

Capitalizing on Diversity: Women's Issues and Sustainable Development in the OCP River Basins

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Little has been written on women's issues in development planning under the Onchocerciasis Control Programme. Those studies that do exist focus on new settlers still in the initial stages of frontier development (Conti 1979; Guissou 1977; Phillott-Almeida 1985). One result has been a strong tendency for researchers to support Rogers' argument (1980) that the overall effects of new lands settlement and resettlement on women are quite negative (Guissou 1977; Murphy and Sprey 1980; Reyna 1983, 1986). But recent research by the Institute for Development Anthropology at the sixteen sites included in the OCP Land Settlement Review (figure 1; table 1) suggests that the situation is far more complex.¹ The case studies of these sites support Koenig's conclusion that in at least some cases, women are better off when the entire household is better off, even when their access to pre-resettlement resources and occupations has been compromised (forthcoming, p.21).

Although it is important to emphasize that not all new-lands settlement in the OCP river basins affects women negatively and that some new-lands settlement can affect them quite positively, it is equally important to counsel caution. That is because the shift from subsistence to more dynamic patterns of household income growth occurred at only six of the sixteen study sites: the Mo Plain and FED (Fonds Européens du Développement)-Agbassa settlements in Togo, the Autorité d'aménagement des vallées des Voltas (AVV), Kompienga, and Solenzo settlements in Burkina Faso, and the Dioila settlement in Mali. Each of these sites involved an area in which donor and government policies had—either intentionally or unintentionally—provided basic services and infrastructure for the settlers moving in. Even then, the resulting development was not always sustainable. In each case in which this occurred, however, the early increase and then decline in women's income and living standards had less to do with their being women than with the overall effects of resettlement and new lands settlement on women.

*Sites showing little evidence of growth
in agricultural income for smallholders*

The Ghana study sites

At none of the four study sites in Ghana (Red Volta Valley and Plateau, the Fumbisi Yagoba-Soo or "Over-

seas" region, the Damongo Planned Settlements, and the Tono Irrigation Scheme) in 1988 did the Ghana team find a single group of settlers that appeared to be increasing agricultural income through the use of either extensive or intensive cultivation methods. The chief reason was the extremely unfavorable policy environment in the decade before 1988 (Akwabi-Ameyaw 1990). With almost no access to improved technology or fertilizer, outside the Tono scheme, farmers attained very low yields and net agricultural incomes, and few households were able to move beyond basic subsistence.

Although the Tono settlers could purchase inputs like fertilizer through the parastatal FASCOM (Farmers Services Company), access to these inputs was constrained. All credit was tied to the Social Security Bank's assessment of the settlers' previous performance in the scheme. This credit assessment was made by the Social Security Bank in collaboration with the scheme management, ICOUR (the Irrigation Company of the Upper East Region). Since farmers were forced to reimburse their credits just after harvest, when farm gate prices were at their lowest, they could never be certain about how much they would earn. This insecure market made it risky for the average farm family to undertake a credit.

In the one major case in which the government attempted to aid spontaneous settlement in the Fumbisi Valley during the 1970s, unrealistic policies subsidized the crops of a small elite at the expense of the local population. The result was an increase in conflict, including the burning of crops. Then, when subsidies ended, the economic viability of these crops was undercut (Akwabi-Ameyaw 1990, pp. 67-68; McMillan, Painter, and Scudder 1992, p.26).

In certain ethnic groups, such as the Mamprussi and Dagomba, who cultivate only bush fields, women did not farm at all and did not even go to the bush to collect fuelwood for household use, these being men's responsibilities. Where women participated physically in the field operations, as in the Red Volta Valley, their activities focused on planting, weeding, and threshing. The chief exception was Frafra immigrant women around Bolgatan-ga and Damongo, who constituted the main agricultural work force for the urban-based commercial farmers (Akwabi-Ameyaw 1990, pp 91-92).

At all of the study sites in Ghana, women concentrated on domestic chores and developing what meager returns they could from trade. Trade was especially important at the research sites located near the trade centers of Fumbisi, "Overseas" and Damongo. Akwabi-Ameyaw argued that the strong emphasis on trade reflected the complete lack of opportunity for income growth in agriculture (personal communication, 1994). He stated that if opportunities were available, many women would take a

