

Fig. 1: Original 7-country area covered by the Onchocerciasis Control Programme and recent 1986 expansion of the control zone.

SEASONALITY, PLANNED SETTLEMENTS, AND RIVERBLINDNESS CONTROL IN BURKINA FASO

Della McMillan

Department of Anthropology, University of Kentucky, Lexington, KY 40506

I. Introduction: Seasonality as an evolving constraint in planned settlement extension programs

As a result of a massive ten-country program to eradicate onchocerciasis¹ in West Africa, large areas of fertile river basin land are becoming safer for human habitation (Fig. 1). National planners are often attracted to planned settlement projects² as a means of coordinating the development of these areas. There is a critical need, therefore, for policy planners to be concerned with the local social and economic processes that are involved in the design of successful planned settlements.

One planning problem that is often overlooked is seasonality. Although immigration to one of the underpopulated river basins covered by the control program may alter the nature of seasonality, it *does not* remove seasonality as an aspect of the farming system to which development planning must adapt. Moreover, I will argue that the failure of many projects to acknowledge the evolving nature of seasonality in settlers' cropping systems has contributed to their reported lack of success (Sawadogo 1979; Murphy and Sprey 1980; OCP 1984, 1985, 1986; Kelly *et al.* 1986) in developing intensive farming.

The question of predicting constraints of seasonality in planned settlements is complicated by the social and economic dislocations caused by moving into a new area. Comparative research on older planned settlements shows that most successful projects pass through a series of three- to five-year stages (Table 1) in terms of the settlers' adjustment to the new social and environmental setting (Hammond 1959; Brokensha 1963). These stages in turn influence the settlers' willingness and ability to adopt new technology and production strategies (Chambers 1969; Hansen and Oliver-Smith 1982; Nelson 1973; Colson 1971; Scudder 1985; Moran 1979). Because of this, we can predict that the nature of seasonality and seasonal constraints on production will be different in planned settlements that have been in existence for different lengths of time.

Table 1. A four stage model of new lands settlement

Stage 1 :	<i>Planning, initial infrastructural development, and settler recruitment</i>
	a. Feasibility studies, planning and design b. Construction of initial infrastructure and settler recruitment
Stage 2 :	<i>Transition</i>
	The use of the word "transition" is to emphasize two points. First, that this is a stage of transition for settlers who in many cases are moving from one habitat to another, and second, that this transitional period must end before settler families can be expected to take risks and increase significantly their productivity. While the duration of the transition stage may be less than a year, it could last for at least 2 years and more often for 5-10 years.
Stage 3 :	<i>Social and economic development</i>
	The distinction between the third and fourth stages has essentially to do with risk-taking. The transition phase ends when enough settlers shift from a conservative stance to a dynamic, open-ended one. It is during stage three that we can expect to see a wide range of investment strategies designed to achieve higher levels of labor productivity through diversification of the family estate.
Stage 4 :	<i>Handing over and incorporation</i>
	a. Handing over b. Incorporation
	Refers to the time when the administration of scheme activities is handed over to settlers and local governmental (non-profit) institutions and a second generation of settlers has taken over leadership roles.

(Source: Scudder 1984.)

A. The concept of settlement stages

In his summary report of the USAID-supported global evaluation of the development potential of new-lands settlement, Scudder (1984) describes four stages, each with a relatively distinct set of planning problems and opportunities. After the dislocation associated with the physical move (Stage One), a transition stage occurs (Stage Two). This refers to the first three to four years during which the settlers are in the early stages of adaptation to scheme policies. The transition phase ends when enough settlers shift from a conservative stance to a dynamic, open-ended one, hence initiating a third stage of economic and social development (Scudder 1984, 1985). This usually occurs only after settler security has increased due to the production of sufficient food and the increasing tendency of the settlers to feel more "at home" in their new environment. It is at this third stage, which Scudder calls "Economic and Social Development," that one can anticipate the settlers' shift from their earlier emphasis on extensive agriculture to a more diverse range of investment strategies that achieve higher levels of labor productivity. A fourth stage, "Handing over and Incorporation," refers to the time when the administration of scheme activities is handed over to settlers and local governmental (non-project) institutions and a second generation of settlers has taken over leadership roles (*ibid.*).

Policy planners need to recognize the existence of these stages in the development of planned settlements, because they influence the way settlers respond to seasonal constraints in the projects' proposed crop development programs. Furthermore, we can predict that the settlers' responses will be different after living at the project for different lengths of time. We can also predict the development over time of important differences within the settler population in terms of family structures, resources, and production success which in turn will affect the settlers' willingness and ability to respond to the seasonal constraints associated with certain types of production activities.

B. The research: a longitudinal case study

To illustrate the key role of seasonality in affecting settler production patterns, this paper describes the early results of the Aménagement des Vallées des Volta (Volta Valley Authority, henceforth AVV) of Burkina Faso. Since 1974 the AVV has coordinated a capital-intensive program of planned settlement and extension to work with settlers moving into the country's depopulated river basins. This represents an area of some 30,000 km², about one-tenth of the total land area of the country that has remained sparsely inhabited because of river blindness (Fig. 2).

More specifically this study describes the role of seasonality in determining how settlers living in one of the

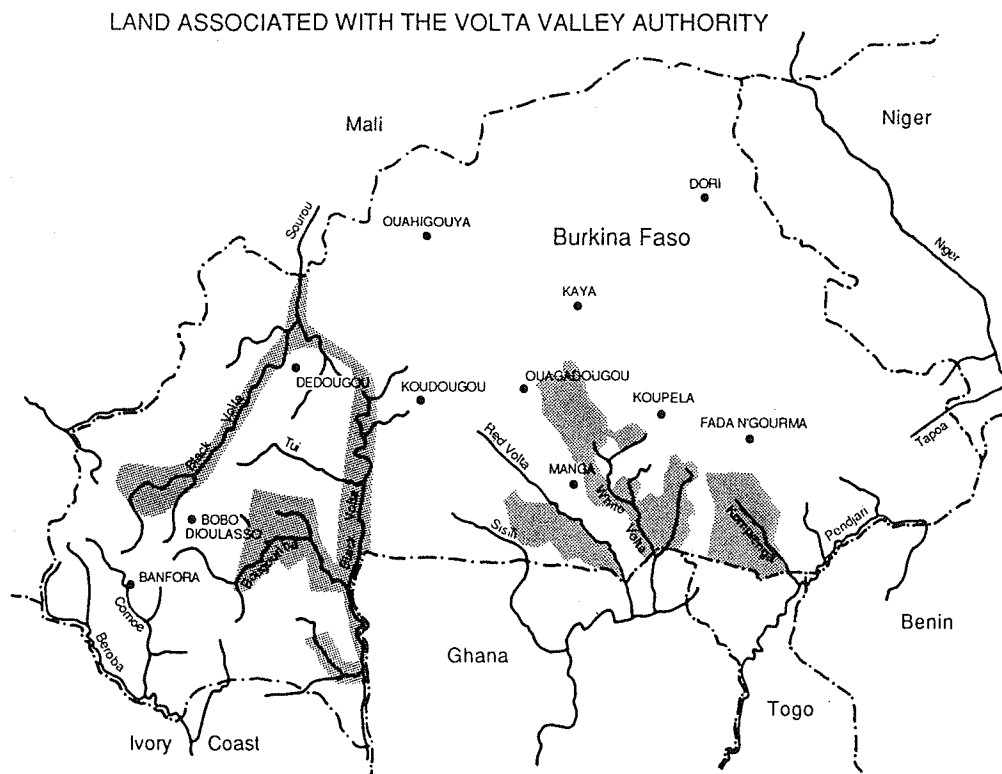


Fig. 2: River basin area placed under the jurisdiction of the Volta Valley Authority in 1974.

AVV planned settlements responded selectively to the AVV program to promote intensive farming. These selective responses are described over a 10-year period. The study explores some of the implications of these local-level processes for the attainment of the planned settlement's wider goals for technological transformation, increased agricultural production, and resource conservation. The paper also examines some of the implications of the research for future development planning in areas covered by river blindness control.

The settlers who provide the focus of the study immigrated from the same home village to the same AVV planned settlement between 1975 and 1977. The home village, Damesma, is located outside Kaya, a regional center to the north of the country's capital, Ouagadougou (Fig. 2). The planned settlement is located outside Mogtedo, to the east of Ouagadougou.

The baseline research for the case study was conducted between 1978 and 1980 (McMillan 1983). Crop production and income data were collected on settler households from Damesma and on 35 "traditional" households that did not immigrate to the project.³ Two restudies of the case study settlers were conducted during the 1983 and 1987 agricultural seasons (Table 2; McMillan 1984, 1986a, 1986b, 1987). Other sources of information on the project include extension records, as well as the results of a project-wide farm-monitoring survey.⁴

This paper is divided into seven sections. The next section provides a brief overview of the issue of seasonality and rural poverty in Burkina. This section points out that the 10-country program to control river blindness was expected to have a host of benefits in terms of reducing seasonality as a constraint on rural and national development in Burkina Faso. The organization and goals of the AVV planned settlement project and its program to promote intensive farming are described in section three. This is followed in section four by a discussion of the early results of the proposed development program in terms of technological transformation, yields, environmental impact, and income based on the analysis of the results of AVV farm-monitoring survey and the case study for the 1979-1980 crop year. The role of seasonality in affecting the settlers' initial participation in different aspects of the proposed extension program is discussed in section five.

In section six, I compare the early results of the crop extension program after five years with the results of the 1983 and 1987 restudies. The analysis shows that over time, the settlers tended to respond to the labor constraints in the proposed extension program by adopting a more diversified pattern of extensive crop production, livestock production, and off-farm employment. We also see the emergence of two socio-economic groups with different patterns of crop and non-crop activities. In the final section I discuss some of the implications of the research for future development planning

Table 2. Sources of information

I. Case Study

Baseline Research, 1978-1980

Farm survey of settlers from the same home village of Damesma living in the same AVV Planned Settlement near Mogtedo (n=9)

Farm survey of farm families in the settlers' home village of Damesma and two neighboring villages (n=35)

Restudy, 1983

Farm survey of the 9 original study households and 16 additional settler households

Restudy, 1987

Farm survey of the 9 original study households and 16 additional households

II. The AVV Farm Monitoring Survey, 1979-1980

Farm survey of settler production on official project fields (n=313, 1979)

III. Extension Records

For all the years of village settlement, 1975-present

in the AVV and other areas covered by river blindness control.

II. Seasonality and rural poverty in Burkina Faso

It has long been recognized that although seasonality cannot be considered the primal cause of rural poverty and hunger in Burkina Faso, it is an important part of a cycle of underdevelopment that operates "to keep poor people poor or make them poorer" (Chambers *et al.* 1981:2).

A. Seasonal rainfall

Rainfall in Burkina Faso is highly seasonal and provides the backdrop against which all production activities take place. There is a superabundance of rain during a short rainy season which lasts from June through September. This is followed by a longer dry season from October through May during which there is virtually no rain and temperatures are high.

