school year 1976-77; 12% of the pupils were female and 88% were male.

To improve the health of their children, women also need to be instructed in hygiene and preventive health care, but they can do little--even to obtain such a simple item as soap--without being involved in economically remunerative ways in the society.

Development efforts to raise the income of farmers are laudable from any perspective, but it is important not to overlook the point that Dogon males do not necessarily use their cash income to increase the household standard of living. As a general rule, Dogon males do not give their wives money. Market gardening may be booming, but women are still struggling to trade a few francs' worth of wild fruit or dried baobab leaves so that they can feed their children.

10. Potentials for Expanding Market Gardening

Beyond the immediate questions of increasing productivity and production of vegetables on the plateau, it has been pondered by some observers that if Dogons can so successfully grow vegetables during the dry season, why would it not be equally possible to grow them during the rainy season on both the plateau and the plain? Turlin (1967), for example, suggests that over the long term, Dogons may adopt gardening as their principal rainy season activity if their millet needs can be obtained through the market system.⁵²

Dogons, for their part, are of the opinion that their

52 Turlin, op. cit., "Document de Synthèse," p. 15.

onions do not grow well during the rains; one of the major crop problems reported by farmers is a yellowing, or tip-burning, of the onion tops and stunted growth said to be caused by rain falling on the plants. Johnson (1977) observes the same symptoms but suggests on the basis of preliminary laboratory analysis that a fungus may be responsible.⁵³

It is not known if onion growing during the rains would succeed under existing conditions. As it is, farmers attempt to plant at the earliest possible moment, and the occasional late rains invariably cause crop damage in one form or another.

Under the soil conditions which exist in many areas of the plateau--that is, soil depths of as little as 8-15 cm--it is questionable whether other vegetables with more extensive root systems than the onion could be grown. Certainly some limited quantities are grown at the present time but only in certain favorable spots. Further consideration would need to include the feasibility of storage and transport of other vegetables in quantities as large or larger than the present volume of onions⁵⁴ and assurance of a market for them. Vegetable consumption in Mali, except for tomatoes and onions in cooked sauces, appears to be low except among the more affluent.

53 Johnson, op. cit., p. 21.

54 The present volume of trade is unknown. In 1972, it was estimated at 4,000 tons (Ibid, p. 2.); however, assuming 500 ha of gardens on the plateau (Ibid, p. 15.) and a mean yield of 24 tons/ha (although yields, of course, will vary), the total tonnage would be 12,000. Export, then, could be expected to exceed the 1972 estimate.

Currently, Dogons on the plateau plant some millet in garden areas during the rainy season; as the grain is harvested, onions are planted (each crop seemingly profiting from any residual effects of manure, compost, or fertilizer applied to the preceding crop). Garden land, therefore, is not necessarily lying unused during the rainy season.

Most important to the question of the possibility of rainy season gardening, however, is the fact that Dogons on the plateau already depend on their cash crop revenues to purchase a portion of the grain required for subsistence needs (and to allow a slight margin of reserve). Were they to abandon millet farming altogether in favor of market gardening, Dogon farmers would not only have to increase their vegetable production substantially merely to meet current grain requirement levels, without regard to the effects of population growth over time, but also expose themselves to all the hazards of monocropping in an already unsure environment.

All Dogon agricultural strategies are directed toward minimizing risk in the unstable and fragile environments of the plateau and plain while, at the same time, trying to maximize whatever returns are possible. Were Dogons to adopt market gardening as their primary agricultural activity, it would seem that they would be exposing themselves to greater risks and a vulnerability far exceeding that of their present situation.

By way of illustration, gardening, whether in the rainy season or the dry season, is dependent on secure rainfall, there

being no water table on the plateau. No technological advance can yet assure rainfall in the Sahel, let alone its amount and distribution. Considering that surface water and seepage through rock strata are the only sources of water, irrigation schemes in case of rainfall failure are unlikely solutions. Just one year's crop failure due to drought--which would inevitably affect the market supply and price of grain as well--would raise the question of how people could feed themselves. The present agricultural strategies of interplanting and crop mix as well as growing cash crops act to mitigate the effects of all but the most severe droughts, and there is no denying that drought in varying forms of severity is a recurrent phenomenon in this geographical area.

It is not known, furthermore, what insects or plant diseases might come to be associated with new vegetable varieties. Similarly, the long-term effects of the fungicides, insecticides, and chemical fertilizers which are now making their appearance on the plateau cannot be known. A disturbing aspect of this is that no baseline data of any kind exist for monitoring the long-term environmental effects of these products. To the present date, not a single soil analysis has been conducted in the areas where agricultural interventions are underway on the plateau and the plain.

10.1. Possibilities of Gardening on the Seno Plain

The same problems which were discussed in relation to the possibility of rainy season gardening on the plateau are appli-

cable to the Seno Plain; however, the water problems are somewhat different. The water table on the plain can be as deep as 60 meters, which under present technology (hand drawing of water with well buckets and ropes) makes watering of gardens an impossible task in most villages. Rainfed tobacco gardens, however, are common and are carefully protected with thorny hedges against the large numbers of domestic animals.

Extensive gardening does take place on what is technically the Seno but what is really a separate and different environment--the "valleys of the piedmont."⁵³ These distinct areas occur at places along the falaise where rainwater from the plateau runs off to form seasonal streams (see Plate 3 in the appendix). In places, dunes separate these areas from the more typical Seno Plain. Soils, temperature, and even vegetation are different in these microenvironments. Crops grown in these areas include onions (including large Bermuda-type onions), tomatoes, nightshade (Solanum aethiopicum), cotton, and fruits. As on the plateau, millet is planted in the garden areas during the rains; vegetables are started in seed beds in the millet fields before the grain is harvested.

As to whether market gardening could take place on a large scale on the Seno Plain, Turlin (1967) suggests that if millet yields could be raised to 1000 kg/ha using chemical fertilizers, one-tenth of the cereal-producing area, or 6,000 hectares, could

53 Turlin, op. cit., II, p. 8.

be allocated for market gardening; elsewhere, Turlin comments on the "problems of water" and "degradation of soils" on the plain.⁵⁴ It appears highly unlikely that yields of 1000 kg/ha will be attained on the plain at any time in the near future and even more unlikely that millet areas will be converted to market gardening areas in any foreseeable future. For better or worse, the Seno is increasingly depended upon to provide grain for a rapidly growing Malian population through the commercialization program as well as for the Dogon, themselves. Under present circumstances, which are far beyond the control of the Dogon producers, it appears improbable that rainy season market gardening will be undertaken on the plain.

Until the water problems which plague most areas of the plain can be solved, little attention can be focused on the dry season horticultural possibilities of the area. Soil studies and horticultural trials are also needed to judge the suitability of the plain for large scale gardening operations.

11. Practicability of Dogon Gardening System Elsewhere

The success of the Dogon onion venture leads to the question of whether such a gardening system could be transferable to other geographical areas. A number of factors would seem to militate against the success of such a transfer. The highly specific natural environment and conditions of soil (and locally devised means of soil management), temperature, humidity, and day length which are characteristic of the plateau and to which local varieties of

⁵⁴ Turlin, op. cit., "Document de Synthèse," p. 6 and p. 15.

vegetables are adapted would be conditions difficult to reproduce elsewhere. If environmental conditions were different elsewhere, as they are most likely to be, there would be no need to adopt such a system as the Dogon one.

The use of certain elements of the Dogon system, such as manuring or composting, for example, might be transferable but would be dependent on other factors. Environmental and economic circumstances elsewhere would have to allow animal keeping. Cultural factors would also intervene, such as experience with raising animals and handling human and animal wastes. The Dogon system also makes use of wild animal manures and plant products for composting which are highly specific elements that would be difficult to duplicate. However, such practices as drying vegetables for storage and transport could be adopted anywhere.

The success of Dogon gardening--aside from market demand, road expansion, and the like--is based on history. The cultivation of onions--as the basis for cultivation of other vegetables and for the expansion of gardening--was not introduced, in any modern sense, from the outside. Dogons had had long familiarity with the crop before it became a "cash crop." In addition to historical experience, the Dogon of the plateau have the economic incentive of needing cash crop revenues to buy grain to supplement their own grain production.

12. Existing Agricultural Interventions

Two programs of agricultural intervention are under way in the Dogon region. The first of these, Operation-Mils (OM),

focuses on the Seno Plain, seeking to introduce animal traction, field preparation prior to seeding, new millet varieties, in-line seeding, closer plant spacing, timely weeding, improved composting, and chemical fertilizers and pesticides. The possibilities of different crop rotations (e.g., a crop sequence of millet, groundnuts, and cowpeas) are also being studied.⁵⁵

The field strategy of OM has been to choose a number of pilot farmers, or paysans pilotes, to whom credit is extended to invest in animals, plows, and animal-drawn carts. A pilot farmer plants millet according to the new methods in demonstration plots; the end results are visible to other farmers who, it is hoped, will emulate the methods of the pilot farmers.

The second program of agricultural intervention, Action Culture Maraichère (ACM), seeks to improve vegetable production on the plateau, but the exact methods by which this is to be achieved are as yet unspecified. Preliminary interest appears to lie in providing farmers with metal watering cans to replace the indigenous calabashes, gourds, and clay pots now used. The improvement of water supplies on the plateau is of prime importance to market gardening; some 65 appropriate sites for dam construction have been identified.⁵⁶ Although yields have not yet been determined, there is interest at the government level in forming co-operatives of onion producers who would sell their products to a government monopoly.

⁵⁵ OM also coordinates the commercialization of millet for the government. Eventual associated activities of OM will include road improvement, well digging, and adult literacy and health programs.

⁵⁶ Johnson, op. cit., p. 11.

12.1. Social Aspects of Development Interventions

From a social perspective, the existing agricultural programs have as their limitation the fact that they overlook the involvement of women, who, in the Dogon milieu, contribute roughly half of the agricultural labor. In addition, women are traditionally the groundnut farmers on the plain--an important consideration as agricultural programs experiment with changing crop rotations to include a cycle of groundnuts--and in some areas of the plateau, women have their own vegetable gardens and are as much in need of agricultural assistance as male farmers.

While it is true that in subsistence farming, Dogon women have no decision-making power, are denied rights in land ownership and inheritance, and have no control over the millet once it is produced, they are, nevertheless, a vital link in the development process. The numerous interrelationships that exist among the natural environment, agricultural and economic activities, nutrition, health, population growth, and development are mediated through the social system. "Women's role" in the society directly affects--and, in some cases, determines--many of these variables and the "feedback mechanisms" which operate among them. As the need to include whole communities in the development process is increasingly understood,⁵⁷ the importance of considering women's roles in societies will become self-evident.

⁵⁷ See, e.g., Ted Owens, "Brief Reflections on a Quick Trip to Mali," report to CDO, AID/Mali, 1975.

As discussed earlier in this report (see pp. 15-17), village organization is lacking in the Dogon region; villagers have no experience with "working together" toward community goals despite their participation in collective work groups. Interpersonal relationships are tense; gain on the part of one villager is resented rather than admired by others. What effect this might have on the pilot farmer approach in disseminating agricultural innovations is not known but should be considered in any evaluation of the program. As it is, the pilot farmers already chosen appear to be among the richer farmers in the villages, who, among other things, can better afford the necessary investments. How these pilot farmers are viewed by the rest of the farmers would be something to be determined.