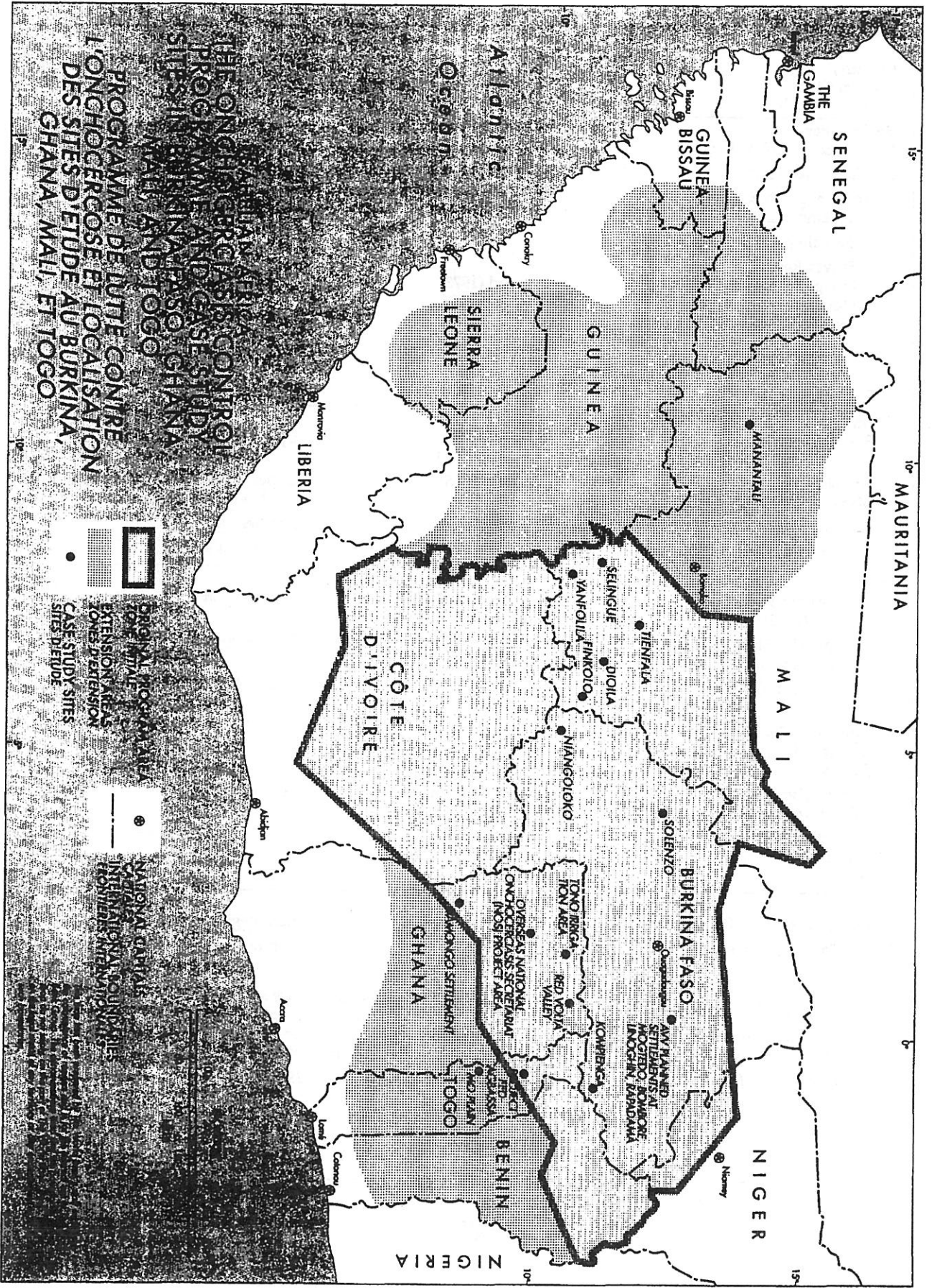


Table 1 The Land Settlement Review Case Studies

Country; name of site; nature of sample	Settlement type; approx. date of settlement onset	Location in country
Burkina Faso		
1. Solenzo (3v:36hh+19v)	Spontaneous (1960s)	Kossi Province
2. Niangoloko (22v)	Spontaneous (1982)	Comoe Province
3. Kompienga (1v:35hh) resettlement and spontaneous (1983)	Dam-related planned	Gourma Province
4. Volta Valley Authority (AVV-UP1)		
a. Survey Restudy		
Linoghin (6v:20hh)	Planned (1973)	Oubritenga Province
Mogtedo-Bombore (7v:20hh)	Planned (1979)	Ganzourgou Province
Mogtedo (6v:40hh)	Planned (1974)	Ganzourgou Province
b. Case Study Restudy		
Mogtedo V3 (1v:20hh)	Planned (1975)	Ganzourgou Province
c. Rapadama (+7)		
	Assisted (1987)	Ganzourgou Province
Ghana		
1. Red Volta Valley and Plateau (2v:30hh)	Cyclical, spont. (late 19th cent.)	Upper East Region
2. Fumbisi-Yagoba-Soo Mankarigu ("Overseas") (4v:30hh)	Assisted (1985)	Upper West, Upper East, and Northern Regions
3. Damongo Settlements (3v:30hh)	Planned (1950s)	Northern Region
4. Tono Irrigation Scheme (2v:30hh)	Planned (1980s)	Upper East Region
Mali		
1. Yanfolila (5v:30hh) Assisted (1985)	Spontaneous (1970s) (Sikasso)	Third Region
2. Selingue (3v:29hh) (late 1970s) and spontaneous	Dam-related planned (Sikasso)	Third Region
3. Dioila (4v:30hh)	Spontaneous (1960s) (Koulikoro)	Second Region
4. Finkolo (3v:30hh) workers' villages at tea plantation (late 1960s)	Wage workers in (Sikasso)	Third Region
5. Tienfala (3v:9hh) railway workers (from early 1900s; continuing)	Spontaneous, by (Koulikoro)	Second Region
6. Manantali (14v:70hh) (1986/87)	Dam-related planned (Kayes)	First Region
Togo		
1. FED-Agbassa (3v:30hh)	Planned (1972)	Kara Region
2. Mo Plain (3v:30hh+6v)	Spontaneous (1970s)	Central Region

Note: Numbers in parentheses that follow site names denote the number of villages at each site where household interviews were conducted, followed by the number of households in the site sample. Numbers preceded by a plus sign denote the number of additional villages at the site where leaders and other community members were interviewed. Information on Manantali was drawn from another IDA contract dealing with that project. (Horowitz, Grim and Konate 1993)

Source: McMillan, Painter and Scudder, 1992, and Koenig, personal communication 1994.

more active role in the household's farm activities. He qualified his statement, however, by saying that it is unlikely that women in certain ethnic groups like the Mamprussi and Dagomba would participate in crop production. Their more likely role would be in food processing and trade. The situation might be quite different, however, in other ethnic groups like the Frafra, where women have traditionally been more active in local farm production.

Selingue (Mali)

Selingue is another case. The original irrigation effort was designed to benefit the indigenous Malinke inhabitants who were displaced by the dam. In an effort to increase the irrigated perimeter's productivity, the management started to encourage the Dogon immigrants who had immigrated on their own into the surrounding zone to join the project (Koenig 1990: 35). It was also decided that the perimeter would be a good place to locate young school leavers. These extra farmers reduced the size of all plots and decreased the amount of land allocated to individual households from between 0.5 to 1.2 hectares in 1984-85 to 0.25 hectares for a household with one to eight economically active individuals and 0.5 hectares for households with nine to sixteen active individuals in 1988. This meager plot size compares with the Office du Niger's policy of allocating 1 hectare of irrigated rice land per person in 1979 (CILSS 1978: 39 in Koenig 1990: 35). Few families could provide for themselves on what they earned from these small plots even with above-average yields of two tons per hectare. Settler insecurity increased further by the management's policy of constantly redistributing parcels. The indigenous farmers compensated by clearing private maize and millet fields in the surrounding zone. As a result, their average food grain production (232 kilograms per person) was much higher than that of the Dogon migrants (29-141 kilograms per person) who had difficulty getting permission to clear and farm in the surrounding dryland zone (Koenig 1990: 39).

Sites where the initial rise in agricultural income growth was unsustainable

In an attempt to circumvent the multiple macro- and micro-level constraints to development at the sites, the AVV, and FED-Agbassa projects provided settlers with a planned settlement package to develop basic infrastructure (schools, health facilities, roads, and wells) and to support intensive farming (Koenig 1990; Painter 1990; McMillan, Nana, and Savadogo 1993). In the more isolated OCP river basins, like the Manantali Dam resettlement, elements of development planning—access to new land, supplementary food aid, wage labor on project construction sites, subsidized extension services—combined

to help raise settlers' incomes (Diarra and others 1994; McMillan 1983; McMillan, Nana, and Savadogo 1993; Painter 1990). In each case, however, the resulting increases in crop and non-crop incomes were not sustainable due to various market, policy, climatological and other conditions.

The Manantali sponsored settlements (Mali)

Once crop productivity in the Manantali settlements deteriorated to the point at which the women were forced to depend on their private fields for basic subsistence, the settlers reduced the amount of time they worked on the collective household fields.² By 1994, only 18 percent of the women reported that they worked on collective fields (down from 42 percent in 1988). But women's efforts to develop private crop production were thwarted by the same overcultivation problems that plagued the main household fields. Women were able to obtain larger plots in the less circumscribed planned villages but, because of the isolation of these villages, received lower prices for their crops (Diarra and others 1994, p. 37). Efforts to develop irrigated gardening, which traditionally had been a major source of off-season employment, were thwarted by the lack of appropriate sites. Once dam construction ended, there were few opportunities to engage in trade. With less uncultivated bush, the women not only were unable to engage in many of their traditional gathering activities, but also were forced to buy some of the products that these activities had once provided, such as shea nut butter, fruits, and soap (Diarra and others 1994). With few opportunities to develop trade based on their production, the women turned to exploiting wood.

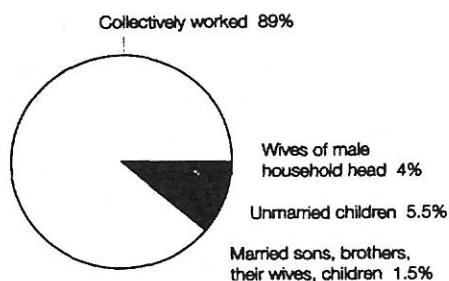
Thus, despite the project's efforts to provide women with land, the lack of a profitable extension package combined with the limited opportunities to develop livestock or nonfarm employment left women worse off than before resettlement. Moreover, they were worse off, but in a situation in which they were still expected to provide for a large share of the household's basic food and condiments. In 1993-94, the male household head helped provide sauce ingredients for the family's meals in only 14.3 percent of the survey households during the dry season and only 23.2 percent of the households during the rainy season (Diarra and others 1994). In addition to providing most of the purchased food, the women were responsible for much of the clothing for themselves and their children (Diarra and others 1994).