There are three major ecological zones based on rainfall and vegetation patterns (Fig. 3):

1. Pre-Guinean in the south and southwest with arborous savanna and relatively plentiful rainfall (900-1500 mm);
2. Sudanic in the center with shrub and grass savanna (500-900 mm); and

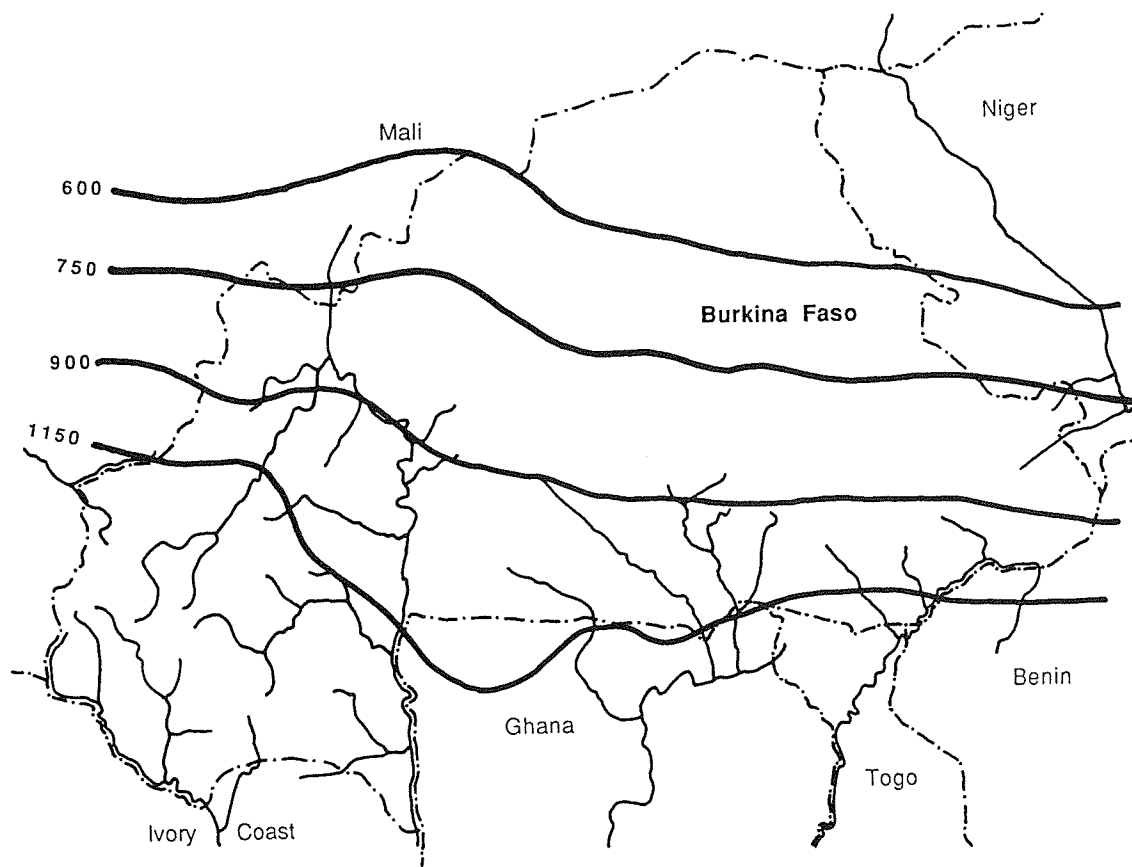


Fig. 3:
Major vegetation and rainfall zones in Burkina Faso.

3. Sahelian in the extreme north with drier shrubs and more desert-like environment with large areas suitable mainly for pasturage (250-500 mm).

In addition, the climate is characterized by large interannual variations in both the total volume and spacing of precipitation. Over the last two decades, the total volume and spacing of the rains during the years 1968-1973, 1983, and 1984 have been considered bad. Unpredictable short droughts at key points in the growing season are more the norm than the exception in the central Sudanic and northern Sahelian regions.

This wide inter- and intra-annual variation in rainfall with its associated implications for crop yields led farmers in the settlers' home villages to develop strategies to offset the effects of drought. Crop strategies include intercropping, planting more than one variety of the same crop in a single field, and planting the largest area possible with little attention to land preparation or weeding. Other economic strategies that tend to buffer the farmers' dependence on highly variable crop production include the maintenance of carry-over cereal stocks, holding livestock and other assets which could be sold to support cereal purchases in the

market, interhousehold economic transfers, seasonal migration, and hunting-gathering activities.

B. Uneven population distribution in relation to climatic resources

A second characteristic of Burkina Faso which interacts with the extreme seasonality of the climate is the country's high population densities and the uneven distribution of this population in relation to rainfall resources. Especially important is the fact that over half the population is concentrated on less than one fourth of the total land area, in the central plateau region. Population densities on the plateau in the mid-1970s (50-100 persons per km²) contrasted sharply with the relatively low densities (below 10 persons per km²) in the arid north and more humid south.

C. Seasonality, rural poverty, and foreign labor tours: a vicious cycle?

The majority of the farmers and pastoralists in the densely populated plateau region continue to depend on a highly seasonal pattern of subsistence agriculture. There are

limited possibilities for irrigation, and government programs to introduce animal traction have not met with much success (Mesnil 1970; Remy 1972; DeWilde *et al.* 1967: 369-390; SAED 1976; Broekhuysse 1974; Barrett *et al.* 1981). Due to high population densities, plateau farmers have been forced to shorten the fallow cycle necessary to restore soil nutrients lost in cultivation. This has had a negative effect on soil fertility and yields and increased the farmers' vulnerability to periodic and lengthy drought.

The extreme poverty of the central plateau has fostered out-migration. The best known population movement is that of young men who leave to work as labor migrants in the more developed coastal economies—in the past Ghana, today Ivory Coast (Remy 1973; Gregory 1974; Coulibaly *et al.* 1980; Finnegan 1980). Much of the migration in the colonial period could be characterized as seasonal, with migrants leaving after planting or weeding and returning in time to assist with early planting the next year. By the time of independence, it was estimated that one out of every five adult Mossi men were working in Ghana or Ivory Coast

(Balima 1969). Gregory (1974) speaks of a downward "spiral of migration, dependency and poverty" which began in the colonial period. Amin (1974) goes so far as to say that the economic and social impact of this early emigration was so severe that it excluded "all alternatives to increasingly unequal development" vis-à-vis the more developed coastal countries. Central to both arguments is the idea that foreign labor tours have reduced the manpower available for the performance of key crop production maintenance activities. Also important is the idea that the emigration brakes innovation by depleting the countryside of young men between the ages of 15 and 35 who are often those most interested in technological change.

D. Seasonality, poverty and agricultural out-migration: exporting the problem to a new frontier?

A second type of poverty-driven out-migration involves settlers moving off the plateau into the less populated areas of the southwest and southeast (Fig. 4; Conde 1978; Remy 1975; Marchal 1975; Schildkrout 1978; Ancey 1974; Izard

AGRICULTURAL MIGRATION FROM THE MOSSI PLATEAU

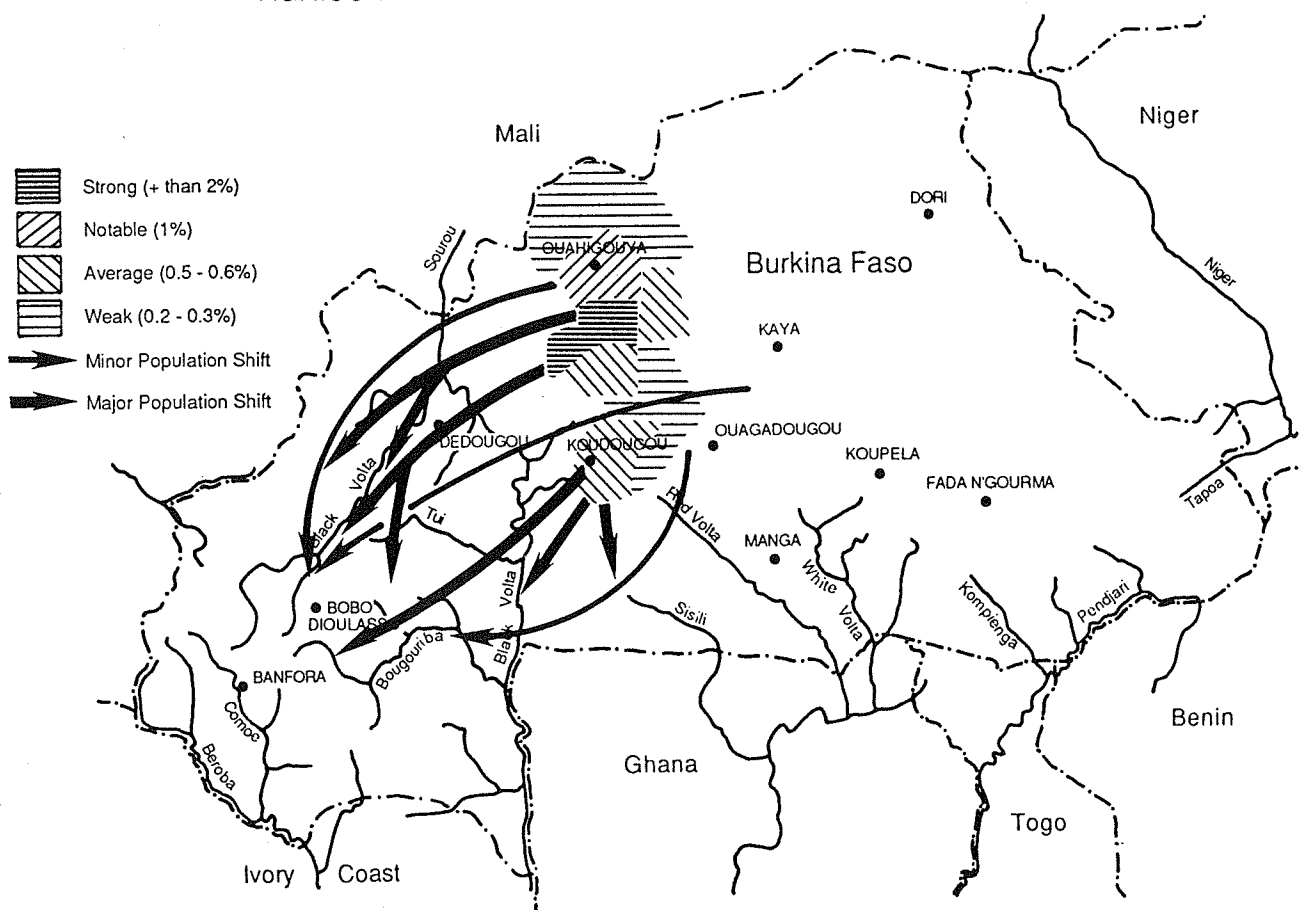


Fig. 4: Outmigration from the central plateau region of Burkina Faso.

and Izard-Hertier 1958; Lahuac 1970; Kohler 1968, 1972; Benoit 1973a, 1973b). By far the major criticism of this spontaneous new-lands settlement in Burkina and indeed throughout the world has been that it tends to reproduce extensive cultivation systems. At higher population densities, these extensive methods can give rise to many of the same environmental degradation problems that precipitated immigration in the first place.

E. River blindness and the protected river basin soils

Despite low population densities, relatively high quality soils, and population pressure on the plateau, almost no agricultural immigration has been directed toward the valleys of the Red, White, and Black Volta Rivers. This has long been attributed to the high incidence of disease in the river basins, especially river blindness.

The literature suggests a cyclical pattern in which the inhabitants of the river basins would leave the valleys and be forced to return when the inland soils could no longer support their numbers (Hervouet 1977, 1978; Marchal 1978). Williams provides a graphic description of the lingering demise of a village in a badly infected area:

...one-tenth to one-half of the men may be totally blind. Brides, traditionally drawn from neighboring villages, refuse to leave home. The younger men start to leave, to get out before they in turn go blind. As the population shrinks, the rate of bites per person increases. The village takes on the aspect of death. The children, rough stones in hand, listlessly scratch arms and legs that already itch with worms. As their sight is so far unimpaired, they act as human guide dogs for the already blind. The village compound of beaten earth, once well swept, is scattered with old animal bones and corn husks. The expanse of millet and sorghum fields gradually contracts. When the last old people die, so does the village. (1974:78)

Other reasons which may have contributed to the lack of settlement in the valleys include: (1) the lack of high quality farm land, (2) difficult access to drinking water, (3) flooding and waterlogging, (4) heavy soils, and (5) the high incidence of animal sleeping sickness (Berg *et al.* 1978:14). Nineteenth-century slave-raiding and a series of epidemics that ravaged the White and Red Volta valleys in the 1940s may also have contributed to the depopulation of certain areas (Hervouet 1977, 1978).

F. Anticipated benefits of controlling river blindness

The presence of these other factors, however, does not diminish the overriding importance of onchocerciasis in deterring settlement in Burkina Faso's river basins. Therefore, it was anticipated that the Onchocerciasis Control Programme (Fig. 5) could have a very positive effect on food production and the long-term development of the country's resources. First, it would create new settlement

opportunities on virgin soils in less drought-prone ecological zones for poor farmers from the plateau areas worst hit by drought in the early 1970s. Second, it would provide the Burkina Faso government with a vast fund of underpopulated valley land where it could coordinate infrastructure development from an early stage. The river basins were also an area where seasonality would presumably be less of a constraint on the local farming systems, thus enhancing the chances that national investments in infrastructure development would be offset by substantial increases in total food and cash crop production.