Villages need to be organized whether to undertake agricultural programs or other community development programs. The agricultural agents currently stationed in villages are in a direct position to work with village groups, but many of them are handicapped by the problem of being of different ethnic groups and not speaking the local language; very few farmers speak French, although some speak Peul, and more and more appear to be learning Bambara. Agricultural agents are further handicapped by their lack of training in working with people, especially in the field situation; they dress and comport themselves in the manner of civil servants (including keeping the hours of civil servants in rural areas where agricultural work and life, in general, do not run by the clock) and set themselves off

from the local populace, engendering a fair amount of distrust.

Agricultural agents need to be trained to work more effectively with farmers--and farmers of both sexes. Agricultural agents, themselves, in spite of their educations, are not free of the influences and customary ways of thinking of the larger society which ignores women. As a long-term goal, it would seem appropriate to train more Dogons as agricultural agents to work in their own region and to train women as agricultural agents.

The inclusion of both men and women in all community development programs, whether village sanitation, improvement of water supplies, preventive health care, nutritional teaching, adult literacy, or agricultural innovation, seems vital to the success of such programs and to the continuation of them by the community, itself.

13. Approaches to Development and Recommendations

In theory, rural development has as its goal the linking of the village to the national economy and the eventual conversion of villagers from low level self-sufficiency to almost total dependence on the goods and services of the larger world through the market system.⁵⁸

At the present time, it would seem vital that the Dogon, despite their participation in the market system, not give up the security they have in producing at least a part of their own subsistence needs. The strength of the Dogon as rural producers lies in their keen knowledge of their natural environment

⁵⁸ Owens, op. cit., p. 4.

and in their agricultural strategies which act to minimize risk and to assure a food supply even in the worst of times, a promise the national economy cannot yet make.

Development interventions, however well-intentioned, introduce "new technologies" to rural peoples only at a certain risk to these people. Among the Dogon, this could apply to the introduction of animal traction, plowing, and chemical fertilizers and pesticides. Rural peoples, as the Dogon, should be assisted in every way possible to improve their conditions of life, but it is of paramount importance that new technologies not render villagers dependent on nonlocal and nonrenewable products or leave them more vulnerable in the end to the existing circumstances of their lives. Unfortunately, many "unknowns" exist. The vagaries of politics and economics cannot always be foreseen; the termination of funding for projects can leave people at the village level exactly where they have always been. On another level, the ecological costs of new technologies, such as plowing in fragile soils or the long-term use of fertilizers and pesticides under Sahelian conditions, simply are not yet known.

Certain questions can be asked about the introduction of new technology to rural peoples. Miller (1977), for example, asks the following questions:

- (1) What are the intrinsic attributes of the new technology? What can it do, and how is it superior to the old?
- (2) What new constraints are associated with these attributes?
- (3) Who controls the application of the technology, and for whose benefit?

59 Frank C. Miller, "Knowledge and Power: Anthropology, Policy Research, and the Green Revolution," American Ethnologist 4 (1), 1977, p. 196.

Development interventions obviously have many dimensions to them. Reasoned approaches which take into account both immediate and long-term environmental, economic, and social effects offer the best hope for success.

Development efforts, of course, extend far beyond the mere provision of technology, as relatively easy, glamorous, and desired as it is in rural areas. The most profound and lasting effects of development are probably those of education and organization of communities to understand and to deal with their own specific problems.

With these points in mind, some recommendations for the plateau area of the Dogon region are offered here.

13.1. Recommendations for the Plateau

The general orientation of the following recommendations is an emphasis on small scale technology, or what has come to be known as "intermediate technology."⁶⁰ With the exception of dam building, which is a more extensive undertaking (although some of the most successful dams on the plateau are small, measuring 30 meters, or less, in length--see Plate 18 in the appendix), improvements in Dogon life could be brought about by decreasing energy expenditure levels by very simple means. But, again, technological "wizardry," regardless of scale, could conceivably be introduced and reintroduced for the next hundred years without any appreciable change in the conditions of village life if the people, themselves, are not convinced of the

⁶⁰ The term arises from the work of E.F. Schumacher and the Intermediate Technology Development Group in England; a division is now based in Menlo Park, California, as well.

need and not involved in the process.

In view of the world energy situation, it would be shortsighted to depend on the continuing availability of petroleum products and by-products in as remote an area as the one inhabited by the Dogon. However, in the eventuality that market trucks, for example, could no longer be operated profitably, the market system could still operate satisfactorily, if somewhat more slowly, with donkey transport. Similarly, if fertilizers were unavailable, farmers could still manure, compost, and green manure their fields and gardens as they always have.

Specific recommendations are as follows:

(1) Emphasize the utilization of renewable energy sources to provide cooking fuel and mechanical power. Exploitation of the abundant solar and wind power on the plateau for domestic and agricultural use has important possibilities and would protect the area from progressive deforestation. Plant native tree species in the area and devise effective fencing against animal encroachments; Dogons have experience with transplanting trees (e.g., baobabs).

(2) Improve water supplies through continued building of small dams and repair of defective dams (or their replacement if repair is impossible). Provide assistance to local groups in dredging out rock faults where wells might be established. Organize village programs of well and dam maintenance, including removal of aquatic plants, if indicated, and finding ways to decrease surface evaporation. Rig pulley systems for drawing water where applicable.

(3) Institute public health programs through village committees.⁶¹ Special emphasis should be placed on maternal and child health, nutritional teaching (men particularly need to be made aware of the nutritional requirements of pregnant and lactating women and of children), hygiene, and village sanitation. Malarial suppression programs are needed; the topography of the plateau does not easily lend itself to mosquito eradication. Fly control is especially needed as eye infections and other fly-borne diseases are very prevalent. Methods of covering, composting, or otherwise disposing of human fecal matter must be found as the digging of latrines is not feasible on the rock surface of the plateau. Village monitoring of dam sites for snail infestation (which is conducive to the schistosomiasis, or bilharziasis, cycle), and village education on the transmission of Guinea worm, or dracontiasis, especially through the walk-in wells so common to the plateau, are also needed.

(4) Increase productivity and production of vegetables on the plateau.⁶² Involve women in market gardening and in any other activities which will increase their economic status. Investigate irrigation possibilities for gardening (e.g., simple, inexpensive indigenous methods used in other African societies such as those employing the counter weight principle

⁶¹ See, e.g., Owens, op. cit., and Raymond B. Isely and Jean F. Martin, "Le comité de santé de village: Point de départ du développement rural," Chronique OMS, 31, 1977.

⁶² For an exhaustive treatment of this topic, see Johnson, op. cit.

to raise water to the garden level in large calabashes).

(5) Improve work implements (see present tool inventory in Plate 7 and the Dogon basket, the primary implement used in farming activities, in Plate 13). Devise easier ways to process onions and onion tops for drying (see Plate 25)--possibly a roller mechanism or press of some kind. Introduce simple milling devices for grain (more elaborate models might be wind-powered or animal-powered). Farmers on the plateau, who currently must head carry individual basketloads of manure and head loads of hay, wood, and agricultural produce (this, of course, applies to both males and females), might particularly benefit from large capacity hand carts (see commercial illustration in Figure 3 in the appendix). Such carts (which could probably be constructed in the Dogon region) could be maneuvered along inclines and irregular surfaces and in other areas generally inaccessible to the more unwieldy animal-drawn carts used on the plain.

(6) Balance livestock production with environmental conditions. Improve animal health and explore possibilities of other animal fodders. Decrease the numbers of goats in herds if economically feasible to do so (sheep are more expensive to purchase). Involve women in ownership and production of animals (a very few women currently own 1 or 2 sheep or goats), especially in poultry production, which would make high-quality protein more accessible to women and children. If laying hens were raised in sufficient numbers, egg production and consump-

tion might be possible. If both animal production and women's economic status were improved, it might be possible to provide children with milk.

(7) Explore investment possibilities other than animal purchase. Extend credit to both male and female farmers. Women need to be provided with the means to obtain a mode of transportation. Donkeys and bicycles are owned only by males, and only men's energy conservation needs are served at the present time.

(8) Facilitate transfer of information. Organize farmers' discussion groups and include women. If possible, increase radio broadcast time in Dogon dialects (currently one brief broadcast of news once a week). Attempt to make radio listening a household or quartier event where everyone can listen; generally it is a "walking around" activity of young males who carry their radios around with them. Encourage school attendance of both male and female children. Involve both males and females in adult literacy programs.

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References

- Baudoin, W.O. 1975. Considérations sur l'irrigation des cultures maraîchères au Sénégal. Tome I. Camberene, Sénégal: Centre pour le Développement de l'Horticulture.
- Direction Opération Mils. n.d. Aspect économique du projet de développement de la culture maraîchère sur le plateau dogon. Unpublished report. Mopti: Opération Mils.
- Fanale, Rosalie. 1974. Utilization of ERTS-1 imagery in the analysis of settlement and land use of the Dogon of Mali. Dissertation for the M.A. Washington: Catholic University.
- Gallais, Jean. 1965. Le paysan dogon. Cahiers d'Outre-Mer 18: 123-143.
- Guggenheim, Hans and Rosalie Fanale. 1975. Guggenheim 1975 Project: A "Shared Technology" for Development. Report II to Christian Aid. The Wunderman Foundation.
- Isely, Raymond B. and Jean F. Martin. 1977. Le comité de santé de village: Point de départ du développement rural. Chronique OMS 31:331-340.
- Johnson, Jerry J. 1977. Market gardening on the Dogon plateau: Action Culture Maraîchère, an analysis. Report to USAID/Mali.
- McLeroy, George B. 1961. The sheep of Sudan: Ecotypes and tribal breeds. The Sudan Journal of Veterinary Science and Animal Husbandry 2 (2):115-140.
1976. Personal communication.
- Miller, Frank C. 1977. Knowledge and power: Anthropology, policy research, and the green revolution. American Ethnologist 4 (1):190-198.
- Owens, Ted. 1975. Brief reflections on a quick trip to Mali. Report to CDO, AID/Mali.
- Skapa-Spicer, Barbara. 1977. Enquête relative au projet de développement communautaire intégré à l'Opération Mils-Mopti. Field survey for USAID/Mali.
- Soudan Français. 1893-1905. Bulletin agricole et commercial. Unpublished reports in National Archives, Bamako.
1897. Mercuriale indiquant les prix des aeurés et objets existents sur le marché de Bandiagara. Unpublished report in National Archives, Bamako.

References (cont.)

Toury, J. and R. Giorgi, J.C. Favieri, and J.F. Savina.
1967. Aliments de l'Ouest Africain. Dakar: O.R.A.N.A.