The AVV sponsored settlements at Mogtédo and Mogtédo-Bomboré (Burkina Faso)

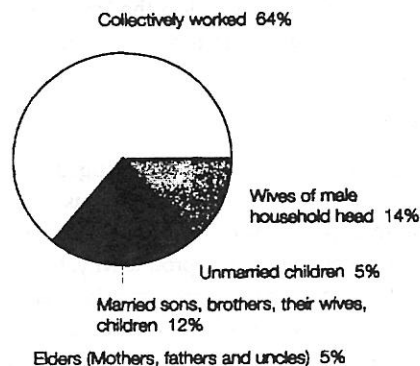
In response to the huge labor demands for cotton, rising production costs (due to lower subsidies), and experience with unreliable yields with the proposed technology

Figure 2 Subdivision of net crop value of income per household, the AVV sponsored settlements, 1979-1989

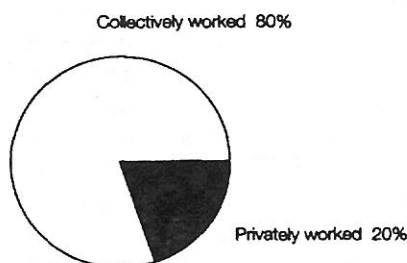
AVV sponsored settlements, 1979



Settlers' home village in Kaya area, 1979



AVV sponsored settlements, 1988



Sources: McMillan 1983.
Savadogo, Sanders and McMillan 1990.

package,³ the AVV project farmers gradually reduced the area planted to high input cotton production and increased the area planted to the less intensive sorghum and millet.⁴ The increased production they achieved was not, however, associated with higher cash income. Indeed, the settlers' average income, calculated using the median price at which crops were sold, was 10 percent less in 1988 than in 1979. When this nominal net income was adjusted for inflation using the International Monetary Fund price index, average income per labor unit (adult labor equivalent, or ALE⁵) on the official household fields was 40 to 50 percent lower in 1988 than in 1979 (McMillan, Nana, and Savadogo 1993, p. 34).

During their first years in the AVV sponsored settlements, the settlers were involved in the heavy work of clearing fields, their families were small, and they had little time or money for noncrop activities, such as livestock or trade. By 1979, three to five years after settlement, most households had established small private plots. Although

the women's private fields represented a smaller share of the total planted area than the share in their home villages (8 percent of total area in 1979, compared with 24 percent in the home village; McMillan 1983, pp. 158 and 388), the income women earned from their private fields was supplemented by gifts of cash from their husbands and gifts of grain from their husbands' friends. In contrast to the home area, where women often were forced to rely on their private production to supplement the household's food during the dry season, in the settlements they usually sold these food crops. In addition, in 1979, many of the expenses that women had traditionally borne in the home area (for example, condiments, school fees, medicines, and family clothing) were being shouldered by the male household heads.

As households shifted away from the earlier "intensive" model, however, they reverted to the "traditional" pattern in which women were responsible for a higher share of the household expenses. By 1988, when the ten-

Table 2 Average Non-farm Income from Different Sources for Individuals Reporting Income from the Source, 1988-1989.

A. Male Head of Household

	Linoghin	Bombore	Mogtedo	Mogtedo V3	Solenzo	Kompienga
1. Unprocessed agric. products	64,120(1)	■	42,000(1)	■	■	23,167(3)
2. Processed agric. products	■	■	■	■	24,000(1)	8,425(2)
3. Forest and water products	■	■	■	■	■	87,000(1)
4. Meat and animal by-products	28,500(1)	122,500(2)	38,650(3)	25,000	■	107,667(3)
5. Commerce	300,000(1)	■	50,250(2)	14,000(3)	■	81,000(3)
6. Handicrafts	21,300(2)	6,070(6)	1,950(1)	6,950(2)	■	53,167(3)
7. Gold	■	2,000(1)	36,166(3)	27,721(7)	■	■
8. Services	4,000(1)	■	5,000(1)	23,700(2)	41,250(2)	50,000(1)
9. Agric. Labor	■	■	20,000(1)	■	■	■
10. Nonagric. Labor	450,000(1)	■	■	250,000	■	■
11. Mill	■	■	■	■	■	550,000(1)

B. One Woman per Family

1. Unprocessed agric. products	9,050(2)	■	■	74,200(2)	■	10,437(10)
2. Processed agric. products	26,043(13)	3,833(5)	3,186(7)	6,642(14)	29,300(6)	6,361(11)
3. Forest and water products	30,050(2)	■	■	■	■	3,000(1)
4. Meat and animal by-products	■	■	37,500(1)	■	■	■
5. Commerce	2,200(1)	6,000(1)	■	■	350(1)	■
6. Handicrafts	7,650(1)	8,150(1)	■	■	■	17,000(1)
7. Gold	■	500(1)	19,691(12)	13,914(16)	■	■
8. Services	■	■	■	3,500(1)	■	■

() indicates how many men and women provided non-zero numbers.

Twenty men and twenty women were interviewed in each of the AVV planned settlements; 36 men and 36 women were interviewed at Solenzo. Means are taken over these numbers.

Source: Savadogo 1989a in McMillan, Nana and Savadogo 1993:52.

year restudy was conducted (ten to thirteen years after the settlements were created), husbands no longer gave cash "harvest presents" to their wives, and the earlier practice of giving large, lavish gifts to friends' wives (an important source of income for women in 1979) had died out. With fewer and less lucrative opportunities in trade than a decade earlier, both men and women farmed more land as private fields. In 1988, private fields accounted for about 20 percent of net agricultural income. Although a larger share than ten years earlier, when it had been 11 percent (before subtracting the costs of animal traction), the income from private fields was still less than it had been in the settlers' home village, where it had accounted

for 36 percent of the total CFA franc (CFAF) value of production or gross income in 1979 (McMillan, Nana, and Savadogo 1993, p. 47, figure 2).

These changes do not appear to have had much effect on women's labor time during the main agricultural season, because cotton requires a high percentage of women's labor during harvests (which occur in the lull after the rains). White sorghum, in contrast (which has a much smaller total labor requirement—394 weighted hours per hectare compared with 1,520 weighted hours for cotton), requires about the same amount of labor as cotton for soil preparation and weeding (see McMillan 1983, pp. 397-99).

Table 3 Percent of women indicating income from off-farm employment and livestock production and average income from these sources for the entire sample, 1988/89 (per woman)

	Sample Size	Off-Farm Income		Net Livestock Income ^a	
		%	CFA	%	CFA
Linoghin	(20)	80	21,331	20	201
Bombore	(20)	35	1,690	45	486
Mogtedo	(20)	60	14,805	45	1,887
Mogtedo V3	(20)	95	23,392	55	3,865
Solenzo	(36)	17	6,833	0	0
Kompienga	(25)	64	9,774	8	442

^a Net income on livestock includes deductions for animal losses by death and theft. The low figures reflect both this and the fact that only a few women in each sample had sold livestock at the time this initial analysis (August 1989) was conducted.

Source: Savadogo 1989a,c in McMillan, Nana and Savadogo 1993:52.

By 1988, the settlers were experiencing growing problems with basic infrastructure because of their inability to manage user fees in ways that allowed them to make repairs and to replenish stocks of drugs and basic equipment. The erratic operation of the groupement-managed grain mill during the preceding five years meant that most women had to revert to the "traditional" (preresettlement) pattern of devoting two to three hours a day to grinding sorghum and millet. Some men would occasionally transport the family grain to a gas-powered mill in Mogtédó, but they were an exception. The same period (1988) was characterized by growing problems with the first generation of bore hole pumps. Pumps sometimes would remain broken for one to two weeks, forcing women to seek water in neighboring villages or to rely on streams or stagnant pools. A similar pattern of early success followed by decline characterized women's health facilities. By 1988, most of the village maternities that UNICEF had stocked with an initial supply of drugs had been abandoned.

In late 1987, gold was discovered near the AVV planned settlements at Mogtédó. The net result was a substantial increase in the income and welfare of female and male farmers near the mining sites (table 2). But the settlers were not optimistic that gold revenues would be reinvested in ways that would improve nonfarm employment in the long run.

Frustrated by the lack of long-term prospects for improving their income and living standards, twenty-one registered households, and ten people from households that did not move (as a group), left Mogtédó; another eight households left Mogtédó-Bomboré just as suddenly.

All relocated to Kompienga, the site of Burkina Faso's first hydroelectric dam, in the extreme southeast of the country. The settlers' main motivation for leaving was to find an area with greater opportunities for dry-season irrigated farming and trade. Some of the strongest advocates of the move were senior wives.