While the settlement and development of the depopulated river basins covered by the OCP was not expected to provide a panacea for rural poverty and development in Burkina Faso, it was intended to provide temporary relief from some of the most urgent pressures and to give the country "a vitally needed breathing space, time to address the fundamental problems: improvement and eventual transformation of farming practices in the direction of permanent intensive cultivation" (Berg *et al.* 1978: iv).

III. The Volta Valley Authority (AVV) planned settlement project

The Volta Valley Authority was created as an independent agency of the Burkina Faso government in 1974. By Presidential decree the project was given complete control of all settlement and development in some 30,000 km² (about one tenth of the total land area of the country) that have remained sparsely inhabited (Fig. 2).

A. Five year farm development model

At the local level the AVV was based on the progressive installation and development of groups of six to seven planned settlements known as blocs. The project was responsible for the selection of village, field, and house sites (Fig. 6); installation of basic infrastructure (wells, roads, bridges, extension worker housing; Fig. 7); and coordination of economic and social services. Settlers were recruited from the overpopulated areas most severely affected by the 1968-73 drought and assisted with their move. Since it was assumed that the majority of the settlers were from impoverished households with little or no reserve food stores, they were provided with a monthly ration of grain, oil, and fish, until they harvested their first crops (Fig. 8).

B. The AVV extension package

In return for the right to cultivate a farm in one of the AVV project farms, a settler had to agree to follow the project's program to promote intensive rainfed farming. Basic elements of the extension package included cultivation with animal traction (Fig. 9); the use of high levels of fertilizer and pesticides on certain crops; a new system of land allocation; new production techniques; cultivation of

Fig. 5:
 River blindness control: a river basin being sprayed by a biodegradable organophosphate that destroys the larvae of the black fly vector. The spraying was originally scheduled to continue for 20 years which is the period of time that an infected person remains contagious.

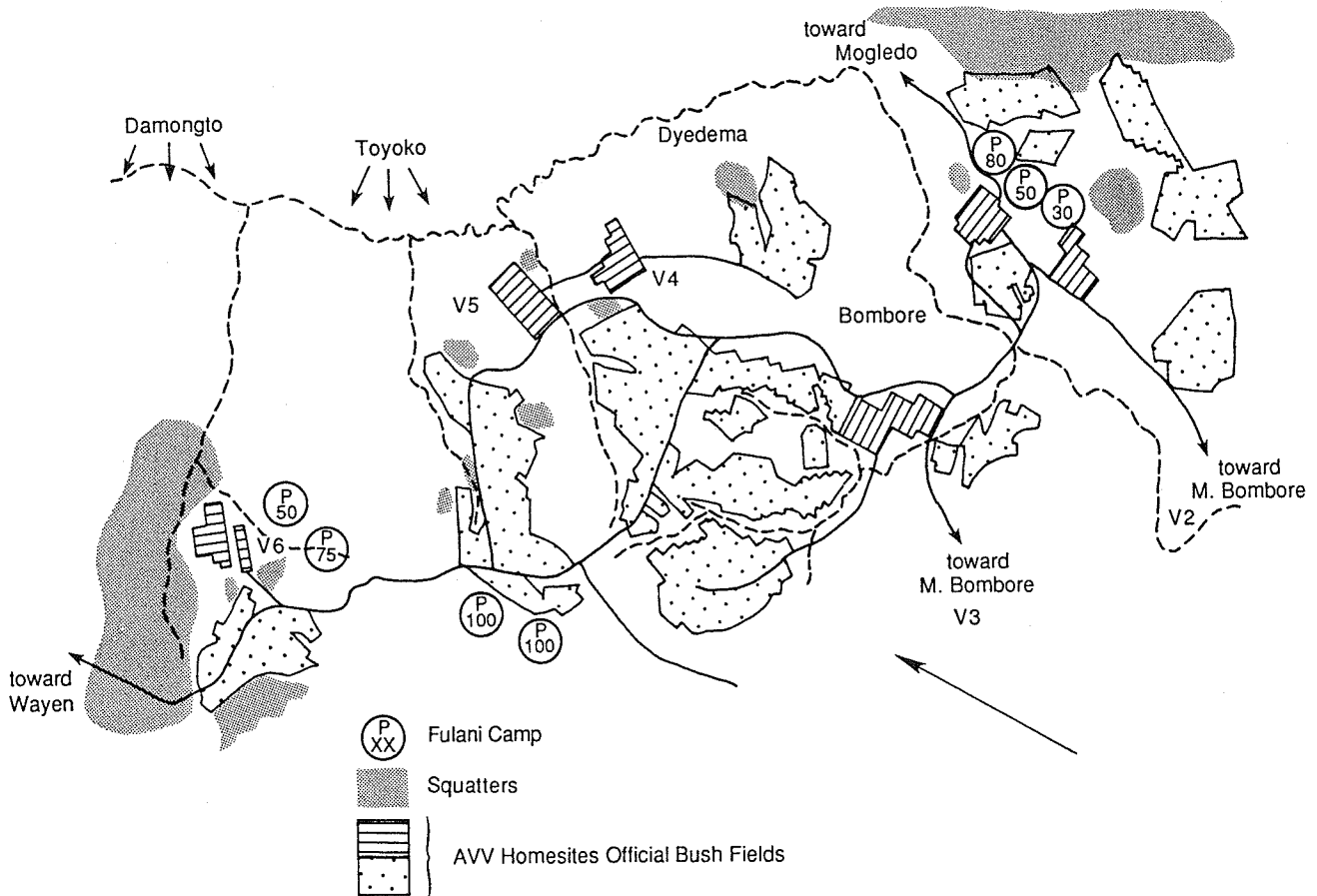


Fig. 6:
 Layout of a planned settlement, the AVV bloc of Mogtledo. The project was responsible for the selection of village, field, and house sites.



Fig. 7: Project constructed infrastructure: the well constructed by the AVV in the project villages. The project was also responsible for the construction of the 25 km improved dirt road and the bridges that connect the settlement to Mogtedo, as well as extension worker housing, a school, and a clinic in a nearby village.

the cash crop cotton; and a system of mandatory (*i.e.*, extension supervised) crop rotation (Table 3).

To enhance the chances that the settlers would follow the recommended cultivation methods and not simply plant the largest area possible, the AVV implemented a policy whereby the land that a settler was officially allowed to farm was to be gauged to the size and composition of the family labor force. This potential for labor was measured by a labor index which assigns weights to persons in the family according to sex and age. Since an adult male is considered to have the work capacity most readily transferred to a variety of tasks, this was the standard unit and was assigned a value of one. Women and children were assigned lesser values (0.75 for adult women, 0.50 for teenage boys, 0.25 for teenage girls). On the basis of this system each settler was assigned a farm classification or type (Table 4). The farm type was used to determine the size of farm to which a settler was entitled. The smaller households received six 1.5 hectare bush fields and a one hectare home (village) site; larger households received fields that were double-size or twice this amount (3.0 hectares). The labor index was also used to regulate the portion of each bush field that a household was allowed to plant. This regulation was supposed to be accomplished, and enforced, by the extension agent, who

Table 3. The recommended AVV crop rotation for the Mogtedo village group

Year	Crop
1	Sorghum
2	Cotton
3	Cotton-Peanuts-Cowpeas
4	Red Sorghum-Millet
5	Fallow
6	Fallow

would mark off an authorized area for cultivation on each of the official bush fields. The system of land regulation was supposed to work so that each farmer cultivated between 1.2 and 2.3 hectares, including the village plot, and from 1.0 to 1.7 hectares without the village plot. This was considered to be the maximum amount of land that could be cultivated in an intensive fashion using the recommended levels of technology.

During the first five years that a project village was in existence, this intensive cultivation package was to be supervised by a dense network of extension services, including one male extension agent per 25 settler households and one female extension agent for every 50. After the first five years, when the settlers would have presumably



Fig. 8:
Food assistance: settlers were provided with supplementary food rations during the first year of living at the project and half rations during the second year.

Table 4. Relationship between family labor index and acreage cultivated in the AVV program model

Farm Type	Labor Index	Area of Fields (ha)	Number of Fields	Total Area of the Farm (ha)	Area of Farm Authorized to Cultivate (ha)
I	1.75-2.25	1.50	6	9	3
Ib	2.50-3.25	1.50	6	9	4
II	3.50-4.50	1.50	6	9	5
III	4.75-5.75	1.50	6	9	6
IV	6.00-7.00	3.00	6	18	7
V	7.25-8.25	3.00	6	18	8
VI	8.50+	3.00	6	18	9



Fig. 9:
Animal traction: in most cases settlers were required to purchase two oxen and a plow after their first year at the project. In addition to the purported benefits in terms of reducing the drudgery of field operations, animal traction was considered to have substantial benefits in terms of improving land preparation and reducing weed growth, as well as providing the settlers with a good beginning on investment in livestock.

mastered the new crop production techniques, the ratio of agents to workers was supposed to be gradually reduced. This progressive reduction in project-specific services was supposed to continue until the administration of development activities in the valleys was placed under the pre-existing system of national extension services.

C. Anticipated results and costs of the AVV extension package

It was assumed that by using the recommended cultivation practices a farmer could obtain yields that were substantially higher than the national average. Moreover, it was assumed that the settlers' per capita food production and cash income would increase every year. During the first three years this increase would derive from the annual addition of a new field to the land the settlers were already farming. After the third agricultural season, any subsequent increase would come from the greater use of fertilizer and labor on the

existing crop area (*i.e.*, more intensive crop production) and the expansion of the settlers' livestock activities, rather than the addition of new fields. Although the proposed agricultural program required a greater outlay of cash and labor than the settlers were accustomed to in their home village, it was considered that these costs would be offset by higher yields.

The costs of the AVV planned settlement program were high, estimated to vary between \$13,500-15,000 per family for the first five years of village development in 1978 (Murphy and Sprey 1980). It was anticipated that the net result would be to create a prosperous band of intensive rainfed farming along the river valleys. The successful AVV farmers—farming with new technology, deriving a high percentage of their incomes from marketing their crops in regional markets, and enjoying a high standard of living—would then provide a model for development in the surrounding areas. It was also anticipated that this sort of

concentration of infrastructure in the planned settlements would provide a center for the coordination of extension, marketing, health, and education services once the valleys were being settled more actively.

IV. Early responses to the AVV extension package after 3-5 year of living at the project (1978-1980)

A. Failure to adopt intensive rainfed farming

An analysis of the results of the AVV farm monitoring survey and the case study for the 1979-1980 crop year indicates that the project was failing to achieve its objective of getting settlers to adopt intensive cultivation methods. Specifically (Murphy and Sprey 1980; McMillan 1983):

1. Settlers who had been at the project for shorter periods of time tended to follow the extension package more closely than those who had been there longer.
2. Cotton was the only crop on which the recommended package of intensive cultivation techniques was consistently applied. This included monocropping, chemical protection, planting in rows, and use of the recommended quantities of fertilizer, thinning, and timely weeding with animal traction.
3. Instead of increasing fertilizer use and reducing the area planted in order to perform more timely weeding, the settlers preferred to plant an even larger area than what they were authorized to farm by the extension service.

B. Positive effects on yields, income, and food production

The project was more successful, however, in achieving its goals of raising crop yields and settler income. In 1979 the case study settlers' cash income from the sale of livestock and other agricultural products was 172,000 CFA per household (US \$750) and 38,000 CFA (US \$160) per worker using the AVV systems of labor and consumption equivalents. This is more than seven times the recorded figures for the settlers' home village and represents an increase in sales from the equivalent of 16-39% of the recorded production of all crops. The case study showed that the average production of cereals per worker was three times the average quantity produced in the home village. This represented an average of 515 kg per family above the minimum food standards established by the FAO for the project.⁵

C. Potentially negative long-term effects on the environment

Although the settlers' yields were much higher than those being achieved by the settlers in the home village, the study suggests that these increased yields were primarily the result of the natural fertility of the new soils—not due to the successful introduction of the recommended package of technical innovations. The settlers were using fertilizer only

on cotton. Manure was seldom used on the fields except on the compound fields surrounding the house. By 1979 the settlers showed a strong tendency not to respect the fallow period or to grow the recommended area of leguminous peanuts and groundpeas—crops that have a potentially beneficial effect on replenishing soil nutrients lost in cultivation. Project staff predicted that this growing tendency toward continuous cultivation with little attention to soil conservation could eventually have a negative effect on soil fertility.