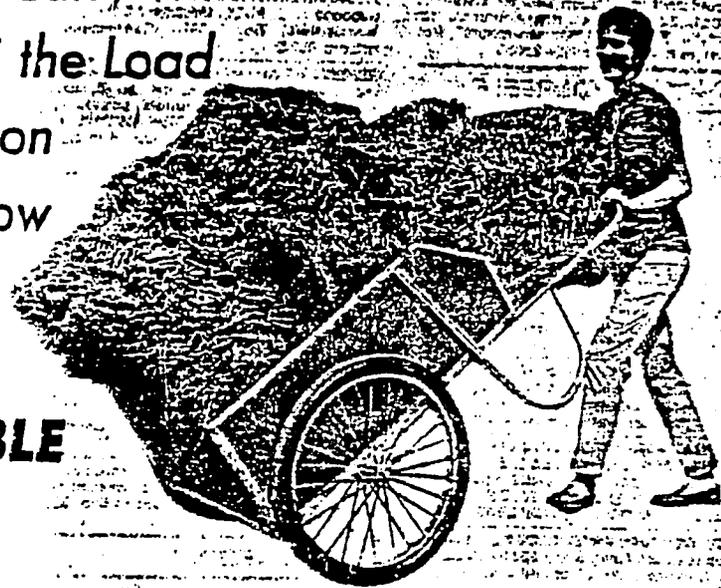
Turlin, H.L. 1967. Opération régionale du pays dogon. Tomes
I, II, IIIa, IIIb, IV, V. Bamako: Institut d'Economie
Rurale.

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Appendix

Figure 3. Commercial Illustration of Hand Cart
Plates 1-26

**NOW... Carry
TEN-TIMES the Load
of a Common
Wheelbarrow
or Cart
with
INCREDIBLE
EASE!**

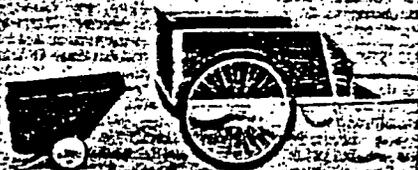


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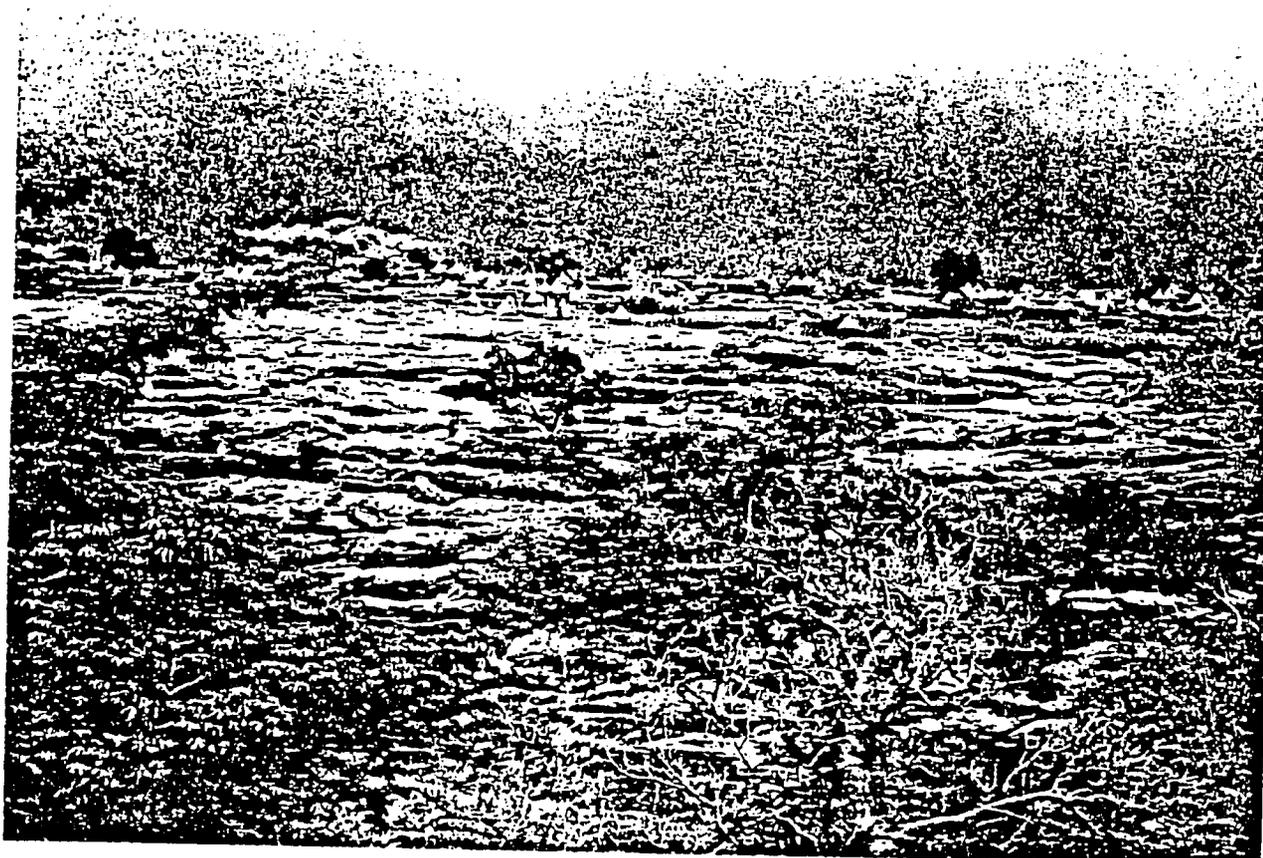
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Plate 1.



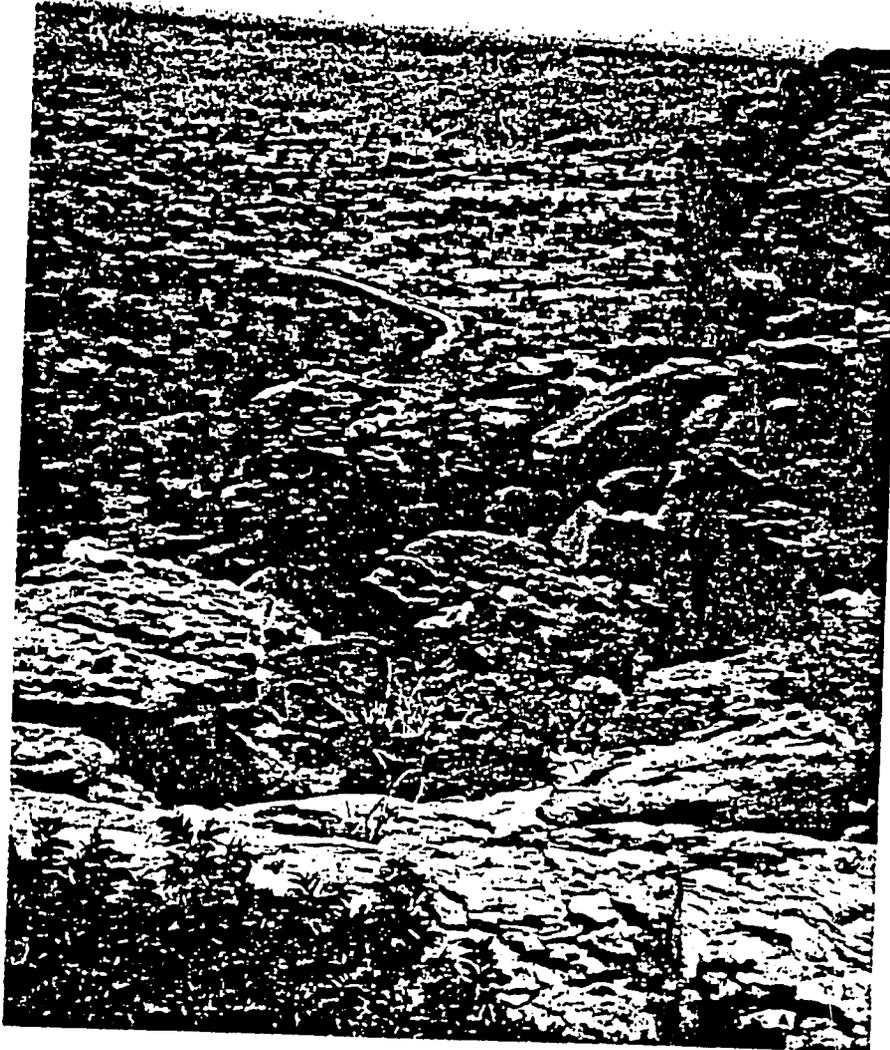
A quartier of Dourou, the field site on the Bandiagara Plateau. A woman (center) ascends a path which leads through fonio. Millet grows among trees in the valley below and on the edge of the village (upper right).

Plate 2.

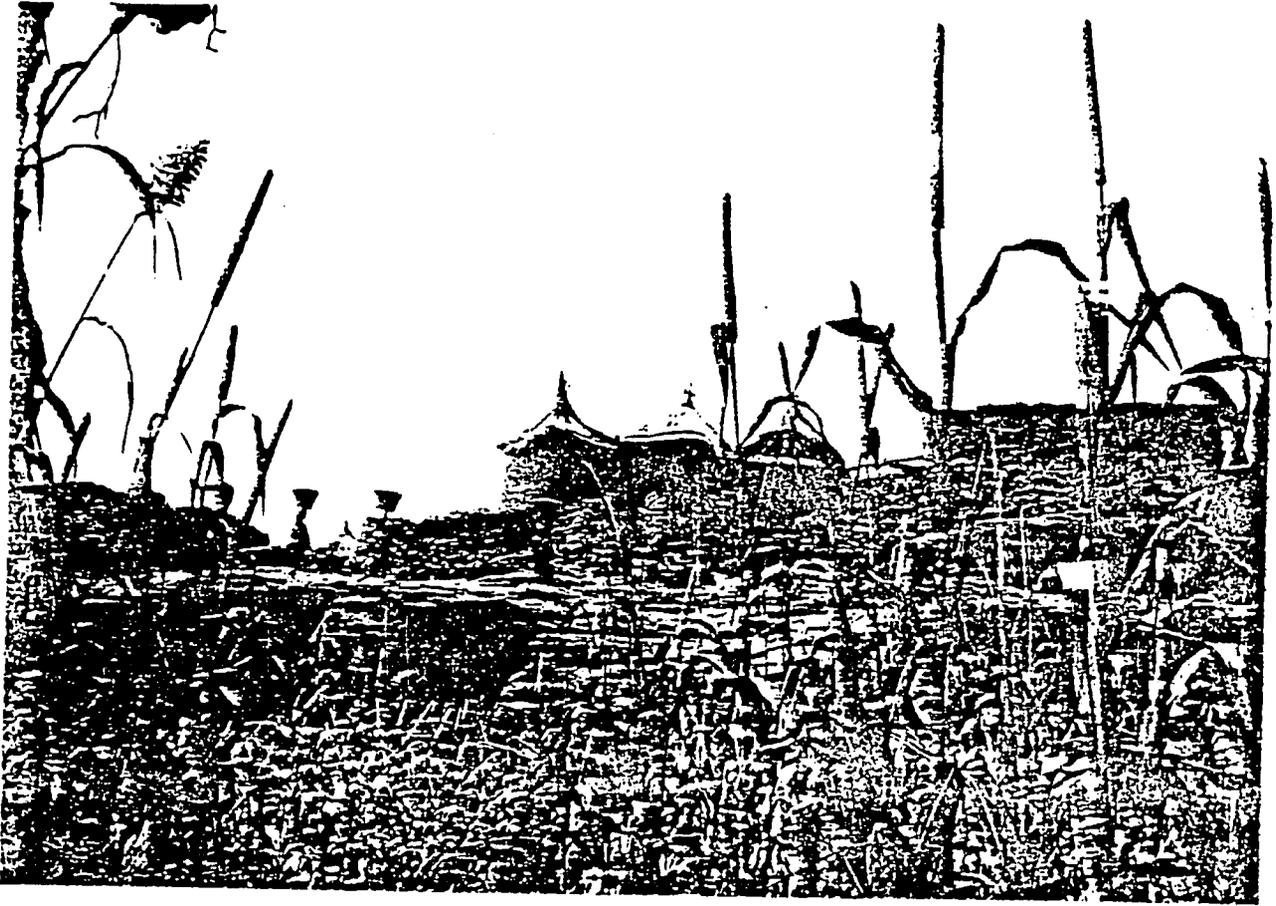


The falaise, or cliffs (300 meters high), overlook the Seno Plain. The village of Nombori (arrow) is built on a talus slope.