"Step" agricultural migration, like that of the AVV farmers from the home village to the AVV settlements (1975-78) and then to Kompienga (1988), is not new. This sort of serial agricultural migration has been practiced on the Mossi Plateau for centuries. The Kompienga census identified fifty-five male household heads who were former AVV settlers from the planned settlements at Mogtédó, Mogtédó-Bomboré, Rapadama, and Mankarga. As many as half of the Mossi living in Kompienga in 1989 had probably lived for two to ten years in other areas of the OCP valleys or the plateau before migrating to the town.

This kind of step migration has costs—not only economic, but also institutional and environmental. At Mogtédó and in certain villages at Rapadama, the out-migration of wealthier farmers meant the loss of income earned during the early period of colonizing the new settlement sites, when crop production was highest. These cash resources could have been reinvested in the development of more intensive, sustainable environmental management—for example, in the construction of stone diguettes (small dikes). Another incalculable cost is the loss of a first generation of settlement leadership. The commercial farmers who left Mogtédó for Kompienga included some of the most ambitious leaders who had worked most closely with the AVV administration in finding practical solutions to the settlers' problems.

Sites with Limited Opportunities for Agricultural Income Growth but Opportunities to Develop Off-farm Employment

A third category of case study sites includes those where greater opportunities to develop off-farm employment made it possible for male and female settlers to raise their living standards despite the areas' limited potential for agricultural income growth.

The AVV planned settlements at Linoghin (Burkina Faso)

In contrast to the AVV planned settlements at Mogtédó and Mogtédó-Bomboré, no settler households immigrated to Kompienga from the AVV planned settlements at Linoghin. Yet the Linoghin farmers confronted the same stagnant prospects for growth in agricultural income as the settlers living in the thirteen neighboring AVV settlements at Mogtédó and Mogtédó-Bomboré described above. The key difference seems to have been the much greater opportunity to develop trade at Linoghin, where one of the settlements was located along the paved highway linking Ouagadougou to eastern Burkina Faso, Togo, Niger, Benin, and Ghana. Eighty percent of the women interviewed at Linoghin recorded income from off-farm employment, none of it from gold (tables 2 and 3). Most was from cooked food, homemade beer, and gathered forest products. The average nonfarm income for the women interviewed at Linoghin was about the same as that recorded at Mogtédó V3, the village where women gained the most from the 1987-88 gold rush.

The greater success of the Linoghin farmers in developing nonfarm, income-earning opportunities seems to be the main factor in their willingness to invest in a new generation of cash and labor-intensive crop production techniques. Ten years ago, there was no visible difference among Linoghin, Mogtédó, and Mogtédó-Bomboré in input use or net productivity per worker (Murphy and Sprey 1980, p. 69). By 1988, however, the net CFAF value of crop production per labor unit (ALE) for the study farmers at Linoghin was 12 percent higher than for those at Bomboré, and 20 percent higher than for those at Mogtédó (McMillan, Nana, and Savadogo 1993, p. 65). In 1988, production expenses (in cash and in kind) for study farmers at Linoghin were 24 percent higher than at Mogtédó and more than 200 percent greater than at Mogtédó-Bomboré and Mogtédó V3 (Savadogo, Sanders, and McMillan 1989, p. 40). Seventy-nine percent of the study farmers used some compound fertilizer on their fields at Linoghin, 85 percent did at Mogtédó, but only 45 percent did at Mogtédó-Bomboré (Savadogo, Sanders, and McMillan 1989, p. 34). The Linoghin settlers also showed the greatest interest in investing in the more

labor-intensive soil conservation measures, such as building diguettes and manure pits. This, along with the almost nonexistent out-migration from the site, reflected their greater interest in investing in long-term settlement. In contrast, the more isolated, less diversified neighboring blocs of Mogtédó and Mogtédó-Bomboré experienced high rates of settler dropout. Of the 255 households acquiring AVV farms at Mogtédó between 1974 and 1978, only 58 percent (148) were still living there in 1989. Out-migration was much lower but still substantial (19 percent) at Mogtédó-Bomboré.

The greater dynamism of the Linoghin settlers manifested itself in other ways as well. For example, an operating mill was run by a private entrepreneur. Although data are incomplete, it seems that the villages at Linoghin have been more successful in pooling funds to replace worn-out pumps. One settler, a pensioned French military veteran, had opened a small private pharmacy in his home. The women had started a small weaving cooperative to profit from the increased urban demand for hand-woven cloth. In contrast to neighboring blocs, in Linoghin the female literacy programs have been popular and well attended. Especially remarkable was the Linoghin group's development of the first kindergarten, reflecting the higher overall spending on education (primary and secondary) in Linoghin observed in the consumption survey.

Finkolo and Tienfala (Mali)

Most of the study households at the Finkolo study site had immigrated to work as wage laborers on a commercial tea plantation that was established in 1967 (Koenig 1990). It was like most plantations in Africa, and provided the workers with an income insufficient to satisfy all their household needs. The ability of tea plantation workers to supplement their income through part-time farming was hampered by lack of inputs and extension advice; the government agency charged with agricultural extension for the zone did not recognize part-time farming, even though, after retiring, many of the workers remained on the small farms that they had cultivated (Koenig 1990, pp. 30-59). Not surprising, average food grain production was low (119 kilograms per person) (Koenig 1990, p. 39 and personal communication 1994). Few settlers owned animal traction equipment or livestock. The small amount of land made available for household fields at Finkolo left none for women's private fields. Despite these constraints, the combination of crop and income earned on the tea plantation allowed farmers to improve their living standards. School attendance, for example, was the highest at all of the study sites.

A similar situation was observed at Tienfala, located in the peri-urban area along the railway line between Bamako and Koulikoro with easy access to the Bamako

market (20-30 kilometers). Although there were no obvious cases of landlessness in Tienfala, it was becoming more and more difficult for small farmers to support themselves on the available land and to maintain adequate fallow periods (Koenig 1990, p. 34). Average food grain production was also low (177 kg per person) (Koenig 1990, p. 39 and personal communication, 1994). Despite these constraints, thirty-five percent of the recorded fields belonged to women (personal communication, 1994). In addition, women entered into a variety of non-farm enterprises. Several of the migrant women in the sample worked as maids, something the local women would not do (Koenig 1990, p. 54). Other women sold wood.

Sites with successful intensive commercial crop production packages

The best example of a crop production package that can be characterized as sustainable is the intensive commercial cotton package promoted in southern Mali and western Burkina Faso (Koenig 1990; McMillan, Nana, and Savadogo 1992). Average annual food grain production for the study farmers at Dioila was 394 kg per person, more than twice the yearly requirement of 180 kg per person (Koenig 1990, p. 38 and personal communication 1994). In addition, the sample households produced an average of 1,817 kg of cotton per household (Koenig 1990). Average cereal (sorghum, millet, and maize) production for animal traction households at Solenzo was a whopping 567 kg per person (if the inflated production figures for the small number of farmers with mini-tractors are included) and 361 kg per person for manual farmers (Savadogo, Sanders, and McMillan 1989, p. 5; McMillan, Nana, and Savadogo 1993, p. 66). Total cotton production averaged 372 kg for manual farmers, 2,202 kg for households with animal traction, and 22,252 kg for the nine households with mini-tractors.

These higher yields, involving a much larger cultivation area for cotton, were associated with much higher demands for household and women's labor.⁶ Indeed, the Institut d'économie rurale (IER) research in the Bougouni region argued that the women's willingness to circumvent the traditional prohibition on women working in the fields alongside their husbands by participating in all-female groups that hired themselves out to work on one another's fields was a major factor in the households' ability to meet the much higher labor demands of the new crop technology (IER 1981, p. 25). Conversely, they argued that no such innovative "social" pattern existed in the semi-intensive or traditional villages, where adoption rates and productivity were lower than in the third village which was characterized as "intensive".

The impact of these higher labor demands on women's private production varied widely between sites. Although

women reduced the time that they devoted to their private rice fields in the intensive IER villages, the average area that they cultivated and the average income that they earned from their rice fields were about the same as in the semi-intensive and traditional village (IER 1981, p. 42). That is because, in contrast to the other two villages, in the village that adopted intensive cultivation the male household heads plowed their fields. A similar pattern of male aid on women's private fields was observed in the early AVV settlements (McMillan 1983). Whatever the motivation for the men contributing their labor on the women's private fields, the net result was to enable women to concentrate their labor on the household's enlarged cotton fields while still retaining their 'right' to private fields.