V. Seasonality in the settlers' evolving farming systems after 3-5 years of living at the project (1978-1980)

A. Seasonal labor constraints and the proposed crop model

Based on an analysis of labor data from 313 households included in the AVV farm-monitoring survey in 1979, Murphy and Sprey (1980) concluded that one of the principal reasons for the lack of attention to the prescribed cropping program was labor. Given the overlapping labor demands of the different crops in the AVV extension package, it was virtually impossible for the small-to-medium-sized households to perform the prescribed operations in a timely fashion. When faced with the option of reducing the land area planted, the settlers preferred a more extensive way of farming, with minimum outlays of cash and labor, and lower yields.

This point is illustrated in Table 5 which combines the average labor demands for different crops with the agricultural calendar for a hypothetical medium-sized household. Assuming that the farm family labor force has 5.25 labor equivalents using the AVV labor index (two adult men over the age of 17, two adult women, two teenage daughters, and two teenage sons, for example) and farms the total area of their six bush fields which they are authorized to farm under the AVV system of restricting crop areas, it would take them 17 working days to complete plowing and 17 working days to complete planting. If a settler family begins plowing when the first rains fall at the beginning of May, the plowing can be finished before the end of May and the sowing by the end of June.

To weed this area takes an average of 30 work days. Since no farmer will begin weeding until planting is completed, the weeding comes too late for most crops. Therefore, the farmer tends to give first priority to weeding the cotton and looks after the sorghum and corn with whatever time is left. As a result, in the AVV farm monitoring survey, cotton was the only crop that was consistently being weeded within the recommended time frame (*ibid.*).

The limitations imposed by this labor bottleneck at weeding were also apparent in the case study. By 1979 the recorded rainy season labor time for the Damesma settlers

Table 5. A comparison of the recommended agricultural calendar and recorded labor for a family of type III with 5.25 labor equivalents (in person working days*)

	Cotton	Sorghum	Other Crops	Compound	Total
Household (ha)	2.25	1.50	2.25	0.75	6.75
Recommended					
Sowing	June	July	June/	Up to	
Weeding			July	farmer	
Actual					
Plowing	29.25	29.50	29.25	9.75	87.75
Sowing	30.50	20.25	30.38	10.13	91.14
Weeding(1)	55.13	36.75	55.13	18.38	165.39
Weeding(2)	4.5	3.0	4.5	1.5	13.5

* The labor input on each field was measured in terms of units of labor days per person or per unit labor. Each day was considered to have four units, two morning (early and late) and two afternoon (early and late) (Murphy and Sprey 1980: 48). Numbers are based on a per hectare per crop average for the entire sample.

(Source: Murphy and Sprey 1980.)

was almost twice the recorded figure for the average home village farmer (1200 weighted hours per unit labor versus 600). This was not, however, associated with any greater care in the performance of the major cultivation tasks. Although the Damesma settlers cultivated an area per unit labor that was 40% greater than the home area farmers in the study, they spent less than half the amount of time in weeding (an average of 120 hours weeding per hectare for the settlers, 250 per hectare for the home village farmers, and 350 per hectare for sample farmers in two neighboring home area villages).

The majority of the increased labor time is explained by an elongation of the agricultural season due to extensive cotton harvests. In a good year, a cotton field can be harvested two or three times. Because of this, the settlers are able to pick cotton through January which is several months beyond the harvest of the main cereal crops.

This is a very different agricultural calendar from the one at Damesma, where almost all the rainy season crops are harvested by the end of November, after which there is a period of five to six months with almost no crop activities. It is during the dry season lull that farm families have traditionally engaged in the most extensive local manufacturing and trade. The large area of cotton that is planted at the AVV has reduced this period of low agricultural activity to less than two months. During the first year when settlers were clearing and destumping the new fields, there was almost no period of low activity.

B. Seasonal labor constraints and animal traction

The labor constraint at weeding was predicted in the original AVV crop extension plan. It was anticipated,

however, that the settlers' use of animal traction would provide a means of offsetting this constraint by making it easier for the settlers to plow a larger surface with a much lower expenditure of energy. It is symptomatic of the farmers' recognition of the purported benefits in terms of increasing drought resistance and reducing weed growth that even the sample farmers whose oxen had been stolen paid 14,000-20,000 CFA to have their fields plowed in 1979—one by tractor and one by rented animal traction equipment.

There was concern, however, that settlers were not using their animal traction equipment as extensively for weeding as the project would have liked them to. This was attributed to several factors. Many farmers, even after the fifth year, had difficulty using the equipment. An untrained animal or trainer could wreak havoc in a field. The difficulty of the operation was compounded by delayed weeding so that the size of the plants impeded the most efficient use of the equipment.

Another dimension of seasonality within the new production environment was associated with the care of the draught oxen. The Mossi have traditionally not kept their cattle on-farm (see Finnegan and Delgado 1980; Delgado 1979). Instead the cattle are generally boarded with Fulani herders who take the animals away from the established settlements during the cropping season, returning them to graze on the cut fields during the dry season (Fig. 10).

With the advent of animal traction at the AVV came the problem of supervising and feeding the oxen. The problem was compounded by the vulnerability of the settlers to cattle theft. The latter problem cannot be overemphasized as a factor affecting the adoption of animal traction in the valleys. In the densely settled home village area, the settlers'

cattle were boarded with Fulani herders, many of whom had exchanged with the Mossi farmers for generations. There was a hierarchy for resolving disputes resulting from the damage done by runaway cattle and for recovering lost and stolen animals.

The thick surrounding bush, and the social and geographical isolation of the settlers in the AVV invited cattle theft. As a result, one member of the family—usually a young teenage child—had to be entrusted with supervising the expensive oxen at all times, during the rainy as well as the dry season. For smaller families with few children or families with children at school, this created problems. One of the unintended results of encouraging and sometimes even forcing small families to purchase plow animals on credit was that many of the animals were stolen within the first three years. In 1979 alone there were four families in the study settlement which reported stolen animals; two of these households were in the sample. The one-time insurance cost (4,000 CFA in 1979) that the AVV settlers paid on the oxen did not cover theft, so that even if the animal was stolen, the farmer was supposed to continue to make his credit payments which were automatically deducted from the income earned at the annual sale of cotton.

In spite of the various drawbacks to the use of animal traction, the settlers were unanimous in extolling the advantages of that aspect of the crop development program. They were less concerned, however, about the benefits of the equipment in easing the physical burden of farm labor or improving soils than with the benefits in terms of owning livestock.

C. Seasonality and the availability of non-household labor

Settlers at the project, like households at home, were primarily dependent on their individual households for farm labor (an average of 85% for the Damesma settlers, 91% for the Damesma farmers, and 97% in the other two home area villages). The settlers did, however, show a substantial increase in their use of non-family labor both in absolute hours (669 versus 235 weighted hours) and as a percentage of total hours worked (15 versus 9%). The largest part of this increase was due to the greater use of hired labor (an average of 392 weighted labor hours or 9% of the total weighted hours for the Damesma settlers versus 12 weighted hours or 0.5% of total hours per household in the home village).

1. Increased use of hired labor. Despite this substantial increase in the use of hired labor, it was virtually impossible for the farmers to hire labor for weeding, which was the key bottleneck in the production cycle. At this time, all the planned settlements and indigenous villages alike were fully employed. Since land was easy to obtain, there was no such thing as a landless peasant who could be attracted to the work. Hired labor was used most extensively for cotton harvests, cutting cotton stalks from the fields before

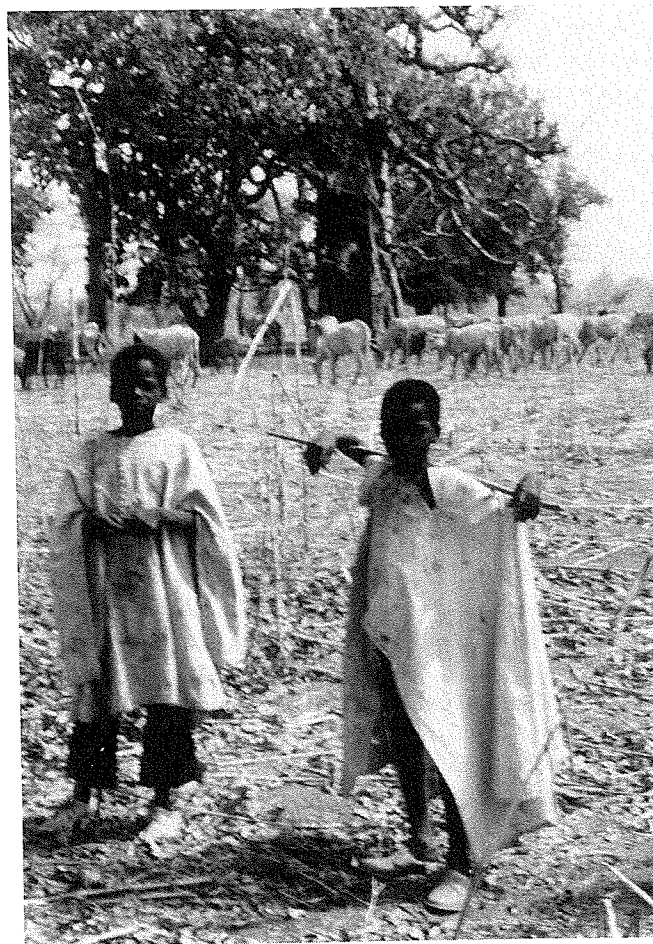


Fig. 10:
Boarding livestock with pastoralists in the settlers' home area. Livestock has always been the Burkina farmers' main way of investing cash and crop production. The traditional pattern has been for farmers to board their animals with Fulani herders who take the animals away from the farmers' fields during the rainy season, bringing them back to graze during the dry season.

planting, and second weeding—tasks which did not overlap in time with the periods of peak labor demand in the surrounding indigenous villages.

Almost none of the hired labor was provided by other settlers. The largest source was poor farmers from nearby indigenous villages who came to the AVV once they had harvested their sorghum crops. The typical pattern was for a woman and her children to board with an AVV household and work on a share basis, usually calculated at one sack of cotton for every six to seven harvested. Hired labor was attractive to the settlers because it enabled them to pick the same field two or three times (most family members refused to pick a field more than once).

Relatively few of the Damesma settlers had family members from the home village to assist them during peak

labor periods. Those who did complained that the work was too hard and the pay scale ridiculously low. One of the favorite entertainments in the settlers' home village was a deaf-mute's mime of how hard he had had to work during his short visit to the project. By 1979, a few of the farm families were actively recruiting nonrelated workers to assist them throughout the agricultural season. In many cases these were men who came without their families in order to explore settlement opportunities at the project.

2. *Limited role for traditional cooperative labor parties.*

In the settlers' home area one of the most important sources of non-family labor for weeding was the labor invitation (*shiswaga*), in which a farmer extended an invitation to his or her neighbors to assist in cultivation or threshing. In return the host provided the guests with food, drink, and occasionally entertainment. Although an invitation can provide supplementary workers during peak labor periods, it also plays an important social and political role. One of the special prerogatives of a village chief or lineage or clan elder is to issue labor invitations to assist in the cultivation of his fields, which are usually much larger than the fields of the average farmer. In turn, attendance, duration of work, and the number of workers each family provides are an indication of their loyalty to the leader.

Although a few settlers in the village engaged in the traditional pattern of labor invitations, it was considered to be an expensive practice and was more a reflection of the seniority and traditional or pre-project status of the farmer

than a norm within the local farming system. Only 2% of the average labor hours per household were procured through cooperative work parties, in contrast to 6% in the home village. The home village figure would have been much higher if the labor figures for neighborhood and village chiefs had been included in this calculation.

VI. Seasonality and the settlers' crop production and investment patterns after 11-13 years of living at the project (1987)

The restudies show a continued pattern of selective response to the labor constraints associated with different types of crop activities. Moreover the studies showed the settlers continuing to invest in a variety of non-crop production activities to offset the effects of intra- and interseasonal variations in the timing and total volume of rainfall.