Plate 3.



Overview of the Seno Plain from the plateau. Seasonal stream (center) formed by runoff from the plateau allows dry season gardening on its margins.



Millet and sorghum interplanted in a valley area between village quarters.

Plate 5.

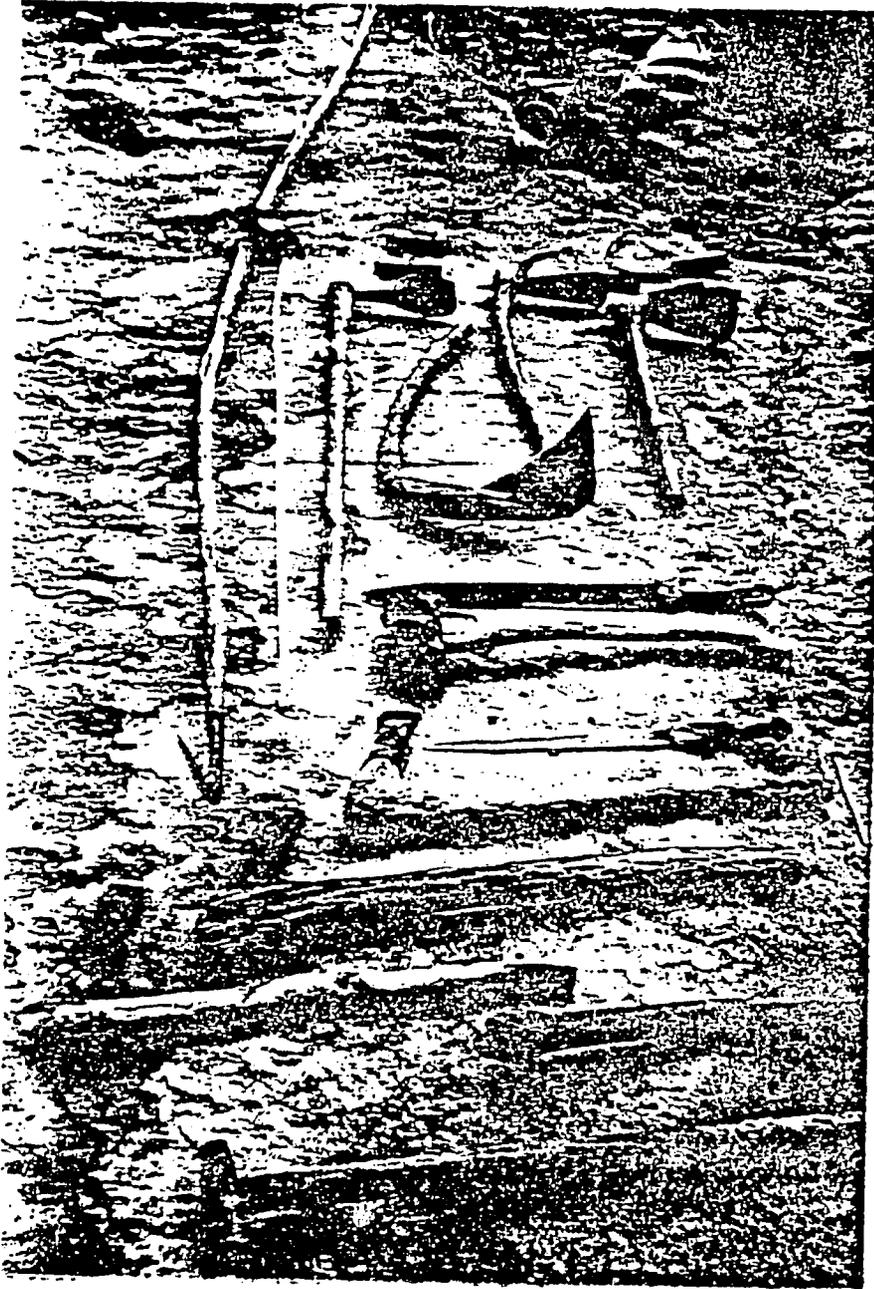


A Dogon farmer cultivates his millet plants in a rock crevice on the plateau.



A Dogon household compound. House construction is of stone covered with mud and windowless. Niches above door (left) store small items. Dry wood piled by granary (right) provides fuel for cooking. Household items include calabashes, wooden bowls, clay cooking and water pots, mortar and pestle, and baskets. Typical notched log ladder provides access to roof and to granaries. Similar ladders are in place along the cliffs, facilitating the climbing of rock surfaces.

Plate 7.



Dogon tool inventory (1 meter reference): cutting blades for millet, sickles for harvesting fonio, various hoes, long-handled cutting hook for tree leaves and fruits, and axes. European sledgehammer, machete-type knife, and shovel (not visible, handle in foreground) are less common items.

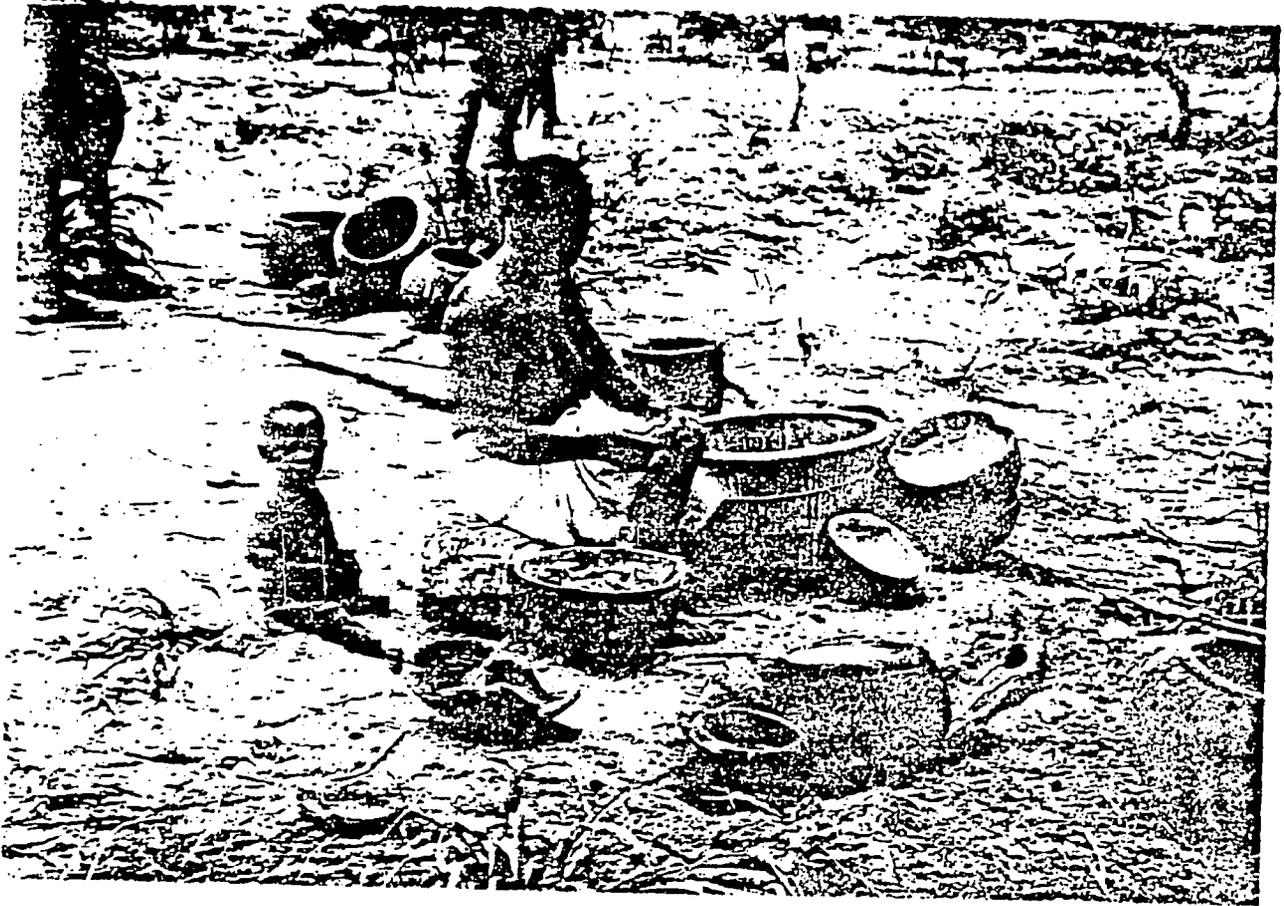


Sowing after the first rain. A Dogon farmer drops millet and sorghum seeds randomly into hills of "green manure" he has opened with one chop of his long-handled hoe. Unopened hills formed during the weeding operation of the previous year are visible in the background.

Plate 9.



Millet field on the Seno Plain. Dogons from the plateau descend to the plain to cultivate millet, living for a week at a time in seasonal huts in the fields. Light tree cover characterizes these fields.



A Dogon woman prepares a meal among growing millet plants on the Seno Plain. Dogons working on the plain must transport water to drink from the plateau or walk long distances to hamlets on the plain to draw water from wells that are up to 60 meters deep.



Bundles of millet attached with strips of tree bark have been dried on roof tops and are now assembled to be put in earthen grain bins (see Plate 12). Children wear the flowering seed stalks of onion plants as necklaces, reflecting seasonal agricultural work divided between grain crops and garden crops.



Earthen grain bins topped with conical thatched roofs in a household compound. Millet on the head is stored in the large granaries which, in size, average 3m x 1.75m x 2m and hold 60-80 bundles. Smaller granaries serve as "kitchen pantries" and for storage of threshed fonio, cowpeas, sorghum, and other nonfood items. Other granaries hold ritual objects and have no agricultural significance.

Plate 13.



In their "off hours," Dogon males fabricate baskets which are a trade item as well as an essential household and farm item. In Dogon baskets, seedlings are started, manure is carried to the fields, harvests of grains and vegetables are transported, wild foods and wood are gathered, goods are carried to and from market, and household items are stored.