In contrast, in two of the three Dioila study villages in the Land Settlement Review, the women reported having few private fields (Koenig 1990, p. 52). Unfortunately, the team was unable to measure the percentage of land area or production that these fields represented. In addition, the women in the Yantolila region (near the IER Bougouni study sites), where *Compagnie malienne pour le développement des textiles* (CMDT) had just begun working, reported having great difficulty acquiring fields (Koenig 1990, pp. 53-54). Qualitative interviews in Burkina and at other sites show that women immigrating to an uncleared area in the OCP river basins depended on their husbands to clear the new fields. For that reason, the first fields invariably were created alongside the household's main fields. The lesser access to cleared land, combined with the higher labor demands of building a house and routine domestic chores, explains why nonsponsored immigrants typically had little time, energy, or land for private crop production.

In the Dioila, Solenzo, and IER intensive cultivation villages, the observed increase in women's labor obligations on the collectively worked household fields and their reduced income from private sources were accompanied by a "renegotiation" of the distribution of resources from the collective household fields. In the middle- and upper-income households that grew the most cotton, the male household heads appeared to be making cash payments to the women and married sons who helped them on the fields as well as providing all the basic food and condiments (Koenig 1990; Lichte, personal communication, 1994). A similar phenomenon was observed at the AVV settlements in 1979, when farmers still had 30 percent of the total land area planted in cotton (McMillan 1983). Besides assuming greater responsibility for household expenses, the early AVV settlers gave gifts of 5,000 to as much as 20,000 CFAF to their wives and older sons and brothers. Indeed, the high cost of these "gifts" was one of the main reasons given for the farmers' unwillingness to

Table 4 CFA Value of Production per Household and for One Woman per Household

Site:	Sample Size	CFA Value of Production (per household)		CFA Value of Production from Private Income Producing Activities (for 1 Woman per Household)			
		From Household Fields	From All Women's Fields	Crop	Livestock	Nonfarm	Total
AVV Linoghin	20	233,762	31,092	19,336	201	21,331	71,960
Bombore	20	237,137	30,594	11,145	486	1,690	13,321
Mogtedo	20	220,242	37,699	16,976	1,887	14,805	33,668
MogtedoV3	20	192,854	36,457	17,385	3,865	23,392	65,892
Solenzo-All	(36)	1,065,185	22,203	12,687	0	6,833	19,520
Manual	13	86,340	■	■	■	■	■
Animal Traction	14	354,231	■	■	■	■	■
Mini-Tractors	9	3,627,438	■	■	■	■	■
Kompienga	25	409,732	33,505	12,633	-442	9,774	21,965

■ indicates data not available.

Sources: Savadogo 1989a: 17-19; McMillan, Nana, and Savadogo 1993: 62, 66.

accept the cotton parastatal's proposal to split the cotton market into two days. They argued that the split market would eliminate any profit because it would obligate them to make two sets of intrahousehold gifts (McMillan 1983).

The same case studies caution against focusing exclusively on the ideal or "modal" pattern of intensive cotton production to avoid overlooking wide differences at a site in household patterns of production (table 4). In particular, it is very easy to overlook the fact that not all households have the cash, land, or labor to adopt new intensive crop production technologies (Koenig 1990, p. 42; IER 1981, 1982; McMillan, Nana, and Savadogo 1993, pp. 62-68). Key factors influencing the ability of farmers to adopt the proposed intensive crop packages include household size, capital, experience with animal traction, and quality of landholdings, as shown in table 5. These same factors account for at least some of the wide variation observed among households in average yields and income (IER 1981, p. 9; Koenig 1990, p. 30).⁷ In many cases, these differences correlate with differences in levels of and dependence on private crop production. For example, women's production accounted for 25 percent of the net value of production for the Solenzo households that farmed manually, but only 6 percent for the households that farmed with animal traction and less than 1 percent for households that owned mini-tractors (McMillan, Nana, and Savadogo 1993, p. 66; Savadogo 1989a, p. 17). This wide variation was obscured by the overall sample average of 2 percent (Savadogo 1989a, p. 17). The same average fig-

ures can mask wide variation between technology groups in women's role in food grain production (table 6).

Koenig observed that, at all of the Mali study sites, women in the poorest households engaged in a wider range of nonfarm activities than women in the middle- and upper-income strata (Koenig 1990, pp. 42-43). In addition, the households in the lower-income strata were much more dependent on the women's nonfarm income to purchase food and satisfy basic needs. Koenig observed a similar phenomenon at Kita, another area in Mali with a successful intensive peanut package (Koenig in Koenig forthcoming). At Kita, women in the lowest-income stratum produced a much greater share of household income than those in the other two income groups (about a third, compared with a tenth or less), and their income was necessary to cover basic household expenses (Koenig in Koenig forthcoming). The IER survey of three CMDT villages near Bougouni (near Yanfolila) found that the poorest households usually had the most diversified sources of income (IER 1981, pp. 42-46). Nonfarm income was especially critical in the low-income households, which used it to purchase food.

A key lesson to be learned from these "successful" study sites is the flexibility of traditional patterns of intrahousehold production in adapting to new, more labor-intensive cash crops. Equally important is that not all households are willing or able to absorb the labor demands and risk associated with this type of high input cultivation package. It is not surprising, therefore, that

Table 5 Crop and Livestock Production per Adult Labor Equivalent (ALE Solenzo 1988/89)

	Dar/Kie			Daboura			All		
	Manual	Animal Traction	Tractor	Manual	Animal Traction	Tractor	Manual	Animal Traction	Tractor
Average family size (no. residents)	8.0 (6)	13.5 (8)	29.5 (5)	8.0 (7)	7.5 (6)	37.0 (4)	■	■	■
Average family labor force (ALE ^a)	2.8	5.3	10.9	2.6	2.5	13.8	2.7 (13)	4.1 (14)	12.2 (9)
Collective Field Area (per farm ^b)	4.4 (6)	7.0 (9)	37.7 (5)	2.7 (7)	5.8 (6)	29.9 (4)	3.5 (13)	6.5 (14)	34.5 (9)
Collective Field Area (ALE)	1.4	1.6	3.4	1.5	1.9	2.2	1.4	1.7	2.8
Cotton (Kg. per ALE)	148	548	2,789	133	513	869	138	537	1,824
Sorghum-Millet (kg. per ALE)	422	694	808	411	1,252	737	410	838	771
Maize (Kg. per ALE)	42	135	4,292	132	94	1,448	88	124	2,864
Net Crop Income all Fields (CFA per ALE)	24,416	79,821	521,167	39,134	104,988	182,850	31,978	86,398	297,331
Annual Livestock Income (CFA per ALE) for Male Household Heads	1,000	11,200	71,907	3,737	-4,911	10,921	■	■	■

() indicates number of households.

■ indicates data not available.

^a Weights used to derive ALE are based on study calculations.

^b Measurements for the fields of the household head and one wife were estimated by crude calculations of length and width. A subsample of fields was subjected to more rigorous field measurements in order to verify the accuracy of our estimates.

Sources: Savadogo, Sanders, and McMillan 1989 and McMillan calculations.

Table 6 Division of Cereal Production between Privately and Cooperatively Worked Fields, Solenzo 1988/1989 (in percent)

Village and technology type	Cooperative	Private Fields		
		All	Men's	Women's
Dar-es-Salaam/Kie				
Manual	100	0	0	0
Animal traction	79	21	10.5	10.5
Tractor	100	0	0	0
Daboura				
Manual	95	5	0	5
Animal traction	98	2	0	2
Tractor	100	0	0	0

Source: Savadogo 1989d.

households in different income and technology groups vary widely in their organization of household and private crop production.