A. Rainfall patterns over time, 1977-1986

Although the river valleys did have a higher average rainfall than the settlers' home village, the rainfall was still unpredictable in both its total volume and pacing. This variation was reflected in the rainfall figures that were recorded for AVV project villages (Fig. 11). For 5 of the years (1978, 1979, 1981, 1982, 1986) in the 10-year period from 1977 to 1986, the total amount and spacing of rainfall rated at or above the recorded average for the previous 12 years. Total rainfall was good but poorly spaced for 2

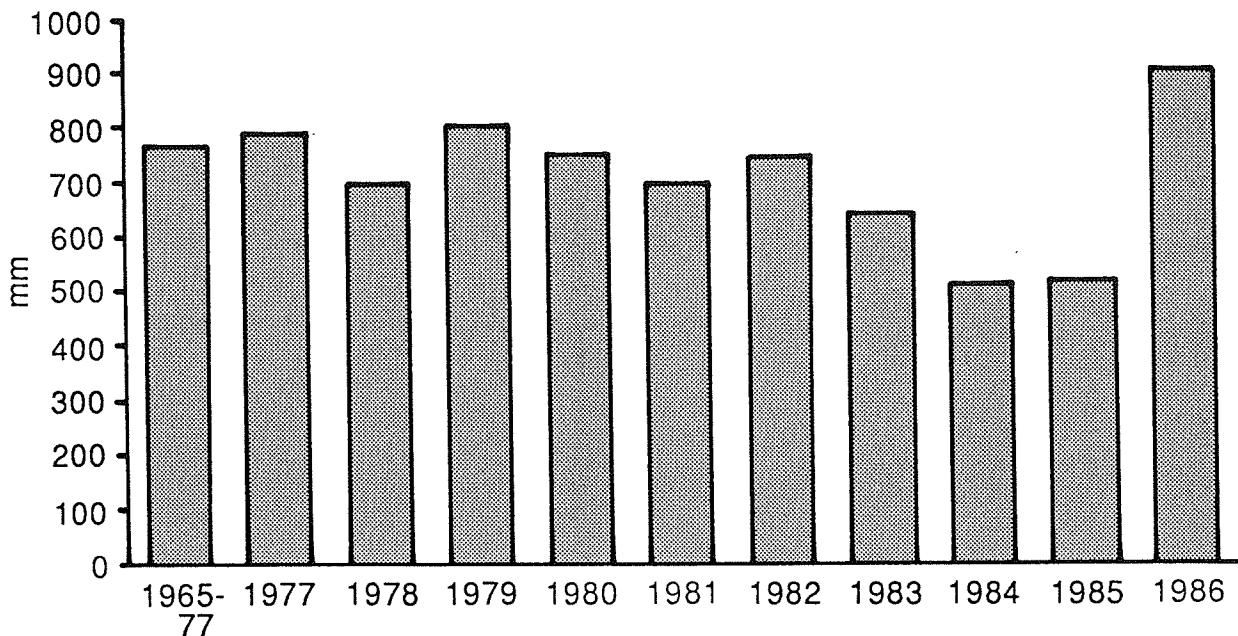


Fig. 11: Total rainfall for the AVV village bloc at Mogtedo, 1965-1977 (source of average figures for this time period: Extension Records, AVV), 1977-1986 (in mm).

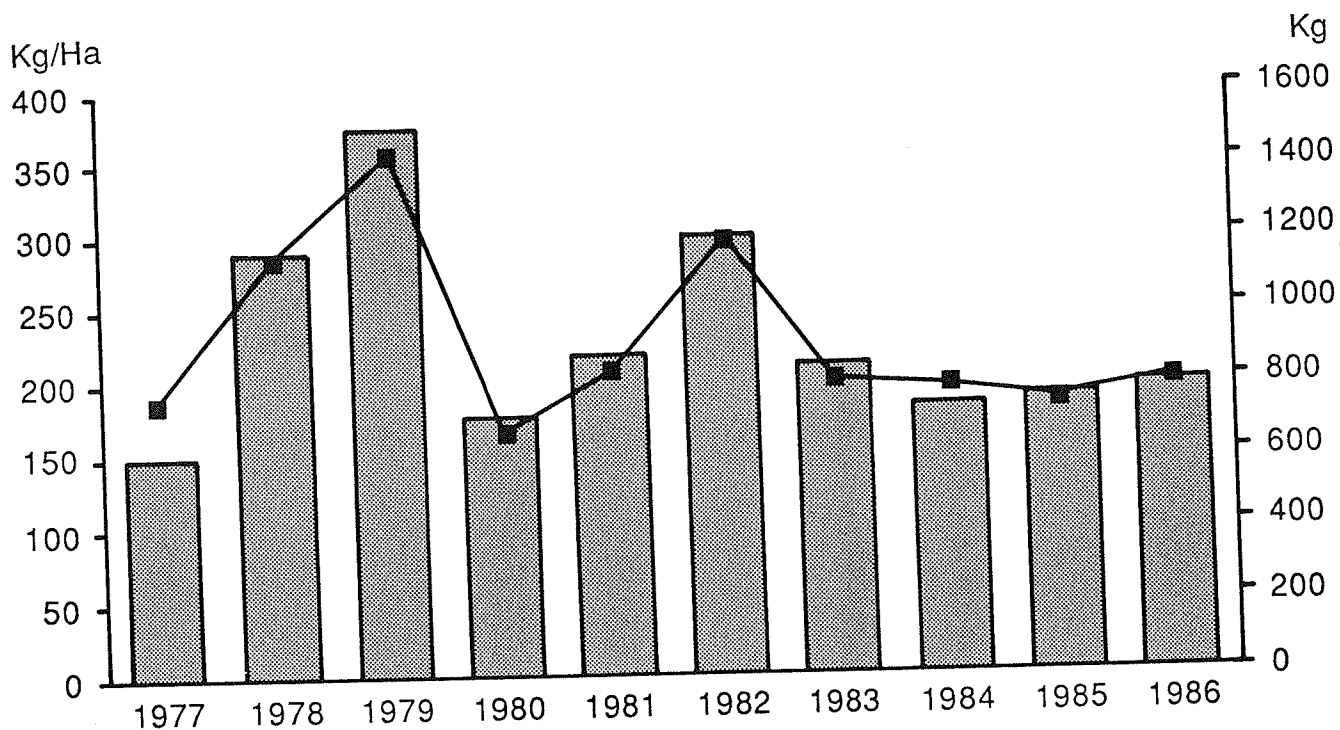


Fig. 12: Total cotton production (right axis) and estimated yields (left axis) for the AVV village bloc at Mogteto, 1977-1986. Solid line indicates yields in kg per hectare; bars indicate total cotton production in specific years.

seasons (1977, 1980). Rainfall was less than average in 3 of the years (1983, 1984, 1985); in 2 of these years (1983, 1984) the spacing of the rains was considered poor as well. In sum, out of 10 years, the rainfall in 5 years was considered good, in 3 below average, and in 2 successive years, disastrous.

B. Continued shift away from the project model for intensive rainfed farming

By 1987, most of the registered households living in the AVV planned settlement had been there for a period of 11-13 years. Those who were there for a shorter period of time were generally replacing earlier drop-outs. Crop data from 1986 and 1987 show a continuation of earlier trends, including a tendency for settler households (1) to plant a much larger area than they were authorized to farm by the project extension service, and (2) to use the recommended package of fertilizer and to give priority to careful weeding for only the cash crop, cotton.

Especially noticeable was a dramatic drop in the percentage of the total area planted in the more labor-intensive cotton in favor of the less labor-intensive cereal crops that could be marketed locally in the study village. This expansion of the area planted in cereals, at the expense of further expansion of cotton, is reflected in the slight leveling out of cotton production after 1979. This leveling

was observed for the bloc of AVV villages at Mogteto despite sustained population levels and yields (Fig. 12). Certain farmers abandoned cotton altogether. In 1986, for example, 14 of the 45 households in the study village planted no cotton at all (Table 6); 24 of the settlers who planted cotton planted less than a ton.

Table 6. Incidence of different levels of cotton production for the study village, 1979-1986

Production (Kg)	Crop Year		
	1979-80	1982-83	1986-87
6000+	2	0	0
5000-5999	1	0	0
4000-4999	2	2	0
3000-3999	3	6	0
2000-2999	21	12	2
1000-1999	14	15	5
500-999	2	4	9
1-499	1	5	15
0	0	1	14
Total	46	45	45

(Source: AVV Extension Records.)

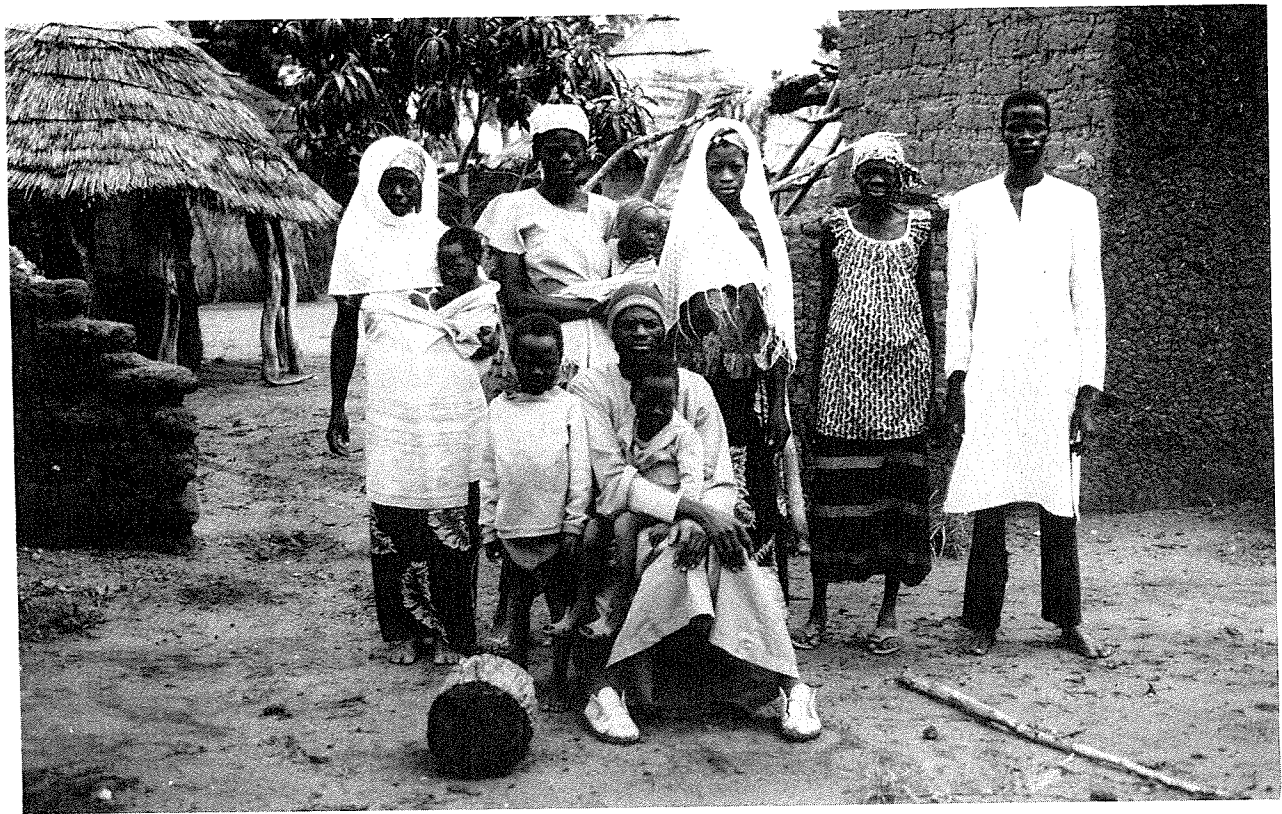


Fig. 13:
Changes in family composition and size: by the fifth year most settler households had increased substantially in size due to births and the immigration of additional family members. The farmer in this photo, one of the successful commercial farmers who left the project in 1988, first immigrated to the project with his wife and one child in 1977. He was later joined by his brother, who was then working as a laborer in Ivory Coast, and his elderly mother. By 1983 the brother was married with a child of his own, and the farmer had taken a second wife.

C. Greater diversification of investment

At least part of the explanation for this selective participation in the recommended crop extension program has to do with the growing tendency of the settlers to invest in various non-crop production activities. During the early years at the project, the settlers were involved in the heavy work of clearing new fields, and there was little time or money for non-crop activities such as livestock raising and trade. By the fifth year, the Kaya settlers had accumulated stores of reserve grain and had paid off all or most of their initial debts to the project. Some of the families had also increased in size through the immigration of additional family members (Fig. 13).