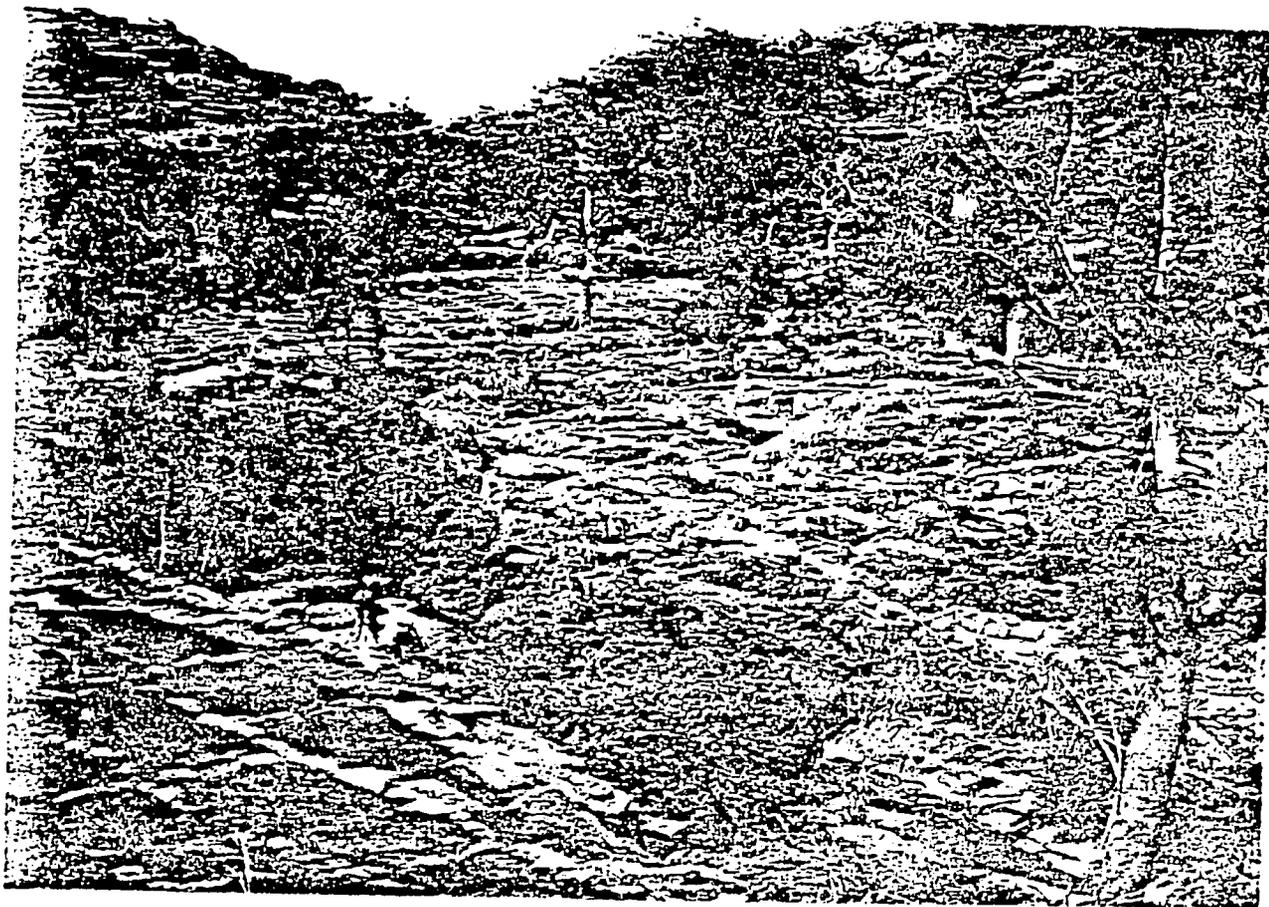


Males harvest fonio in a valley of the plateau. A stand of millet grows next to the fonio. A small seasonal stream (not visible) runs beside the millet and is planted with rice.



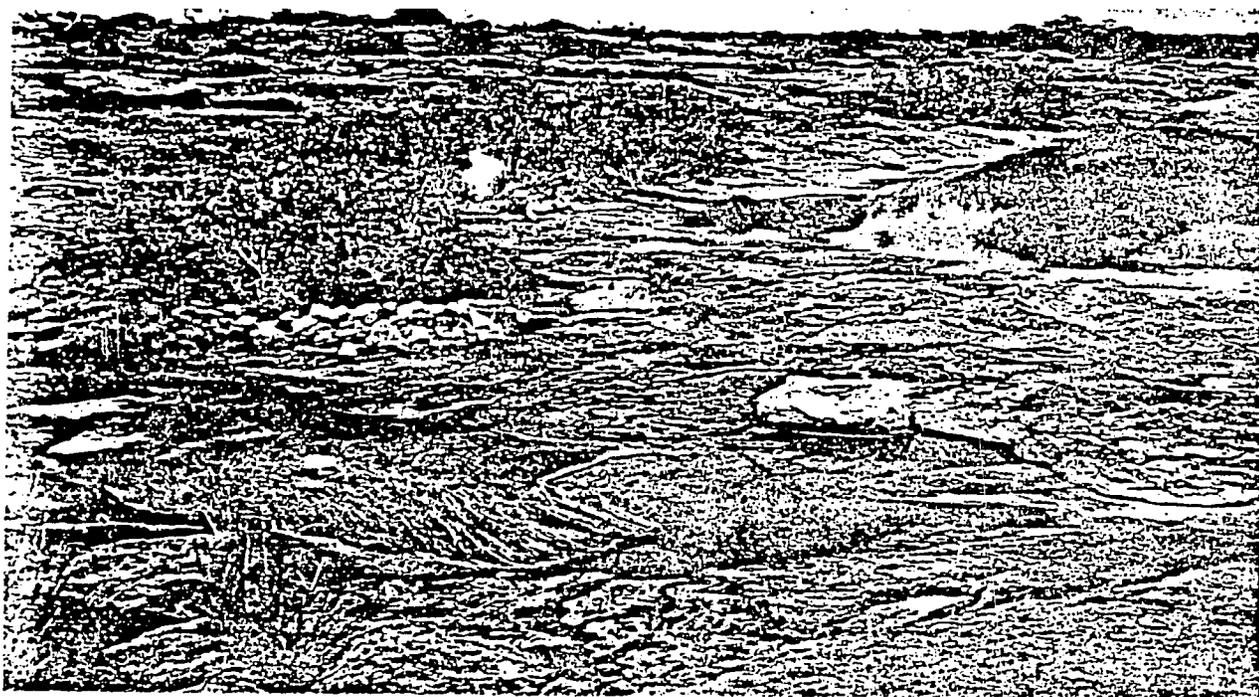
A Dogon woman carrying her child gathers cut fonio for drying and eventual threshing.

Plate 16.

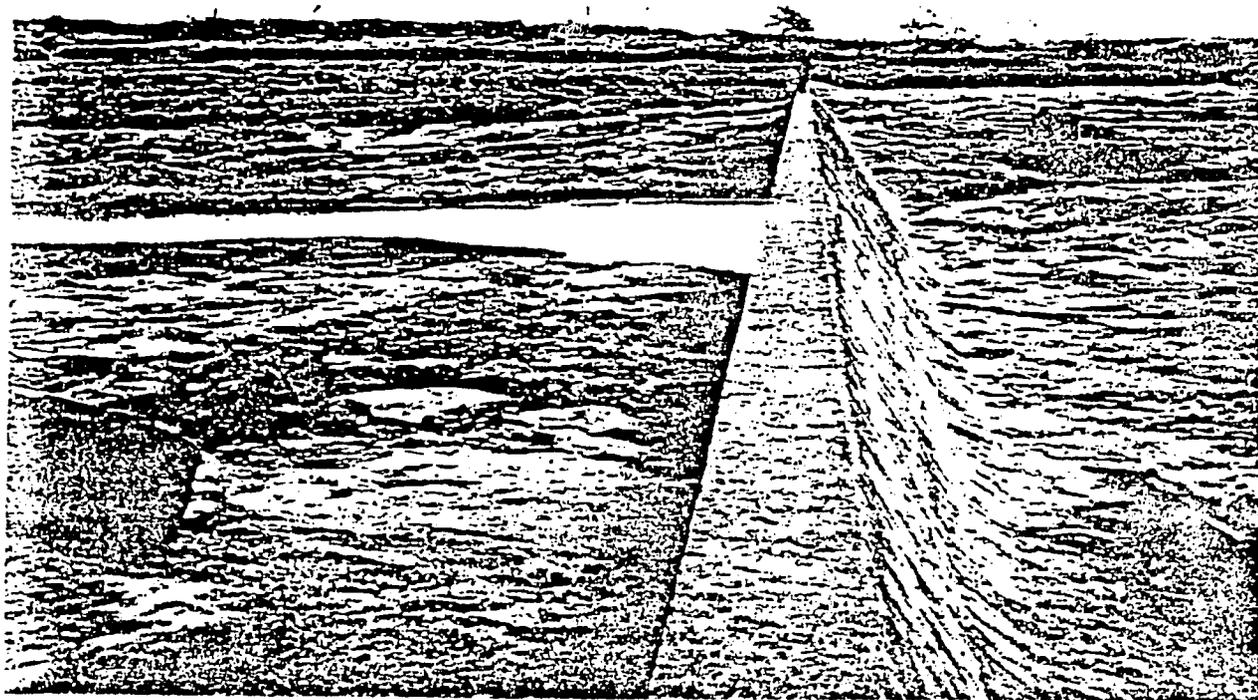


One of many different types of Dogon garden sites. Small onions grow in terraced plots around a water source..

Plate 17.



A cluster of small gardens built on bare rock outcrops. Maize and tomatoes are tightly interplanted and are hand watered from the pooled rainwater in the foreground.



Small dams such as this one at Dourou built in 1965 allow more extensive gardening and a longer growing period. Approximately 30m long and 4m high at the central, deepest point, the dam is constructed of stone and concrete. During the rainy season the entire area shown here, including a part of the garden area visible in the background, is flooded with just one rain. In the absence of floodgates, however, silt buildup is an unresolved problem; deep silt borders the water shown in this picture and is not removed by the population.



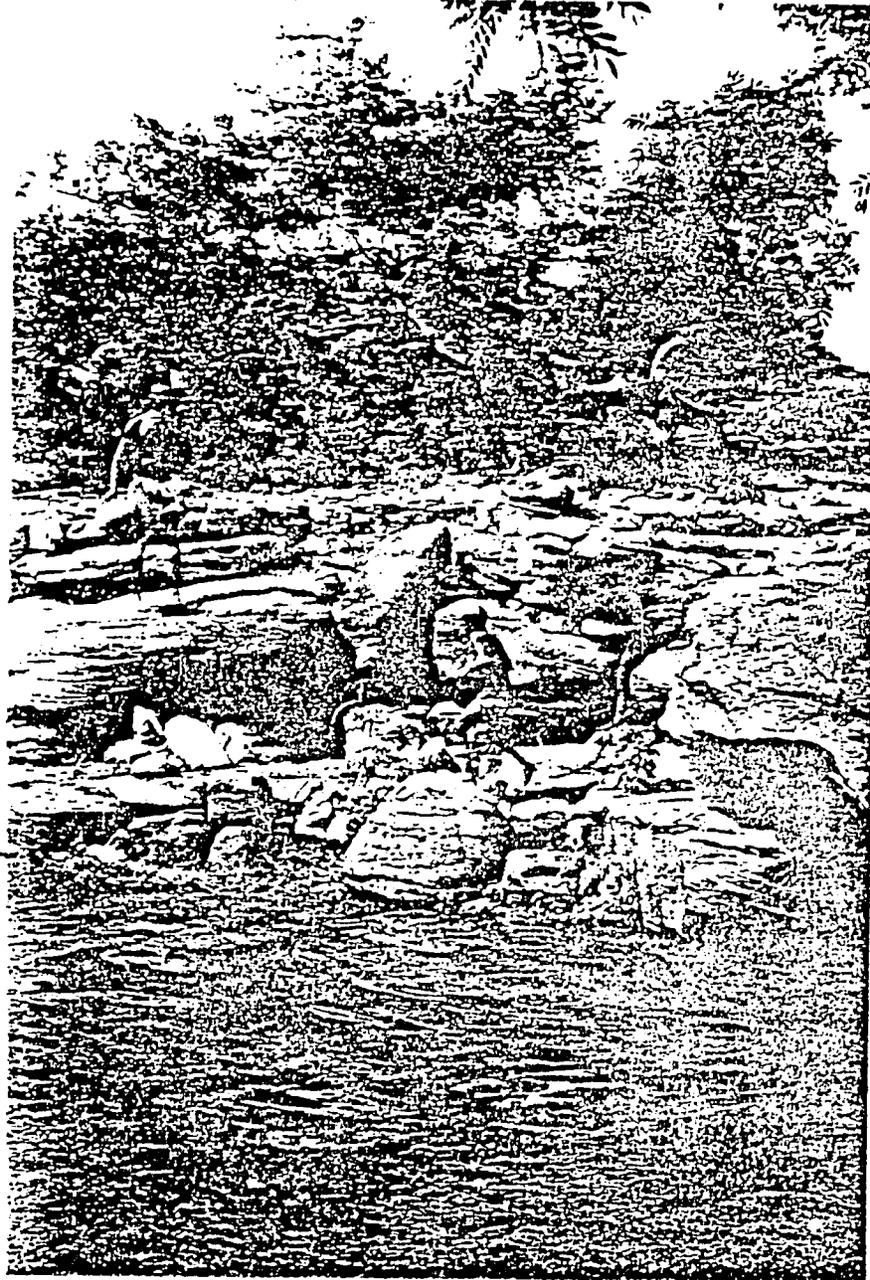
A Dogon farmer prepares the foundation for a new garden plot. Sledgehammers are used to break up large rock outcrops into appropriately-sized pieces.