Conclusion

The Land Settlement Review confirms the observation based on comparative research that women were generally worse off, at least initially, in areas of new-lands settlement (Koenig forthcoming; Scudder 1981, 1984; Sequeira 1993). One reason for this is the substantial increase in demand for women's labor for domestic and agricultural chores. The initial transition period also was associated with women's loss of their traditional sources of independent income from private fields, irrigated gardening, and nonfarm employment—not just in the AVV settlements but in sponsored and spontaneous settlements worldwide (Koenig forthcoming; Scudder 1981, 1984; Sequeira 1993).

The river basins' isolation and their greater distance from markets increased the amount of time spent in transporting crop and forest products to markets. Women's loss of access to the gas-powered mills that many had used in their home areas led to a dramatic increase in the time spent in processing food. With few permanent water points, the average time required to get water also increased, by several hours a day. As a result, women often obtained water from lakes and stagnant sources, which contributed to an increase in guinea worm and infant diarrheal disease at some of the study sites (Painter 1990). When combined with the backbreaking work of clearing and planting new fields, the increased labor associated with routine domestic tasks meant that female settlers had little time for their independent social and economic activities during the early years. Burdened with higher labor demands and less familiar with their new environment, the women often decreased their use of gathered foods and forest products (McMillan 1983; Diarra and others 1994). Colson observed a similar result at Kariba, where it had a serious effect on infant and child nutrition (Colson 1971).

A central theme in the resettlement literature is that female settlers usually lose their inherited rights to land when they move (Colson 1971; Koenig forthcoming; Salem-Murdock 1989; Sequeira 1993). The loss of inherited land tenure rights is especially disruptive in matrilineal societies (Kiste 1972; Koenig forthcoming). Studies emphasize that the lack of inherited rights, fewer sources of independent income, and distance from their natal families increase women's vulnerability in the event of a divorce or the husband's death (Brain 1976; Koenig forthcoming; Sequeira 1993).

When the women settlers immigrated to the OCP areas, they also lost their traditional rights to crop and grazing land. Their acquisition of new land in the river basins was complicated by their dependence on men to clear the

land. Since rights to land are usually held by the person who clears it, the women generally became more dependent on their husbands for land than they had been before moving. Over the long term, most women did acquire private fields, even in planned settlement projects, such as the AVV and FED-Agbassa projects, that made no provision for private fields (McMillan, Nana, and Savadogo 1993; Painter 1990). The chief exceptions occurred where the amount of land given to the recognized male household head was considered inadequate to farm—for example, Finkolo, Tienfala, Selingué, and a village in Manantali (Koenig 1990, p. 43, and forthcoming, p. 11).

Koenig (forthcoming) points out that women generally were less concerned about the loss of land rights per se than about the consequences. She observed that where resettlement resulted in a higher standard of living and men were willing to share the higher income with their wives, women had a more positive perception of the move. Two of the best-documented examples of this are the Zimbabwe schemes studied by Jacobs (1989) and the Shukriya tenants in Sudan's New Halfa scheme (Salem-Murdock 1989). Studies emphasize that women can compensate for a loss of rights in agriculture if they can find other, nonagricultural sources of income (Koenig forthcoming, p. 18). At New Halfa, for example, many women began to trade, and they thus approved of the resettlement despite their loss of "traditional" occupations (Salem-Murdock 1989). In the more isolated Kariba villages that were far from beer halls, women were able to increase their incomes by making bee: when the harvests were good (Colson 1971, pp. 130-32).

Similar patterns were observed at the Land Settlement Review study sites, but the resulting income increases were not always sustainable. In each case, however, the early increase and then subsequent decline in women's income had less to do with their being women than with the overall failure to generate sustainable opportunities for increasing agricultural income at the study sites.

When profitable technologies were available, women showed their willingness to forego the land rights and income earning opportunities they had enjoyed before immigration. Women thus contributed to the adoption and productivity of new technologies and land management practices. In the absence of profitable activities, the income earned from women's crop, livestock, and nonfarm activities helped the families to survive.

Recommendations

1. Support adaptive, gender-sensitive, on-farm research and extension

The intensive cotton package implemented in southern Mali and western Burkina Faso has been the only crop technology package promoted in the OCP river basins that

approximates the popular definitions of environmental sustainability. This package builds on more than fifty years of consistent support for action-oriented research and extension by the French and national governments. Its development was further supported by the existence of strong, well-organized rural development organizations such as the CMDT and Société des fibres textiles (SOFITEX), which offered agricultural credit, improved inputs, and advice to farmers growing new crops on new lands (Koenig 1990, p. 64; McMillan, Nana, and Savadogo 1993).

Few such technologies exist for the other Sudano-Sahelian zones. Moreover, in these zones the "normal" problems of technology development were complicated by the lack of established cropping systems or research data on which to base extension recommendations and advice. The river basins' sparse population means that they often lacked the basic infrastructure (roads, bridges, schools, markets, and administrative centers) that supports development. Some of the reasons that an area may have remained uninhabited, such as human or animal diseases, or unhealthy drinking water, also pose problems, as does insecure land tenure. For all these reasons, technology development in the less privileged zones is likely to be a long process of trial and error.

There is a critical need for donors, nongovernmental organizations (NGOs), and governments to support research to develop the technology and policies necessary to support higher-yielding, sustainable crop production practices. Planners recognize the need to support agricultural development. All too often, however, the follow-up planning has focused on preliminary surveys designed to measure arbitrary levels of success, basic infrastructure, and extension. In the early AVV project, for example, there was almost no attempt before 1986 to link the results of the project's farm monitoring program to modification of the recommended package (see Murphy and Sprey 1980). A similar pattern of "top-down" extension was observed at most of the other sites. Indeed, no evidence of on-farm adaptive crop or livestock research was found at any of the study sites in 1988 except in the CMDT and SOFITEX cotton zones.

This finding is consistent with Scudder's observation, based on a comparative review of more than 100 new-lands settlement projects in Africa, Asia, and Latin America, that extension services were either nonexistent or minimal in 53 percent of the government-sponsored settlements and of good to excellent quality in only 11 percent (Scudder 1984, p. 33). Of the ten spontaneous settlements on which he had data, nine either had no extension services or had only minimal extension services.

The recommendation to support adaptive, gender-sensitive, on-farm research should not be interpreted as suggesting that conventional crop research should be

de-emphasized. Rather, echoing Scudder's global recommendation, it is clear that every research station that serves a specific agro-ecological or political zone "should include an area which simulates in size and other conditions the different kinds of settler holdings in that zone" (Scudder 1984, p. 24).

As part of this process, there is a critical need to reinforce and expand existing efforts to promote the full participation of women in the identification, testing, and dissemination of new technologies. There are several practical reasons for this. One has to do with the fact that women's knowledge of the environment is not the same as men's. Drawing on women's knowledge can help prevent costly mistakes, such as investing in seed varieties, field layout patterns, roads, or road networks that are not adapted to the needs of rural farm families. Another practical reason for ensuring women's participation is that it helps improve the chances that both male and female farmers can accommodate the new labor and production demands by adjusting intrahousehold patterns of production and consumption.

2. Anticipate and reinforce the evolving patterns of income diversification at the sites

In the short run, even the most seasoned planners are unlikely to be able to predict all of the factors that will affect the development of commercial farming in the OCP river basins. For that reason, the planners' goal should be to develop a diversified production system, rather than a system focused on the intensive production of one or two commercial crops, such as the early programs advocated at the AVV, FED-Agbassa, and Manantali projects (McMillan 1993). A diversified economic system that includes possibilities for earning income from irrigated dry-season farming, livestock, forestry, trade, and rainfed agriculture offers both men and women the greatest freedom to develop innovative responses to new constraints and opportunities.