Having succeeded in achieving their early goals for increased production and cash income, the settlers, in the true spirit of incipient capitalism, wanted more. To break out of the limitations being imposed on them by the AVV extension service, the settlers wanted to plant the largest amount of land possible. It is at about this time that the larger households also began a pattern of investing in livestock.

1. Large livestock purchases. By 1979, many of the settlers in their third to fifth year at the project were selling their traction animals. An analysis of livestock purchases, sales, and upkeep during 1979 shows that the settlers tended to sell about the same amount of livestock that they bought. This was in sharp contrast to the home villages where recorded sales were three to five times the recorded purchases during the same year.

The substantial growth observed in village herd size by 1983 (Fig. 14) recreated the traditional—*i.e.*, pre-settlement—labor constraint on herding. As late as 1983 many of the families were trying to keep two to four untrained animals in pens by their houses along with their traction animals, and to have them supervised by a family member. The year 1982 was remarkable for the large number of cattle that were stolen. The result was that smaller families, with insufficient labor to supervise the animals continuously, quickly sold off their larger animals. This results in the slight dip that we see in total livestock ownership after 1982 for the village bloc (Fig. 14) and the growing number of settlers without animal traction or

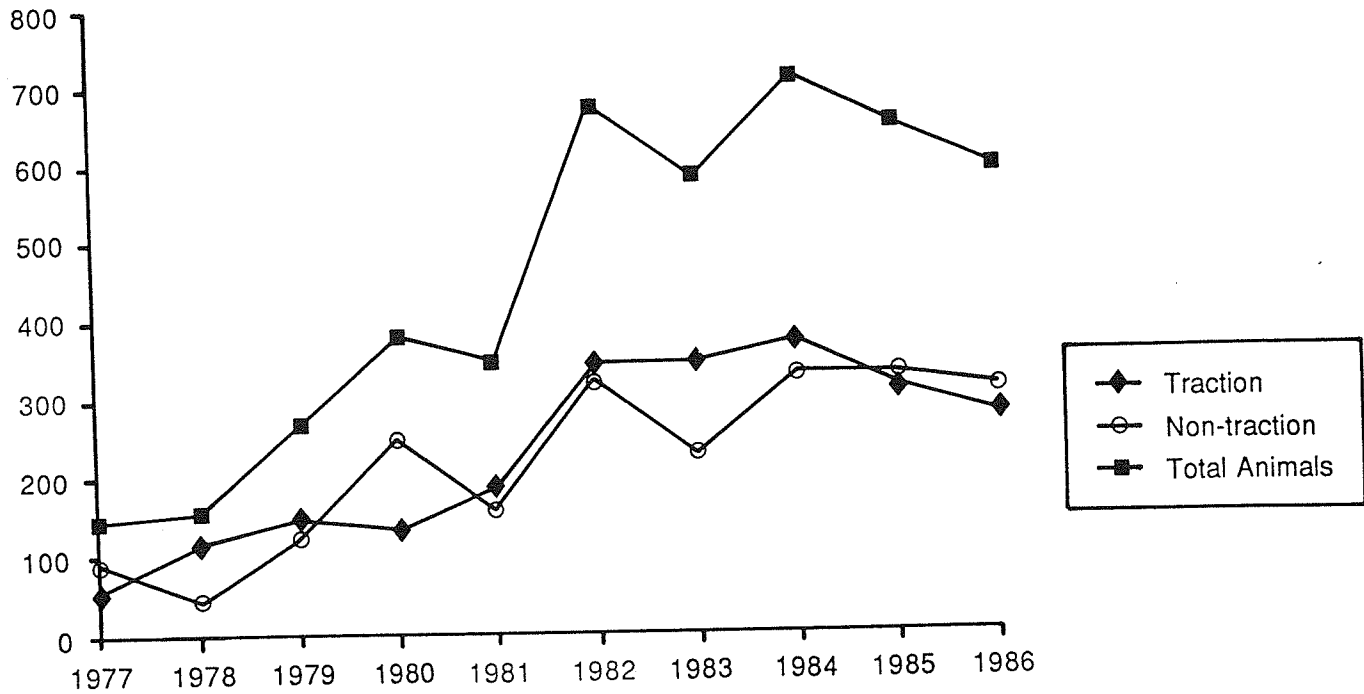


Fig. 14:
Total number of cattle registered with the extension service for the AVV bloc of Mogtedo, 1977-1986.

livestock (Table 7). In 1979-1980 almost every settler household in the village had at least two animals; by April 1983, at the start of the rains, 5 families had no livestock at all; by 1987, 11 families had no livestock. In most cases the farmers without plow oxen rented tractors to plow their fields before planting, except in a few cases where a member of their extended family would plow the fields with their oxen.

A growing number of the top producers—who by 1983 were accumulating small herds of 12-14 cattle—were starting to entrust their cattle to the one Fulani family living in the village. The Fulani settler family had a large corral in which they kept the animals during the night. During the day, the animals were taken away from the cultivated areas by a shepherd from this Fulani family.

One of the most remarkable developments we observed

Table 7. Incidence of large livestock ownership in the AVV study village (grazing cattle as well as cattle classified as traction animals)

No. Animals	Crop Year		
	1979-80	1982-83	1986-87
30+	0	0	1
20-29	0	0	2
10-19	0	3	1
5-9	17	5	8
3-4	22	12	8
1-2	7	19	10
0	0*	5	11
	46	44	41

*Figure probably inaccurate due to problem in my copying of the extension records for this year; some households listed as having 1-2 animals probably have none.

(Source: AVV Extension Records.)

in 1987 was the extremely large herds being accumulated by the same top three producer households that had emerged as leaders in cotton production as early as 1979. I observed a herd size of over 50 animals for two of the farmers and one of about 25 for the third in 1987. The full size of the herds is not reflected in Table 7 since farmers with large herds tend to downgrade the size of the herd they report to the extension services. A second tier of successful livestock producers with 4-6 non-traction animals was also apparent by 1987.

Equally striking was the fact that, in contrast to 1979 and 1983, none of the cattle were being kept on-farm or with the lone Fulani herder in the settlement. Instead, the settlers were all boarding their animals with different members of the same extended family of non-project Fulani herders. In retrospect, the seeds of this trend could be seen as early as 1979 when two of the top producers had started to board a few of their animals with Fulani herders in the region. The herders tethered the AVV settlers' animals near the temporary houses they constructed along the edge of the AVV settlement until mid-July, when the potential danger of keeping so many animals near the growing crops became too great. In contrast to the home village where the herders stayed in direct contact with the farmers for only a few months of the year, the herders keeping the AVV farmers'

cattle left behind a few members of their family to look after the small fields they planted near the AVV settlement.⁶

2. *Small livestock purchases.* By 1983 many of the women, and married and single children, had used the cash and in-kind gifts they received from the family's cooperative farming to purchase goats and sheep (Fig. 15). I observed this trend in 1983 and considered it a very positive development. Due to the much higher demands for family farm labor in the project, women and children had not been able to plant as large an area in private fields as was customary in the home village area.⁷ I considered this substantial increase in small livestock ownership to be part of a more general trend toward the settlers' reinstating some area of private production that was more compatible with their seasonal demands for labor in the cooperatively worked fields.

This trend toward women and unmarried children developing small herds of goats and sheep has not continued. Moreover, many of the women's and children's carefully nurtured herds were virtually decimated by some sort of small ruminant disease the year before. The extension service had little sympathy for the farmers since the farmers had presumably been informed that the animals could be vaccinated against the disease. Small ruminant production

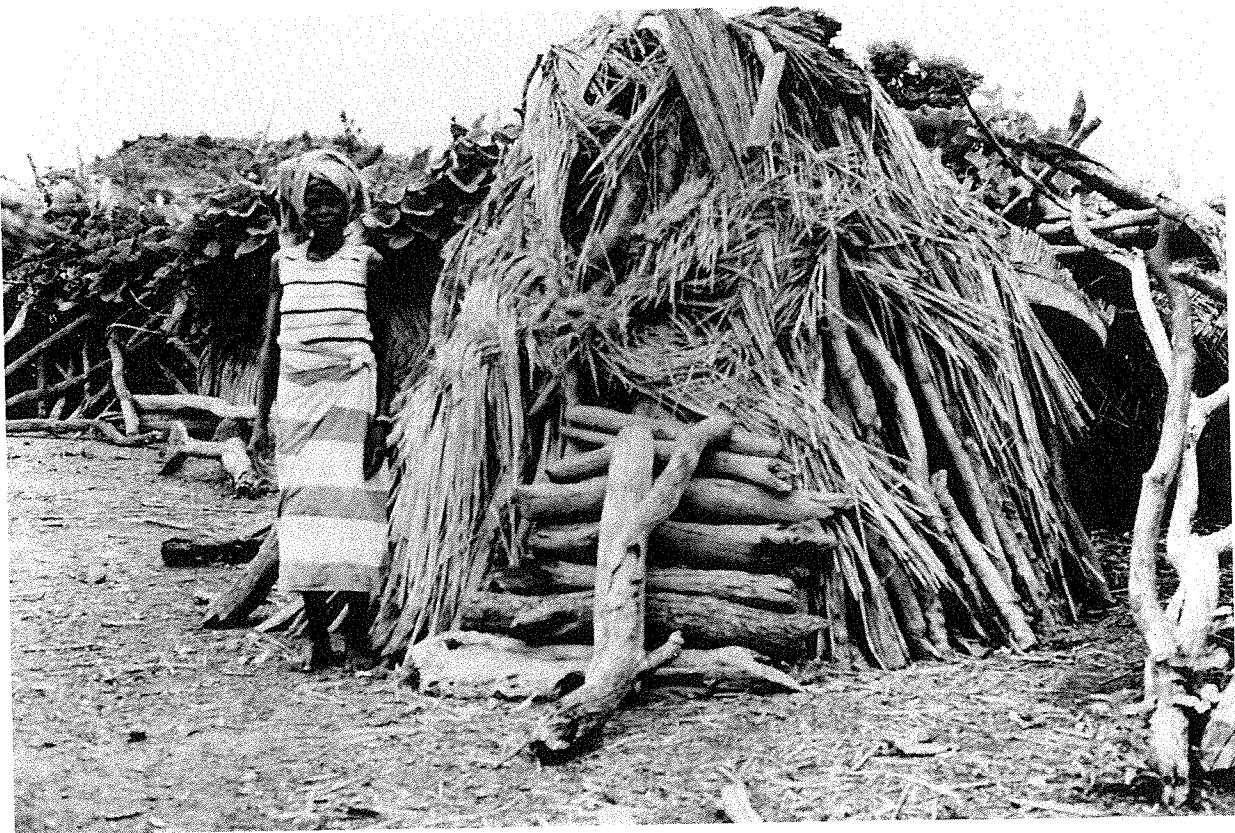


Fig. 15:
Woman standing next to goat pen. By 1983 many of the women in the project took the money they received as harvest gifts from their husbands and the sale of privately produced crops to purchase small livestock.

had not, however, been a priority in the initial project plan, nor had it been very much emphasized by the extension service.

D. Sponsoring additional immigration

Another trend that could be observed as early as 1979 was the tendency by settlers to sponsor the immigration of additional family members. There were typically two patterns for this sponsorship. In one, an individual might come and work, live, and eat with a settler during one year. During the second year, he would request and receive an AVV farm. If an AVV farm was available in the village because someone had left the scheme, the new settler could claim it. If one was not, the prospective settler might move to one of the new AVV settlements being created nearby. After the harvest, the worker would receive some cash as well as grain to assist him in setting up his new farm. If the host and the worker were related, this sort of sponsorship of the new by the older settler might continue for another year or two.

A second sponsorship pattern involved an established settler family supporting the immigration of another farm family. In some cases the new immigrants would actually board with the established settler household for a year before claiming their own AVV farm. In other cases, the older settlers would simply help out new settlers. This aid was considered to supplement the food aid they were already receiving from the project. In addition to food aid, the established settler sponsor would sometimes help the newcomers to plow and clear their new fields. In contrast to what I expected to find—rich settlers exploiting the labor of the naive newcomers—I found far more going in the opposite direction. Except in a few cases, the settler families being sponsored could claim some kinship tie to the host either through marriage or descent. The restudy showed that this particular type of food aid was the equivalent of 30 to 50% of the recorded harvest for 1982 in many households, sometimes doubling a household's food needs.