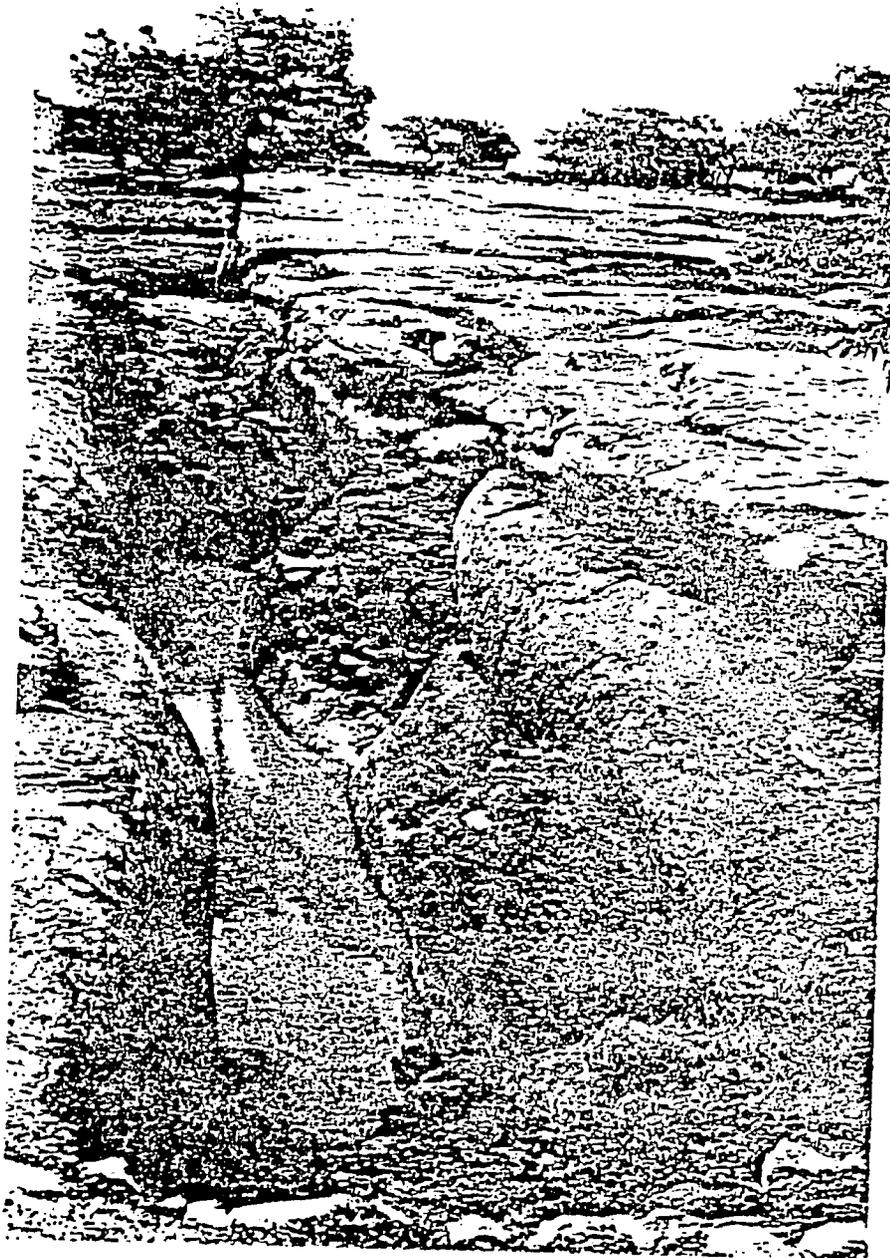
Farmers tend their onion crops. Within three days of planting, onion sets sprout; within 50-60 days onions can be harvested if growing conditions have been good.



A late rain has flooded this farmer's onion garden. The farmer attempts to recover the onion sets he had planted the day before. As the sets were not yet established, they can be replanted. Had the rain come two days later, the farmer would have lost his entire investment in seed onions.



Gardens are hand watered with calabashes from a seasonal pool of rainwater. Calabashes vary in capacity but generally hold about 15 liters of water.



Fissures, or faults, such as this one are common on the plateau, providing walk-in wells for drinking or irrigation purposes. This particular one provides village drinking water and is also a watering hole for animals; it measures 27m long, 5m wide, and 8m deep.

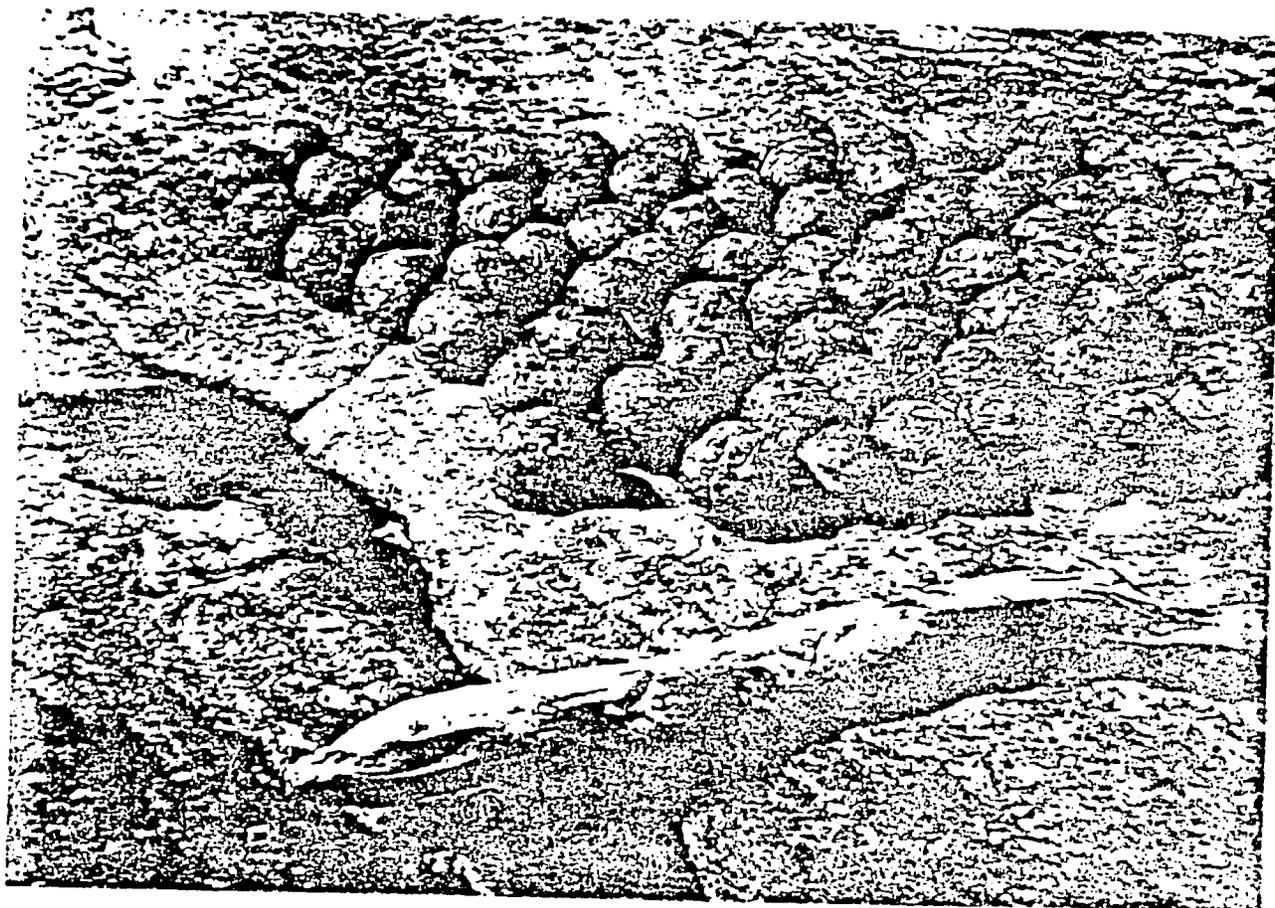


The onion harvest. First the green tops are cut off with a knife and processed into leaf balls (see Plates 25-26). On the day following, usually a market day, the bulbs are dug up with a hoe. The small, many-cloved shallot-like onions lose moisture content rapidly, so storage is kept to a minimum. If not sold shortly after harvesting, the onions are pounded in a mortar and dried in balls for later sale.



The onion tops are pounded with heavy sticks to break down the leaf structure. Handfuls of the resulting mass are formed into balls and as much of the liquid component as possible is squeezed out.

Plate 26.



Onion leaf balls, 20-25cm in circumference, are left to dry on rock surfaces for approximately 10 days before they are marketed.

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21 August 1977

To: Dr. Michael M. Horowitz, Professor, SUNY at Binghamton

From: Riitta K. Eskelinen, RFSUNY Research Assistant in
Social Anthropology

Field Report, Dogon Cereals Project: Demographic Variables in
a Village Population

This fifth in a series of field reports on the Dogon peoples of the Bandiagara Plateau of the Mali Republic addresses itself to an analysis of demographic variables. Based on field observations and data collection over a 15 month period, the results tabulated here illustrate demographic conditions in a Sahelian population inhabiting an extremely marginal habitat.