While diversification is important in all systems, it is especially important in areas that lack established commercial crop production packages such as those supported by the CMDT in Mali and SOFITEX in Burkina Faso. In these areas, the availability and profitability of nonfarm income earning opportunities (for men and women) are likely to influence reinvestment patterns. Some of our best evidence for this comes from the AVV planned settlements at Linoghin. Plentiful nonfarm employment gave the Linoghin settlers the means to invest in a new generation of crop technology and land management practices. Higher cash income due to plentiful off-farm employment gave the Linoghin settlers the means and the motivation to invest in a new generation of crop technology and land management practices that would allow them to increase or at least

stabilize agricultural production at the site. In much the same way, the high potential for developing irrigation and trade at the Kompienga study site seems to account for the low rates of farmer out-migration despite declining yields and the lack of government support for agriculture.⁸

Diversification is likely to be relatively unimportant in the initial development of areas with intensive commercial packages such as the CMDT cotton package. But over the long run the development of diverse commercial food and cash crop production helps to buffer the impact of a collapse in the price or subsidies for a single dominant cash crop. A dramatic drop in the profitability of a dominant cash crop affects both rich and poor, but wealthier households have a greater ability to move on to an area offering new opportunities.

A diversified package of income earning opportunities based on several crops, livestock, and nonfarm employment improves the chances that new immigrants, who often have less labor and cash than established farmers, will be able to absorb the cash costs and higher risk of moving into new, higher-yielding crop production technologies. The same "bank" of more diversified income earning opportunities provides a cushion for smaller households that may be forced to abandon more labor-intensive, high-risk technologies because of illness, old age, or the out-migration of a key worker.

These findings corroborate other research showing that increased economic diversification need not be at the expense of additional investment in intensive farming or higher crop productivity (Scudder 1981, 1984). Indeed, there is little evidence from successful settlements throughout the tropics of significant numbers of wealthier farmers withdrawing entirely from agriculture as long as appropriate agricultural markets exist (Scudder 1981, 1984). In terms of environmental sustainability, crop productivity, and positive regional development, one of the most successful settlements in the tropics is Minneriya, established in the dry zone of Sri Lanka in the 1980's (Scudder and Wimaladharm 1985, 1990). Wimaladharm found that over 90 percent of holdings in the early 1980's were still controlled by the same families—including now adult children to whom parents had handed over management (Scudder and Wimaladharm 1990). High rates of settler turnover in Africa, Asia, and Latin America are associated with a lack of opportunity as well as insecure tenure and unfavorable project and macro-level prices and/or price policies that deflate the returns to sustainable cropping (Scudder 1981, 1984; Painter and others 1984).

There is a need to increase the awareness of governments, NGOs, and donors about the vital link between farm and nonfarm employment in the OCP and at older settlement sites worldwide. This is a theme that was examined for agriculture in general and for new-land set-

tlements in particular during the 1970s (Hagglade, Hazell, and Brown 1987, 1989; Johnston and Kilby 1975, p. 301; World Bank 1978; Weitz, Pelley, and Applebaum 1978; van Raay and Hilhorst 1981). But it seems to have been lost during the 1980s, as the emphasis shifted to macroeconomic policy reform and reinforcing national research institutions and regional research networks.

For more decentralized, diversified income earning opportunities to develop, they need to be reinforced by new technology. There is an immediate need for research to identify promising technologies that could improve the returns to women's manufacturing and food processing activities, for wider dissemination of information on existing food processing technologies. Another priority need is for national initiatives to decentralize food processing and to expand markets for nontraditional, locally manufactured products.

In view of the importance that settlers attach to developing diversified sources of income, policymakers should concentrate, at least initially, on less isolated areas where opportunities for diversification are greater. The chief exception should be isolated areas with considerable natural resource or economic potential, such as areas near dams and protected (or classified) forests.

If the first generation settlers in an area is successful in development efforts, that success is likely to attract additional settlers. Therefore, it is important for policymakers to phase development investments over a long period. Growth of a settlement normally results in the creation of new markets and in the expansion of existing markets and administrative centers. These expanded markets tend to increase women's nonfarm employment by creating new market opportunities and reducing input and labor costs. The AVV's many futile attempts to develop markets show that it is not always easy to predict where new market centers will develop. Nevertheless, government investment in roads and infrastructure that facilitates the development of market centers increases the profitability of local agricultural and nonfarm enterprises. Donors might therefore plan a second generation of funding to support the development of market and administrative centers that emerge during the first phase of an intervention and whose continued success is critical to the attainment of longer-term project goals of sustainable development.

3. Link basic literacy training to the development of better models for funding and managing labor-saving technology and social infrastructure

There is clear evidence that women suffer disproportionately from the lack of infrastructure in the sparsely settled river basins, since this increases the labor involved in time consuming activities like carrying water, processing food, and raising healthy children, transporting crops

and trade. To remedy this, a large number of research and planning documents emphasize the need to develop health and education infrastructure, as well as labor-saving technology for domestic tasks, as a "women's issue" (see Phillott-Almeida 1985).

But no model has yet demonstrated the best means to support these types of project. In one model the new infrastructure was provided by a development authority similar to the AVV or FED-Agbassa. Invariably, however, these projects ran into trouble when it came time to hand over management of the infrastructure to the settlers (McMillan, Nana, and Savadogo 1993; Painter 1990; Koenig 1990). An important problem was the settlers' low level of education. For this reason, some of the more recent programs emphasize the need to link infrastructure development programs with programs to teach the basic literacy and accounting skills necessary to manage this infrastructure. Policymakers would benefit from a critical analysis of the factors that have contributed to (or detracted from) the success of group-managed infrastructure such as wells, mills, village pharmacies, and schools in the older areas of new-lands settlement or in particular countries.

Far less attention has been focused on the issue of privately managed mills, clinics, and village pharmacies. Although the Land Settlement Review did not examine this issue, a high percentage of the mills operating in successful zones of spontaneous in-migration seemed to be privately owned. The high failure rates for group-managed enterprises suggests that more attention needs to be paid to the relative merits of private sector management. Few women care who operates a mill or dispensary; they care only that it is open and capable of delivering the required services.

4. Develop income earning opportunities based on renewable forest products

Given the heavy concentration of protected and natural forests in the OCP river basins, priority should be given to NGO and government efforts to develop income earning opportunities based on renewable forest products. The genius of this type of project is that it creates a group of people with a vested interest in regulating those who attempt to exploit the forests. And since women typically are the primary gatherers and processors of forest products (firewood, charcoal, honey), they often are the major participants in and beneficiaries of such projects.

5. Analyze women's issues and strategies to address these issues within a wider systems context

A final recommendation concerns the need for planners to analyze gender issues within a wider systems context. Failure to do so can lead policymakers:

- To overestimate or underestimate the impact of gen-

der-related factors on a household's willingness and ability to adopt new technology and land management practices⁹

- To misidentify the major sources of household income and to estimate incorrectly the size of household income
- To overestimate the impact of gender-specific constraints relative to that of broader system constraints
- To exclude women from the design of crop and livestock extension programs by focusing attention instead on gender-specific infrastructure and income earning projects.

The call for a broader systems approach is similar to a recent shift in thinking about women in developing country agriculture toward the concept of "gender planning," which, in taking account of the fact that women and men play different roles in Third World societies and therefore often have different needs, provides both the conceptual framework and the methodological tools for incorporating gender into planning (Moser 1989: 1799).

6. Need for a longitudinal perspective on women's issues

An important weakness of OCP planning and evaluation documents, however, has been their strong tendency to consider household and intrahousehold opportunities, constraints, and goals as if they are static. This stems in part from the difficulty of quantifying and verifying the reliability of information on intrahousehold labor and commodity flows and in part from the need to simplify interview forms to ease data collection and comparative analysis (McMillan 1987).

A promising methodology for developing comparative, longitudinal research on settlement trends is to incorporate intensive, micro-level studies of intrahousehold change and diversification in a more broadly based farm monitoring survey. This methodology was used in the longitudinal case studies of the AVV and the Manantali sponsored settlements (see Diarra and others 1994; Koenig 1990; McMillan 1983, 1987; McMillan, Nana, and Savadogo 1993). A longitudinal approach is important for development research in general, but it is especially important for analyzing new-lands settlements because of the high demands for labor and investment during the early years and the significant stress of adjusting to new social and production environments (Scudder 1984).