E. Trend toward two patterns of settler diversification—successful commercial and successful traditional

1. Successful commercial settlers. As early as 1978 it was possible to see the emergence of a group of top producers who were distinguished by their high level of cotton production and their early diversification into livestock and off-farm employment. In 1979 the three top producer families produced over 5 metric tons of cotton. A second tier of 5 top producers produced over 3 metric tons each. The settlers in this group used a portion of the cash revenues from the sale of the cotton to invest in cattle and off-farm production activities, including trade in kola nuts, cloth, animals, and grain, as well as butchery, and a bicycle and moped parts and repair shop. With one exception, the members of this group were the farm families with the greatest number of large livestock in 1983 and 1986.

This group was also distinguished by other traits that can be broadly characterized as social. As a group, with one exception, the successful commercial farmers were the settlers from Damesma or neighboring Kaya villages who had encouraged many of the absent members of their extended nuclear families to join them but who had not, in general, sponsored the immigration of other households from their extended patrilineal lineage groups. As a group, they were also characterized as not having put great amounts of energy or money into maintaining cordial ties with their traditional patrilineal extended families. Instead this group tended to emphasize the development of new economic and social linkages with one another that were more compatible with their new positions as commercially successful AVV settlers. One reflection of these social patterns was the fact that the daughters of the successful commercial farmers tended to marry the sons of other successful settlers (Fig. 16). Indeed, the decision by several of the farmers from Damesma to marry their daughters to the sons of other successful AVV settlers was in several cases deliberately at odds with the wishes of their traditional clan elders who remained based in the home villages. The settlers in this group were also characterized, again with one exception, by their conversion to Islam. Islam became an important mechanism with which the settlers could express their new identification with one another.

2. Successful traditional settlers. I refer to the first group of settlers as "successful commercial farmers" to distinguish them from a second group whose patterns of production and community development over the 10-year period were quite different. This group included a number of farmers who jointly had used their early economic successes at the AVV to sponsor the immigration of additional family members. The core group of settlers in the village included settlers from Poedogo, one of the seven traditional clan groups in the settlers' home village who had been unusually successful in sponsoring the immigration of additional family members, including their leaders. The second largest group of settlers in this group were those who had allied themselves with this reconstituted subclan through marriage ties and religious affiliation. As a group, the older members tended to practice the traditional Mossi religion and the younger ones to be Christian. With one exception, the settlers from this group tended to emphasize the extensive cultivation of food crops with smaller amounts of livestock and, until 1986, smaller amounts of cotton produced (both in absolute terms and as a percentage of their total cropping pattern)⁸ than the first group of successful commercial settlers.

F. Coming, staying, leaving, moving on: 1988

By 1987 it was possible to identify each of the registered households who continued to live in the AVV study settlement with one or the other of these two groups. These alliances could be seen in terms of the settlers' religious



Fig. 16:
 Daughter of successful AVV settler marrying another successful AVV settler. Young woman in this picture is the 15-17 year old daughter of a successful commercial settler who immigrated to the project in 1975. She was married to the successful commercial settler on the right a few months before this picture was taken.

preference, their attendance at one another's celebrations, to whom they married their children, with whom they engaged in gift giving, and whom they helped in day-to-day life and in a pinch. These social alliances were as distinctive for the two groups as the way in which they farmed.

This subdivision into two relatively distinct patterns of social and economic response was given additional significance by more recent events. In February 1988, eight of the settler households in the 1987 restudy left the project. These were not just any farmers, but included among them (with the same one exception I have indicated throughout) all of the first tier (ranked in terms of cotton production and livestock ownership) and most of the second tier of the successful commercial farmers. Moreover, the high rate of drop-out appears to be only part of a more general trend for settler drop-out; this year an unconfirmed 100 households have formally resigned from the project. This is an unprecedentedly large number of settler dropouts for a given year. In contrast to earlier dropouts from the project, none of

the recent dropouts returned home. Seven of the eight families migrated as a group to an irrigation project outside the AVV; one of them joined a family member who was already working as a trader in the area near Bobo-Dioulasso in the prosperous southwest part of Burkina Faso.

VII. Conclusions and policy implications

A. Settlement stages and the proposed extension package

To conclude, the case study confirms what the stage models of new-lands settlement by Scudder, Chambers, Colson, and Nelson would lead us to suspect—that the AVV settlers did pass through a series of interrelated stages of economic and community development. These stages, in turn, affected the settlers' willingness to gamble on technological innovation and their economic performance. The results of this study show, however, that the associated technological changes were not in the predicted directions—that is to say they were not in the direction of greater and greater intensification of crop production or even of remaining in the government-sponsored planned settlements. Instead, after a short foray into extension-agent-supervised intensive farming, the settlers tended to abandon the more labor-intensive aspects of the proposed crop extension package in favor of planting the largest area possible with minimal inputs of labor and cash.

Various elements of the planned settlement and crop extension programs did work together to raise settler income and to create new commercial opportunities. They did not, however, reduce the settlers' more long-term needs to buffer the effects of future droughts and disasters on crop production. Although government projects like the AVV can offset the risk of inter- and intra-seasonal food shortages in the short run, they cannot be depended on. It is no secret to the settlers living in the river basins covered by the OCP that African governments and government-provided social and economic services tend to be unstable.

As settlers increased their income and became more committed to a permanent move, they became interested in diversifying into areas outside their singular dependence on crop production. For one group of farmers this successful development meant reinvesting the settlers' new earnings from the sale of cash crops and their draught animals into further expansion of commercial farm and off-farm activities. This expanded production did not, however, involve increased intensification of the land and labor inputs used in crop production. Instead the extra funds were used to foster greater diversification of production through extensive production of the cash crop cotton and the expansion of livestock and off-farm activities. A second group of farmers, which I refer to as the successful traditional farmers, built on their earlier success to sponsor the immigration of additional members from their unilineal descent group. This ultimately led to the reconstitution of many of the political and social

functions of their extended family social groups.

What we have then is two alternative paths for responding to early economic success and the labor constraints in the proposed extension program. One path focuses on expanding commercial enterprises, and cutting traditional social ties and creating new ones; another focuses on the expansion of traditional subsistence food production with limited diversification and the reinstatement of a strong network of traditional social ties. Both development paths—one I refer to as "successful commercial" and the other as "successful traditional"—are sustainable within a given set of market and environmental conditions.

The pattern of successful diversified commercial agriculture based on isolated extended family households is dependent on high levels of government support and/or close proximity to markets and social and economic services. When government livestock, extension, health and other services began to be reduced, the successful commercial farmers became concerned. Disconnected from these special services it is unlikely that the settlers could have maintained their earlier rates of rapid commercial income growth and diversification. The planned settlement's location, 25 km from the small but active Mogtedo market (45 km if one of the bridges washes out), restricted the types of commercial activities in which the settlers could successfully engage without special government assistance.

The AVV extension and planned settlement program had succeeded in getting this group of farmers up the first rung of the ladder of diversified commercial success. The settlers cut many of their traditional social ties and replaced them with religious and marriage ties to other successful farmers—ties that were more compatible with their new status as successful commercial farmers. The successful commercial farmers reflected on their long-term possibilities, found them wanting, and moved as a group (minus one family that moved out of agriculture into a commercial enterprise near Bobo-Dioulasso in the southeast) to an irrigation scheme where the long-term prospects for commercial income growth were better. A second group which had used their earlier success to sponsor the immigration of additional family members remained behind. This latter group—the successful traditional farmers—practiced a type of extensive rainfed farming of food grains that could be both purchased and sold and that presumably did not wear out the soil in the same way as cotton.

B. Conclusions and policy recommendations

To conclude, the availability of a vast "new" depopulated land resource, made possible by the Onchocerciasis Control Programme, led the AVV to advocate an extension package which was effective in the short run in allowing the settlers to become reinstated in the new area at a level of production, cash cropping, and technology much higher than what they had enjoyed in their home villages. In the long run,

however, the proposed cropping package failed to address the settlers' need for farm-level adaptations to intra- and inter-seasonal constraints in the new agricultural environment.

The study also shows that settler adaptations to the new seasonality constraints in the valleys were not static but capable of changing very rapidly. Some of these changes were specific to the settler households and included different patterns of household access to labor and cash resources. Other changes were more specifically related to the wider economic, ecological, and social environment. These changes included the settlers' gradual expansion through marriage and additional immigration of a network of kin-based social ties, the expanding non-farm opportunities in the region, their perception of government attitudes toward their permanent land-tenure rights, and the need to expand local economic opportunities for the first generation of settlers' children.

A major conclusion has to do with the need for policy planners to anticipate the impact of seasonality on settlers' willingness and ability to adopt certain types of intensive rainfed farming. An additional concern has to do with the need for policy planners to anticipate important changes over time in the role of seasonality within the local cropping systems due to rapid changes in the cash, labor, and entrepreneurial characteristics of individual households, as well as certain factors in the wider economic and social environment.

My final point is simply that government programs to promote settlement and development of the land covered by the OCP, and other types of disease control programs, must become increasingly aware that immigration to new, presumably more fertile and more drought-resistant river basins does not do away with seasonality as a constraint to the adoption of new intensive crop technology. Moreover, changes in the wider economic and social environment will influence the willingness and ability of settlers to juggle risk and the seasonal labor constraints associated with different extension themes. As settlers increase their commitment to remaining in a planned settlement project, we are likely to see a shift away from more short-term objectives of increased production and higher income, toward production strategies that are sustainable within the social and economic circumstances of the isolated river basins. Just as we saw a gradual process of "agricultural involution" away from the intensive farming in the first 14 years of the settlement's existence, it is highly likely that we will see an increase in more intensive crop production with longer periods of residence and community reinstatement over the next 15 years. *If* one of the long-term objectives of government-sponsored planned settlements is to create a band of higher yielding and less environmentally destructive cropping systems, then project administrators and donors must learn to recognize these locally evolving patterns of seasonality as constraints but also as opportunities.

Notes

1. Onchocerciasis, or river blindness, is a disease transmitted to humans by the female fly, *Simulium damnosum*. The fly carries the larva of a parasitic worm, *Onchocerca volvulus*, which spreads into the epidermal tissues of the skin, eventually reaching the anterior chambers of the eye. Clinical indication of the disease appears only after repeated bites from infected flies. Effects include skin discoloration, itching, subcutaneous nodules, and in the later states, eye lesions that may result in blindness. It has long been recognized that the Volta Basin of West Africa is one of the worst endemic onchocerciasis areas in the world. A United Nations survey in the early 1970s estimated that nearly 700,000 km², with a population of 10 million, were affected. Of this number, an estimated 1 million people were infected and 70,000-100,000 were either blind or suffering serious eye impairments.

2. A wide range of models for planned settlement has been tried (Brokensha *et al.* 1977; Berg *et al.* 1978; OCP 1985, 1986). At one end of the continuum are expensive projects in which some agency is involved in every phase of the development program, including land preparation; the transfer, installation, and initial support of the settlers; and the implementation of major technical innovations such as irrigation or plows. At the other extreme are less expensive projects which simply provide some basic infrastructure, and extension and social services for settlers moving into the river basins on their own. There has been little disagreement, however, that the central goal of either policy option should be to provide support for extension programs to promote the development of higher yielding, more ecologically sustainable farming systems.

3. The primary mechanism for the collection of data in the AVV farm-monitoring program was an economic survey of a random sample of households in all of the major AVV village clusters. The unit of research in the AVV was the "exploitation," defined as the social unit that cultivates one of the 10 or 20 hectare AVV farms. Each sample household in the survey was visited once a week by an enumerator with a packet of questionnaires. During the interview, the male household head was asked questions concerning any labor and non-labor inputs (*e.g.*, fertilizer, manure, and pesticides) on the bush fields that the household was authorized to farm under the crop rotation system. Other questions in the interview focused on the cash income, expense, and loss associated with non-crop production (*e.g.*, trade, crafts, livestock) and the sale and non-market distribution of food and cash crops (Murphy and Sprey 1980). Enumerators were also required to measure the total area planted and harvests for each of the cultivated bush and house fields.

4. The baseline research for the case study was one of two case studies funded through the same grant from USAID

to the Department of Agricultural Economics at Purdue University that provided supplementary support for the AVV farm monitoring program. A Technical Assistance Grant from SECID's (South-East Consortium of International Development) Center for Women in Development supported the restudy in 1983, and grants from the University of Kentucky Research Foundation and the National Institute of Health the 1987 restudy.