Poor of soils and receiving only some 500-600 mm of annual rainfall concentrated in 3-4 months of the year, the Bandiagara Plateau offers a subsistence of the harshest sort to Dogon millet and sorghum farmers. Agricultural work is carried out wholly by labor intensive hand-hoeing methods. Limited soil areas on the rocky plateau lead farmers to practice bush fallow farming on the adjacent Seno Plain at distances of up to 20 km from the village. In addition, Dogons grow a post-rainy season cash crop of shallot-like onions requiring labor inputs at a time^{which} coincides with peak work loads revolving around the harvest and transport of millet. The labor of many hands, young and old, is needed for the timely soil preparation, sowing, cultivation, harvest, transport, and storage necessary to assure a food supply for the coming year.

In the study village (population 1274), 91% of males age 15 and older participate in farming activities, 74% of females age 15 and older contribute agricultural labor, and 11% of combined males and females under the age of 15 are engaged in farming activities. These statistics do not speak to the additional labor performed by women and girls: gathering (wild foodstuffs, wood for cooking fuel, and water), lengthy daily food preparation, and child care.

It is no surprise, then, that village attitudes are pro-natalist. To eke out a living in this harsh environment requires a great expenditure of energy; every child born offers the hope of an additional worker, if he or she survives. Moreover, for the long term, children are the only buttress against the infirmities of old age.

For the Dogon, as for other Third World peoples, the complexities of the population problem are manifold. There can be no argument that balanced population growth is an important component of economic development, but what does this mean in

2.

terms of the day-to-day realities of subsistence agriculturalists such as the Dogon? The dilemma is clear: without a certain (undetermined) number of children, Dogons cannot exploit the widely distant micro-environments which are essential to their livelihood. Hired labor is unavailable, and the feasibility of mechanization in most of these areas is very limited. At the same time, medical services are all but nonexistent, and infant and child mortality is high. In a sample of 108 females who had ever given birth to a live child, 87% had experienced infant/child loss. In addition, repeated childbirth drains the health of the female portion of the farming population as well as diminishing the chances of survivorship of subsequent infants. On the other hand, too much population growth risks exhausting the already fragile land and depleting the environment of such resources as tree cover with all too evident consequences for the population.

It is within this ecologic, economic, and social framework that the following demographic data are presented.

A Note on Methodology

For those familiar with population survey work in rural Africa, it is not necessary to comment on the numerous pitfalls which one may encounter in the field. For other researchers and development workers, a few words may be instructive. In the Dogon milieu, one collecting any information will immediately be confronted with problems of (1) unique identification of individuals, (2) delimitation of household affiliation, and (3) age determination. In addition, the vast majority of the population is nonliterate and non-French-speaking; moreover, some nine distinct dialects, some of which are not mutually intelligible except for salutations, are spoken in the region.

In the study village, as in other parts of Mali, one must uniquely identify individuals when practically everyone has the same surname and a limited range of first names, commonly based on birth order. One solution--omitting the surname and using the first name and the name of the individual's father--was an effective stopgap measure until individuals were known personally. However, this approach, too, can have its pitfalls if more than one person is recording data. As people convert to Islam--a dominant trend on the Bandiagara Plateau--they adopt Muslim names; at one point in my field work, I realized that three individuals for whom I had varied data were, in fact, one and the same individual who had quite innocently given different names on several occasions. Verifying census data can be time-consuming when other individuals (e.g., Animist parents) refer to people by other names than the ones they, themselves, have adopted.

Dogon villages are laid out as mazes seemingly for historical reasons of security. In older quartiers, two meter high walls

3.

surround household compounds and form unbroken walls along narrow passageways among the rocks upon which all plateau villages are constructed. While working in quartiers with which I was less familiar, I would lose my way from time to time much to the amusement of ever watchful Dogons on rooftops who would guide me back to my destination (passages through which even children would unerringly guide me without flashlights in the dead of night). Having once located a household, however, was only part of the problem. Given patrilocal residence patterns (the rule of taking up residence with or near the parents of the male partner in a marriage) and the practice of naming the eldest male (e.g., for tax purposes) as the household head of a large, extended kin group which was actually dispersed in separate dwellings, it was necessary to delimit more precisely actual consumption and reproductive units. This could not be done on the basis of food-sharing groups as some, but not all, kin groups ate together from communal grain stores during a part of the year and separately for the rest of the year. For demographic purposes, it was decided to survey households merely on the basis of sleeping arrangements. To some degree, this is inaccurate as teen-agers, for example, and some younger children sleep apart in separate houses although their daytime affiliation is to a specific household, though not necessarily that of their biological parents. Of 240 households surveyed, mean household size was 4.3; however, this reflects very little of actual social life and is no indication of numbers of children per biological parents, for children are not necessarily raised by their own parents but are redistributed among maternal and paternal kin.

Age determinations in a nonliterate population are difficult at best. Among the Dogon, people do not keep track of ages in years but have a general sense of age at certain life passages. Ages were estimated on the basis of various factors; for example, individuals' own perception of their ages (for males especially, ages seemed to be exaggerated due, undoubtedly, to the respect accorded older males in the society), age-matching with other villagers, coincidence of certain life events with a local event calendar (e.g., a major drought, a well-known battle against colonial invaders, the building of the road, the year of enlistment or return from French military service of certain individuals), and, in the case of infants, on the basis of dentition.

Age determinations for women were much more difficult than for men. Many women come from other villages making age-matching with peers difficult. I found women to be much poorer informants than men, the reason in part being that so little value is placed on women's lives. Males who could remember five generations of their patrilineage could not tell me the name of their grandmothers. A village elder I was once questioning about the age of his wife (and one who had listened to me on various occasions trying to elicit information on women's genealogies from older males) blurted out quite hostilely, "we aren't interested in women or women's ages. When we want a woman, we ask 'can she prepare millet, can she carry water, can she work?' We don't need to ask how old she

By governmental decree, all Malian males must obtain an identity card; on another form families are listed for purposes of taxation (women with 4 living children, incidentally, are not taxable). I did not find these documents accurate or useful; however, some individuals in rural areas are now obtaining birth certificates for infants which will prove invaluable for the future. In Mali as a whole, it is estimated by the World Health Organization Regional Office for Africa that 15% of births are currently recorded.

Population Composition

The total population of the study village is 1274. Ethnic composition is Dogon with 2 Mossi households and representatives of two artisan caste groups--a blacksmith and dependents (7 individuals) and indigo cloth dyers-leather workers (75 individuals). Administrative personnel, including school teachers, health workers, and agricultural agents of nonlocal origin, and their dependents number 40.

The population pyramid (age-sex distributions) is shown in Figure 1, indicating a young population in which 45% of individuals are under 15 years of age. The sex ratio, or number of males per 100 females is 94.

Dependency ratios (dependents per 100 population 20-64 years of age) are shown in Table 1.

Table 1.
Dependency Ratios, Dourou, 1977.

Youth Dependency Under 20	Aged Dependency 65+	Total Dependency Ratio
136.9	14.4	151.3

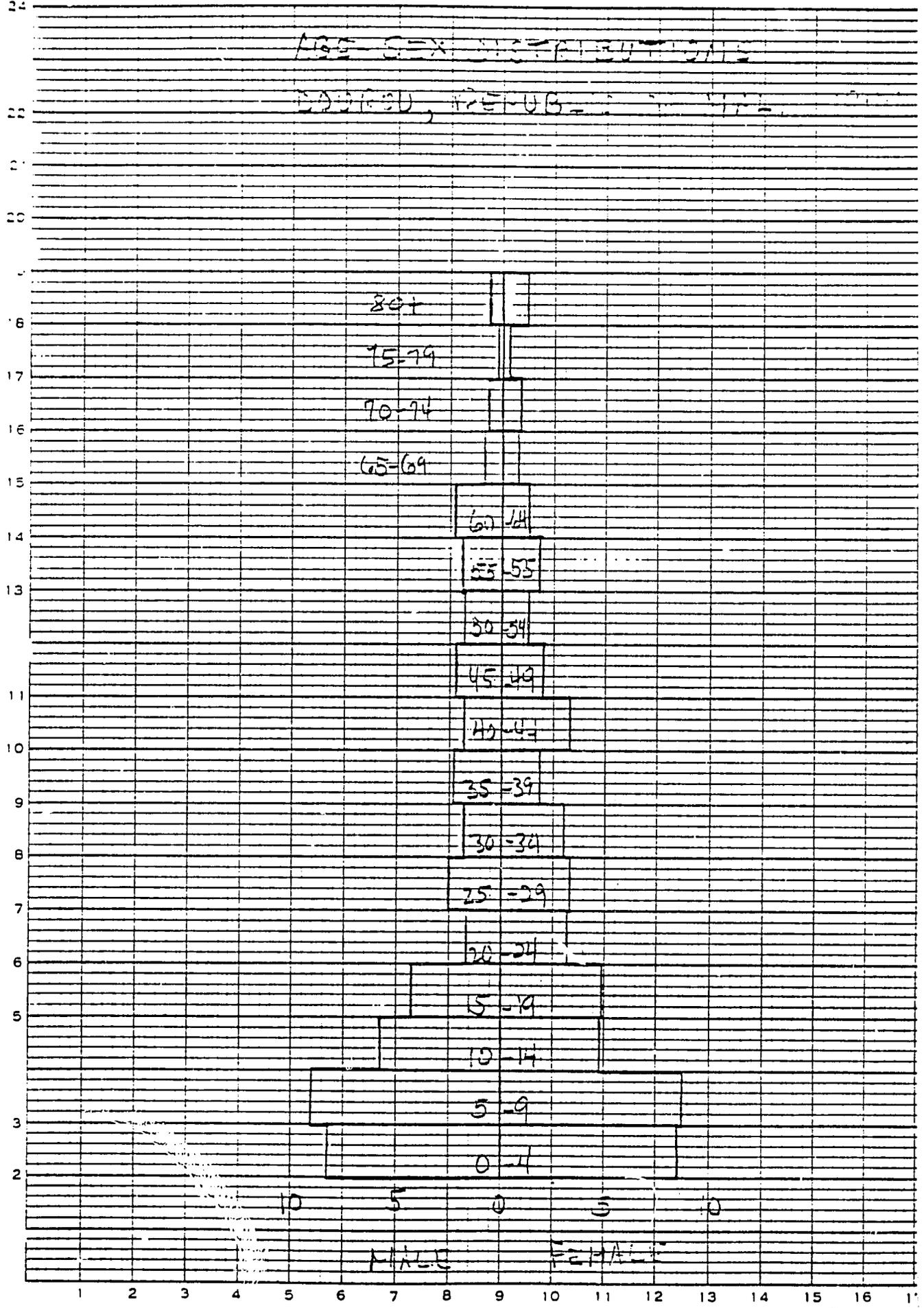
Population Distribution and Density

The settlement pattern is highly localized. Household compounds are honeycombed together atop rock outcrops. Two major quartiers (subdivided into 10 minor ones) are separated by a valley system and deep gorges. The 1274 inhabitants live within an approximate one square kilometer area.

The total land area exploited by the population in the

5.

Figure 1.



6.

cultivation and gathering of foodstuffs, the collection of water and wood and miscellaneous leaves, roots, barks, and wild animal manures is estimated at the very maximum to be 120 km², yielding a density of 10.6. However, some of this area is jointly exploited by other villages.

Vital Rates

The Crude Birth Rate (live births per 1000 persons living) is 46 for the year 1976-77. The Crude Death Rate is 27. Total deaths by age and sex are shown in Table 2.