Whenever possible, studies should strive to be longitudinal—that is, they should reexamine the same group of households at different points in the project cycle. If longitudinal research is not possible, careful attention should be given to distinguishing between households at different stages in adopting a new technology package. This approach allows researchers and policymakers to distin-

guish between long- and short-term effects of technical innovation and resettlement. It can also increase appreciation of the fact that the issue of women's roles in OCP development is not only—or even primarily—about equity. Rather, general differences in development are fundamentally economic, and, as such, have significant implications for the current and long-term sustainability of specific sites and of the entire OCP zone.

Notes

1. The research was conducted in 1989 by four country teams that comprised a mix of national and international consultants. The teams conducted interviews in 114 villages and several cooperatives. The household surveys included 485 settler households in 66 villages (see McMillan, Painter, and Scudder 1992, pp. 5-6). Questions asked of household members at each study site concerned household migration histories; patterns of production, consumption, and investment; the nature and uses made of returns on production; off-farm activities; and natural resource management. In most cases, though not all, only one man and one woman were interviewed in each study household. Community leaders and other individuals were asked questions about village history, migration, and settlement in the area, land use and land conflict, the presence of social services, infrastructure, markets, and the like. Regional-level information on settlement and development was obtained through interviews with representatives of government and nongovernmental organizations and projects and through a review of government documents (McMillan, Painter, and Scudder 1992). Although gender issues were addressed for each topical area, they were not the primary focus of the study.

2. Like the AVV and FED-Agbassa plans, the project plan for the Manantali Dam resettlement scheme included the expectation that settlers would continue to use the high input package suggested by ODIPAC (Opération de Développement Intégré des Productions Arachidières et Céréalières) that would have allowed the settlers to grow a mix of cash and subsistence crops on a fixed area of land that was more circumscribed than that to which they had been accustomed (see Horowitz, Koenig, Grimm, and Konate 1993; Diarra and others 1994).

3. The success of the intensive cotton production model in western Burkina Faso led the AVV to advocate a similar model for the planned settlements along the Nakambe (formerly the White Volta).

4. The AVV farmers reduced cotton cultivation from 38-42 percent of the planted area in household fields in 1978 to 20 percent in 1988, and increased the area planted to the less intensive sorghum and millet from 33-48 percent of the household field area to 60 percent (McMillan, Nana, and Savadogo 1993, p. 64).

5. The AVV uses a system of labor equivalents to determine the amount of land a household receives and a similar system to determine the distribution of supplementary food during the first year. A household's potential labor is measured by a labor index that assigns weights to persons according to sex and age. Since an adult male is considered to have the work capacity most readily transferred to a variety of tasks, adult males are the standard unit and are assigned a value of one. Women and children are assigned lesser values (0.75 for adult women, 0.50 for teenage boys, 0.25 for a woman over age 55). The use of labor and consumption equivalents to standardize the units of comparative analysis (so that one does not calculate the "average" household income based on units that may range in size from three to thirty-five people and one to twelve workers) is a hotly debated topic in farm management research.

6. In 1979, the recorded rainy season labor time for Kaya settlers who had lived in the AVV planned settlements for three to five years was twice the recorded figure for the home village (1,200 weighted hours per labor unit compared with 600), due in large part to the fact that 30 percent of the total area was planted in cotton.

7. The IER research in the most intensive CMDT village showed that cotton yields ranged from 747 to 2,346 kg/ha and averaged 1,091 kg/ha (IER 1981, p. 9). Sorghum yields ranged from 736 to 2,369 kg/ha and averaged 1,380 kg/ha.

8. The reinstatement of women's private fields and off-farm employment at Kompienga was very rapid due in large part to the strong base of existing social infrastructure associated with the dam, such as housing, wells, roads, and health care facilities, as well as the fact that some of the fields were all or partially cleared by the first generation of spontaneous settlers before the former AVV settlers arrived.

9. One of the best examples of this was the fear that a strong tradition of "private" fields would reduce settlers' willingness to adopt more labor-intensive crop technologies. Instead, the case studies note several instances in which the women were willing to forgo certain "traditional" prerogatives as long as there were sufficient economic incentives. Moreover, in the absence of strong economic incentives, the case studies showed that nothing could prevent the women from reinstating private income earning opportunities even when these were not specified in the project plan (AVV and FED-Agbassa).

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Settlement and Development of Onchocerciasis-Freed Areas in Mali

Ministry of Rural Development and the Environment, Mali

Development of onchocerciasis-freed areas

For a very long time, onchocerciasis (or river blindness) has been the main constraint on the development of vast areas of high productivity in Mali. Indeed, the area of prevalence of this serious endemic disease covers 350,472 square kilometers, or 28 percent of the national territory (five regions out of eight, and twenty-seven cercles—local administrative units—out of forty-six). Often, more than 90 percent of the economically active rural population in these areas was affected.

The government of Mali not only launched a program to combat the disease, it also planned for the economic development of the areas freed from onchocerciasis. In December 1974, therefore, an Onchocerciasis Unit was created at the level of the Ministry of Planning with the support of the UNDP, the FAO, and the World Bank. Since then, major successes have been achieved with regard to the endemic disease, and the populations are flowing back into formerly deserted areas.

The global strategy of combating desertification favors developing more fertile areas before already desertified areas. For this reason, areas freed of onchocerciasis were given priority for agricultural extension and the establishment of technical structures.

Characteristics of the area

The onchocerciasis area extends across the Sudanese-Guinean and Sudanese savannas and the Sahelian-Sudanese steppe. Rainfall there ranges from 1,300 millimeters per year in the south to 400 millimeters per year in the north. According to the 1987 census, the area had 5,189,417 inhabitants—or more than 65 percent of the total population of the country. The density there is 21.97 inhabitants per square kilometer, compared with a national average of 7 inhabitants per square kilometer. This population is 90 percent rural and is divided among small villages. The formerly infested region is largely farmland and pasture area with immense economic potential.

The current economic activities there are farming, fishing, stock raising, and forestry. It can be safely said that the onchocerciasis area is the breadbasket of the country. It furnishes:

- More than half of Mali's millet and sorghum
- All cotton produced for export
- More than 20 percent of the production

of paddy and groundnuts.

It is also the foremost mining area of the country, combining the gold mines of SIAMA I and II, Kalana, and Sadiola and all the diamond mines, marble quarries, and other mineral works. The hydroelectric dams of Sélingué and Manantali—with their high potential for increasing agricultural and electrical production—are major industrial assets of the onchocerciasis area.

The onchocerciasis area is also rich in natural resources:

- The area's agricultural land reserves are estimated at 7,168,768 hectares. The rate of land use is 36.25 percent. The area farmed per number of inhabitants gives the ratio of 0.94 hectares per capita. The land reserves are estimated at about 100 years.
- The pasture resources consist of natural forests, cropland after the harvest, harvest residues, and agro-industrial by-products. Forage resources reportedly fall far short of the needs of the animals using the area.
- The forest resources (now receding rapidly under pressure of the drought and wood cutting) are expected to provide the area with a reserve of firewood for about 150 years.
- The wildlife and fish resources, formerly considerable, are rapidly receding despite the existence in the onchocerciasis area of Mali's only national park as well as wildlife reserves, numerous watercourses, and large reservoirs of water in the Sélingué and Manantali dams.
- The area's water resources are considerable and make it possible not only to develop the lands but also to replenish underground springs and meet human and animal consumption needs. Nevertheless, a perceptible and continuous decline in rainfall has been noted in the area since 1950.

Extension services in the area are provided by the major development offices and operations, a large number of nongovernmental organizations, and other national and international projects—including the Onchocerciasis Control Programme.

In the onchocerciasis area, mechanization is furthest advanced in the country, and the rural areas are well organized into village associations, village tons, and women's groups. In the CMDT area, an experiment with rural savings-and-loan banks is in progress.

Since the drought of 1973, the western, southern, and eastern edges of the onchocerciasis area have experienced heavy immigration of populations and their cattle fleeing particularly harsh climatic conditions, especially from the Mopti Region and regions of the north.

Major health control efforts in the area include:

- A devolution plan for the Onchocerciasis Control