The baseline research included a farm-monitoring study of 35 households in the settlers' home area and 9 families from this village who were living in the same settlement village. It was our intent (not always realized) to interview each adult and teenage member of the household at least once a week in order to gather basic information on all of the agricultural and non-agricultural activities that had occurred since the last interview.

Two short restudies of the settler households were conducted during the summers of 1983 and 1987. In each case the sample size was expanded to include not only the 9 settler households in the baseline research but 15-16 additional farm families.

5. Figures are based on the 1975 Project Identification Report of the Dutch government for the AVV which estimated a minimum daily food requirement of 2,230 calories per person per year including losses during storage (Murphy and Sprey 1980:22). Figures represent the difference between the recorded grain harvest per resident and the recommended 240 kg per person minimum of cereals.

6. The members of the herders' families who stayed behind might be interpreted as a sort of "collateral," ensuring that the herders would return with the animals.

7. In the settlers' home village the land that was farmed by a particular household group was subdivided into cooperatively and privately worked fields. Cooperatively worked fields are cultivated by the entire household. In addition, all individuals in the household have the right to cultivate a certain amount of land for their own personal needs. Approximately 38% of the land planted by the study farmers in the settlers' home village in 1979 was farmed cooperatively. Sixteen percent of the total area consisted of women's private fields. The AVV made no formal provision for these private cultivation rights. By 1979, however, the settlers were reinstating small areas of private fields. In 1979, 11% of the study settlers' area planted was cultivated as private fields, 4% by women; in 1983, the figure was 13% as private fields and 7% by women.

8. In 1986 and 1987 the settlers who had been top cotton producers in the early years planted almost no cotton at all. This fact was puzzling but is easier to explain in light of their subsequent departure from the project.

References

- Amin, S., 1974. Modern Migrations in Western Africa. In *Modern Migrations in Western Africa*. ed. Samir Amin, pp. 64-124. Oxford University Press, London.
- Ancey, G., 1974. Facteur et Système de Production dans la Société Mossi d'aujourd'hui: Migrations, Travail, Terre et Capital. In *Enquête sur les mouvements de population à partir du pays mossi*, Vol. 2. ORSTOM, Ouagadougou.
- Balima, A.S., 1969. *Genese de la Haute-Volta*. Presses Africaines, Ouagadougou.
- Barrett, V., G. Lassiter, D. Wilcock, D. Baker, and E. Crawford, 1981. *Animal Traction in Eastern Upper Volta: A Technical, Economic and Institutional Analysis*. Department of Agricultural Economics, Michigan State University, East Lansing.
- Benoit, M., 1973a. *Espaces agraires mossi en pays Bwa*. 2 vol. Office de la recherche scientifique et technique outre-mer. ORSTOM, Ouagadougou.
- 1973b. Le champ spatial mossi dans les pays du Voun-Hou et de la Volta Noire (Cercle de Nouna, Haute-Volta). *Cahiers des sciences humaines* 10(1):115-137.
- Berg, E., J. Bisilliat, M. Burer, H. Graetz, R. Melville, V. Volyvan, J. Park, R. Sawadogo, H. Sederlof, and K. van der Meer, 1978. Onchocerciasis Control Program: OCP Economic Review Mission. (mimeo)
- Broekhuysse, J., 1974. *Développement du Nord du plateau mossi*. 4 vol. Département de recherches sociales, Institut royal des tropiques, Amsterdam.
- Brokensha, D., 1963. Volta Resettlement and Anthropological Research. *Human Organization* 22:286-290.
- Brokensha, D., M. Horowitz, and T. Scudder, 1977. *The Anthropology of Rural Development in the Sahel: Proposals for Research*. Institute for Development Anthropology, Binghamton, NY.
- Capron, J., and J.M.Kohler, 1975. Environnement Sociologique des migrations agricoles. In *Enquête sur les mouvements de population à partir du pays mossi*. Vol. 1. ORSTOM, Ouagadougou.
- Chambers, R., 1969. *Settlement Schemes in Tropical Africa: A Study of Organizations and Development*. Routledge and Kegan Paul, London.
- Chambers, R., R. Longhurst, and A. Pacey, eds., 1981. *Seasonal Dimensions to Rural Poverty*. Allenhold, Osmun and Co., London.
- Colson, E., 1971. *The Social Consequences of Resettlement: The Impact of the Kariba Resettlement upon the Gwembe Tonga*. Kariba Studies, 4. University of Manchester Press, Manchester.
- Conde, J., 1978. *Migration in Upper Volta*. World Bank, Development Economics Department, Washington, DC.
- Coulibaly, S., J. Gregory, and V. Piche, 1980. *Importance et ambivalence de la migration voltaïque. Les migrations voltaïques*. Vol. 1. Institut national de la statistique et de la démographie, Ouagadougou.
- Delgado, C.L., 1979. *Livestock versus Foodgrain Production in Southeast Upper Volta: A Resource Allocation Analysis*. Livestock Production and Marketing in the Entente States of West Africa, Vol. 1. University of Michigan, Center for Research on Economic Development, East Lansing.
- DeWilde, J., P. McLoughlin, A. Guinard, T. Scudder, and R. Maubouche, 1967. *Experiences with Agricultural Development in Tropical Africa: The Case Studies*, Vol. 2. The Johns Hopkins University Press for the International Bank for Reconstruction and Development, Baltimore, MD.
- Finnegan, G., 1980. Employment Opportunity and Migration Among the Mossi of Upper Volta. In *Research in Economic Anthropology*, Vol. 3, ed. G. Dalton, pp. 291-323. JAI Press, Inc., Greenwich, CT.
- Finnegan, Gregory A., and Christopher L. Delgado, 1980. Cachez la Vache: Mossi Cattle, Fulbe Keepers and the Maintenance of Ethnicity. In *Image and Reality in African Interethnic Relations: The Fulbe and Their Neighbors*, ed. Emily A. Schultz, pp. 31-50. Studies in Third World Societies, 11. College of William and Mary, Williamsburg, VA.
- Gregory, J., 1974. Development and In-migration in Upper Volta. In *Modern Migrations in West Africa*, ed. Samir Amin, pp. 304-320. Oxford University Press, London.
- Hammond, P., 1959. Economic Change and Mossi Acculturation. In *Continuity and Change in African Cultures*, ed. W.R. Bascom and M.J. Herskovits, pp. 238-256. University of Chicago Press, Chicago, IL.
- Hansen, A., and A. Oliver-Smith, eds., 1982. *Involuntary Migration and Resettlement: The Problems and Responses of Dislocated Peoples*. Westview Press, Boulder, CO.
- Hervouet, J., 1977. *Peuplement et mouvements de population dans les vallées des Volta Blanche et Rouge*. ORSTOM, Ouagadougou.
- 1978. La mise en valeur des vallées des Volta Blanche et Rouge. Un accident historique. *Cahiers ORSTOM: Serie sciences humaines* 15(1):81-97.
- Izard, M., and F. Izard-Hertier, 1958. *Bouna: Monographie d'un village Pana de la vallée du Sourou (Haute-Volta)*. Service de l'hydraulique de Haute Volta pour l'Institut des sciences humaines appliquées (ISHA) de l'Université de Bordeaux, Ouagadougou.
- Kelly, J., C.J. Shiff, H.C. Goodman, L. Dash, A.B. Brown, and A.K. Galaydh, 1986. *Impact Review of the Onchocerciasis Control Program Ouagadougou, August 1985*. A.I.D. Project Impact Evaluation Report No. 63. U.S. Agency for International Development, Washington, DC.
- Kohler, J.M., 1968. Activités agricoles et transformation socio-economique de l'Ouest du Mossi. ORSTOM, Paris.
- 1972. Les migrations des Mossi de l'Ouest. ORSTOM, Paris.

- Lahuec, J-P., 1970. Une communauté évolutive Mossi Zaonghe (Haute Volta). *Etudes Rurales*: 37-39.
- Marchal, J-Y., 1975. Géographie des aires d'émigration en pays mossi. In *Enquête sur les mouvements de population à partir du pays mossi*. Vol. 2, Pt. 3. ORSTOM, Ouagadougou.
- 1978. L'Onchocercose et les faits de peuplement dans le bassin de Volta. *Journal des africanistes* 48(2):9-30.
- McMillan, D., 1983. A Resettlement Scheme in Upper Volta. Unpublished Ph.D. dissertation. Northwestern University, Evanston, IL.
- 1984. *Changing Patterns of Grain Production in a Resettlement Scheme in Burkina Faso*. Center for Women in Development, Southeast Consortium for International Development, Washington, DC.
- 1986a: Distribution of Resources in Mossi Households. In *Food in Sub-Saharan Africa*, ed. A. Hansen and D. McMillan. Lynne Rienner Publishers, Boulder, CO.
- 1986b: The Social Impacts of Planned Settlement in Burkina Faso. In *Denying Famine a Future in Africa*, ed. M. Glantz. Cambridge University Press, Cambridge.
- 1987. Monitoring the Evolution of Household Economic Systems Over Time in Farming Systems Research. *Development and Change* 18:295-314.
- Moran, E.F., 1979. Criteria for Choosing Successful Homesteaders in Brazil. In *Research in Economic Anthropology*, Vol. 1, ed. G. Dalton, pp. 339-359. JAI Press, Greenwich, CT.
- Mesnil, J., 1970. Connaissance du milieu et vulgarisation agricole dans le cas de l'opération Centre mossi. 9 vol. SATEC, Paris.
- Murphy, J., and L. Sprey, 1980. *The Volta Valley Authority: Socio-Economic Evaluation of a Resettlement Project in Upper Volta*. Purdue University, Department of Agricultural Economics, West Lafayette, IN.
- Nelson, M., 1973. *The Development of Tropical Lands: Policy Issues in Latin America*. Johns Hopkins Press, Baltimore, MD.
- Onchocerciasis Control Programme (OCP), 1984. Socioeconomic Impact of the Onchocerciasis Control Programme in Upper Volta 1973-1983. Presented to the JPC during the meeting of the fifth session, Dec. 1984. OCP, Ouagadougou.
- Onchocerciasis Control Programme (OCP), 1985. Ten Years of Onchocerciasis Control in West Africa. Review of the Onchocerciasis Control Programme in the Volta River Basin from 1974-1984. World Health Organization, Geneva. OCP/GVA/85.1B.
- Onchocerciasis Control Programme (OCP), 1986. Rapport d'évaluation de l'Impact Socio-économique du Programme de Lutte Contre l'Onchocercose. Presented to the JPC during the meeting of the 7th session, Accra, 9-12 Dec. 1986. ORSTOM, Ouagadougou.
- Remy, G., 1972. Les leçons d'un échec: la culture attelée en pays Mossi. *Cahiers d'Etudes Africaines* 12.
- 1973. *Les migrations de travail et les mouvements de colonisation Mossi*. ORSTOM, Paris.
- 1975: Les migrations vers les "Terres Neuves". Un nouveau courant migratoire. In *Enquête sur les mouvements de population à partir du pays mossi*, Vol. 1, Pt. 2. ORSTOM, Ouagadougou.
- Sawadogo, R.C., 1979. Problèmes d'aménagement et de viabilisation sociale dans les projets de développement économique de l'aire du programme de lutte contre l'onchocercose. In *Maîtrise de l'espace agricole et Développement en Afrique Tropicale: Logique Paysanne et Rationalité Technique*, ed. P. Couty, J.Y. Marchal, P. Pélissier, M. Poussi, G. Savonnet, and A. Schwartz, pp. 335-340. Office de la Recherche Scientifique et Technique Outre-Mer, Paris.
- Schildkrout, E., 1978. *People of the Zongo: The Transformation of Ethnic Identities in Ghana*. University Press, Cambridge.
- Scudder, T., 1984. *The Development Potential of New Lands Settlement in the Tropics and Subtropics: A Global State of the Art Evaluation with Specific Emphasis on Policy Implications*. AID Program Evaluation Discussion Paper No. 21. September. U.S. Agency for International Development, Washington, DC.
- 1985. *The Experience of the World Bank with Government-sponsored Land Settlement*. Report No. 5625. The World Bank, Operations Evaluation Department, Washington, DC.
- Société Africaine d'Etudes et de Développement (SAED), 1976. Etude d'un programme régional de développement intégré. 2 vol. SAED, Ouagadougou.
- Williams, J., 1974. Scourge of Sahel Basins. *Geographical Magazine*, November:78-79.