Table 2.
Total Deaths, 1976-77, By Age and Sex, Dourou.
N=34

Age	Male	Female	Total
0-4	15 (44%)	13 (38%)	28 (82%)
5-59	-	-	-
60-79	3 (9%)	3 (9%)	6 (18%)
80+	-	-	-
Total	18 (53%)	16 (47%)	34 (100%)

The General Fertility Rate (total number of births during the year per total number of women of childbearing age) is 200. The Child-Woman Ratio, or Fertility Ratio (number of children under 5 years per 1000 women ages 20-49) is 991. Age-Specific Fertility Rates in Table 3 reflect relative fertility performance by 5-year age groups.

Table 3.
Age-Specific Fertility Rate, Dourou, 1976-77.
N=59

Age	# Women	Births	ASFR
15-19	63	5	79.4
20-24	42	9	214.3
25-29	41	12	292.7
30-34	39	11	282
35-39	25	8	320
40-44	44	10	227.3
45-49	26	4	153.8
	280	59	1569.5

Of the 280 fecundable women in the village (22% of the total population), 41, or 15% of all women 15-49 were found to be currently pregnant.

Data on migration are incomplete; observation could not be conducted on an ongoing basis for the total population. For the quartier of residence (population 419), there were 5 in-migrants and 1 out-migrant in a 12 month period. Extrapolated to the total population, such figures would yield a hypothetical rate of 12 per thousand in-migration and 2 per thousand out-migration.

The growth rate based merely on births and deaths would be 1.9% per year. With the hypothetical migration rates included, annual growth would be 2.9%, but it must be emphasized that this is a hypothetical construct, not a rate calculated from actual observations.

Natality Profiles

In addition to survey work, interviews were conducted with 130 females ages 15-80+ on their childbearing histories. The number of live births experienced by these women are tabulated in Table 4. Calculated also in Table 4 are mean number of live births by 5 year age cohorts and total cohort fertility profiles which indicate total numbers of children born to women who have completed childbearing. In Table 5, total cohort fertility is controlled for religion. In the population as a whole, of 240 household heads surveyed, 39% designated themselves as Animists, 10% as Christians, and 51% as Muslims. Women unfliningly adopt the religion of their husbands. As a generality, older people tend to be Animists while younger people are turning to Islam. The pervasive influence of Islam is demonstrated by the phenomenon of elderly women whose Animist husbands have died converting to Islam, their rationale being that no one will be left to bury them when they, themselves, die. I found one elderly woman who had converted to Christianity despite the fact that her husband was a steadfast Animist.

Table 5.
Total Fertility by Age and Religion, Dourou, 1977.
N=46

Age	Animist	Christian	Muslim
45-49	6.5	7.5	12.7
50-54	11	-	10
55-59	8.4	-	11
60-64	9.3	-	6
65+	8.2	6	8

Of 240 households surveyed, 20% were found to be polygynous the maximum number of wives being three. Animists accounted for 12% of polygyny, Christians for 2%, and Muslims for 86%.

Table 4.

Number of Live Births by Age of Mother, Dourou, 1977.

N=130

No.	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+	
0	22	-	-	-	-	-	-	-	-	-	-	
1	3	6	1	-	-	-	-	-	-	-	-	
2	2	6	1	-	-	-	-	-	-	-	-	
3	-	1	3	-	-	1	1	-	-	-	2	
4	-	-	3	3	1	-	-	-	-	1	-	
5	-	-	1	3	-	-	-	-	-	-	-	
6	-	-	1	1	4	2	1	-	2	1	3	
7	-	-	-	1	3	1	2	-	-	-	3	
8	-	-	-	-	1	2	4	-	1	1	4	
9	-	-	-	-	-	4	1	1	-	-	1	
10	-	-	-	-	-	2	1	-	1	-	4	
11	-	-	-	-	-	3	-	3	1	-	2	
12	-	-	-	-	-	2	1	-	1	1	-	
13	-	-	-	-	-	-	-	-	-	1	1	
	27	13	10	8	9	17	11	4	6	5	20	Totals
	# Women=130											
	7	21	35	40	57	151	86	42	53	43	161	Totals
	# Children=696											
	.26	1.6	3.5	5	6.3	8.9	7.8	10.5	8.8	8.6	8	
	Mean number of live births by age of mother											
	Total Cohort Fertility 7.8 10.5 8.8 8.6 8											

In the sample of women interviewed, of those who had ever given birth to a live child (N=108), 87% had experienced the loss of an infant or child; 6% had experienced spontaneous abortion and 5%, stillbirth. Every woman in the sample age 20 or older had given birth to at least one child; the one primigravida in the sample was 18 years of age.

Social Considerations

In demographic terms, marriage among the Dogon is an insignificant variable. Sexual exposure begins early in puberty and one or more births generally occur before a woman moves into the house of the man--the act which constitutes marriage in the Dogon milieu. There is no bride price or dowry and no ceremony or celebration of any kind. The woman is expected to bring her own clay pots and other cooking utensils with her.

By tradition, the first child of the union is given to the woman's parents to be raised. Subsequent children may also be distributed among members of the kin group; elderly widows and widowers living alone are commonly given young children to raise.

Divorce is a relatively simple affair--the woman leaves the household of her husband either of her own volition or at the behest of her husband. Both partners are then free to seek other mates. The husband is entitled to claim all progeny of the union. Divorce, in its traditional form, appears to have allowed women an unusual degree of freedom to extricate themselves from undesirable conditions (this is perhaps related to their economic contributions to the household through agricultural labor and providing food through gathering and trading). Efforts are currently being made by the Malian government to convince the population to enter into civil marriages which cannot be dissolved without going through the judicial process (revenues are involved). Demographically, women who can remove themselves at will from a marital union conceivably could spend less time at risk to pregnancy over the span of their fecundable years than women who are more or less permanently married.

Other influences on natality include the changing religious orientation of the population. Whereas Animist populations of the 1930s practiced postpartum abstinence for 2-3 years¹ combined with breastfeeding of infants, theoretically increasing child spacing and decreasing total numbers of children born per woman, current-day Islamic teaching requires resumption of sexual relations on the 40th day postpartum. In fact, the figures presented in Table 4 suggest that, for whatever reason,

¹ See, e.g., Denise Paulme, Organisation Sociale des Dogon, 1940, pp. 432-439.

mean number of births per woman is increasing. Dogons began converting to Islam approximately 40 years ago. For the cohort 45-49 (who would have been entering puberty after this time), some differential natality by religion does seem apparent.

Interestingly, the oldest woman interviewed, well into her 80s, had given birth to 3 children--all of whom survived to adulthood--and recounted birth intervals of 6-7 years. Current birth intervals are the order of 2 years.

Ages of spouses are not widely discrepant in the society particularly in the first marriage, but, again, age at marriage has little to do with childbearing patterns. Men may marry anywhere from their mid-twenties to early thirties; women tend to be in their late teens or early twenties. Older men who take a second wife may marry a much younger woman. In the event of death of the spouse, remarriage occurs for both sexes except in the case of post-menopausal females who do not remarry. (Menarche, incidentally, appears to occur about age 15.

In this population, education has no effect on natality as virtually no one of childbearing age has been to school. There are no alternative roles for women other than childbearing and domestic and agricultural labor.

Nutrition

Women in Dogon society eat a differential diet as compared to men in their own households. Men, having a cash crop income, can afford to consume meat at the marketplace while women seldom can. Women's diet during pregnancy and lactation is the same as it is during any other time. Women do state that they have a desire to "eat more" when they are pregnant. The high rate of infant loss among these women may be related to maternal nutritional status.

Children are universally breastfed; in the event of insufficient milk supply, "wet nurses" are employed until the mother can produce enough of her own milk. Bottle feeding is not known or practiced. Supplements to the infant diet begin at about 12 months; small tastes of food, however, are given as early as 3 months. There are no special foods for infants and children; they are given the same ground millet mixed with water or cooked millet paste with sauce that is the adult staple diet (all of which is soft in consistency). Milk is not available for children.

Weaning is begun when signs of the next pregnancy become apparent and is a traumatic time for the child. Some children refuse to eat at this time and cling tearfully to their mothers' breasts. Women sometimes put pulverized hot pepper on their

nipples to discourage breastfeeding. Many mothers are at their wit's end and long into their next pregnancy before weaning is achieved. One of the more indelible visions I have of the difficulties of the weaning period comes from witnessing the weaning process and ultimate death of a 2 year old boy I came to know. This child steadfastly rejected any nourishment (his mother was by then in her sixth month of pregnancy), became more and more dehydrated from a dysentery-like syndrome and died abruptly despite everyone's best efforts. I once observed a woman from another village breastfeeding a child of about 4 years of age; she related that a younger child she had been breastfeeding had died, so she gave her milk to the older child.

Natality Regulation

No evidence was found of the use of natalty regulating methods such as contraception, abortion, or infanticide.² Women denied any knowledge of such methods but were not convincing in their denials. One woman I questioned about a plant abortifacient I had heard about in the area assured me quite authoritatively that I could drink "a calabash full" and it wouldn't have the slightest effect in inducing abortion.

Young males intimated that young, unmarried females knew of certain plant products--"leaves"--which would prevent pregnancy or induce abortion. Some young people in the village felt that the anti-malarial drug, "Nivaquine," was effective in warding off pregnancy. Dogons believe that the days immediately following the menstrual period are the most fertile and the time when conception occurs. Informants stated that some young girls would refuse sexual relations during this time.

The veracity, or lack thereof, of these accounts is not as important as the fact that individuals of both sexes are aware that certain measures can possibly forestall pregnancy when it is advantageous to the parties involved. It is clear that young females wish to prolong their youthful days, but, at the same time, there is no other alternative for village women but marriage and childbearing and women must, in effect, demonstrate their fecundity before they marry. Nevertheless, the overwhelmingly pronatalist attitudes of the community need not be at odds with the view that longer birth spacing combined with improved nutrition, sanitation, and health care is a positive good for everyone involved.

Gender preference is for the male child. Questions about ideal family size invariably brought laughter and the response

2 One confirmed case of infanticide by strangling did come to my attention in another village but had nothing to do with population regulation as an issue. The individual--the grandmother of the newborn infant--was later seized by civil authorities and sent to jail.

that "all that God provided" was the number they wanted. An older woman in a discussion with her daughter said that one should bear 8-10 children in order to have 4-5 survive. Two younger women candidly informed me the number of children they presently had--3 and 4 respectively (although both had had 4 pregnancies)--would suffice.

Sterility does not appear to be a health problem of consequence in the area; however, it is devastating to the individual woman as it is she who bears the blame unless the male is obviously impotent. I knew of one woman who left her marriage and the village due to her inability to conceive although she entered a second marriage elsewhere.

Summary and Conclusions

In the Dogon milieu, women enter into sexual unions early and remain in them until their non-fertile years. Women continue to bear children even as their own daughters begin their childbearing period. Short birth intervals are the rule and total fertility rates are high even by African standards.

Seasonal labor migration by young males is all but non-existent in the area studied, exposing females to a high risk of pregnancy throughout the year. The more characteristic long-term migration to the Ivory Coast or other distant areas by young males (some of whom are already married) may have a demographic effect of decreased natality during the peak fecundable years of the women involved.

The primary responsibility for raising children is not necessarily borne by the biological parents, and children are valued in the society for the labor they eventually provide and for perpetuating the lineage as well as providing old age security.