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THE DYNAMICS OF LAND TENURE ON THE BAKEL SMALL IRRIGATED PERIMETERS

Final Report on the Land Tenure Center Research Program

by

Peter C. Bloch

This report presents the results of the Land Tenure Center's research program on land tenure dynamics in the Bakel Small Irrigated Perimeters. The program was funded under USAID-Dakar's Irrigation and Water Management I project (685-0280), from September 1986 to June 1989. The author, who was the principal investigator, is grateful to USAID/Dakar for its continued support, and wishes especially to thank Gilbert Haycock, Mamadou Ndaw, Nguyen Khoi Le and Charles Shorter of the Irrigation, Water Management and Engineering Office and James Bonner of the Agriculture Office. He also thanks the officials of SAED-Bakel, most notably Michaël Wane and Yaya Dia, for their unstinting cooperation. The program would not have been possible without the warm welcome our research team was given in the villages of the Department of Bakel; the people who were especially helpful include Manca Ndiaye and Mamadou Sidibé of Moudery, Seydou Nianghané of Ballou, and Opa Sy of Sénéoudébou.

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I. Background

A. Origin of the Research

The research reported here was requested by USAID/Dakar as an integral component of its Irrigation and Water Management I Project (IWM-I), whose principal purpose was the rehabilitation and extension of village-level irrigated perimeters in the Department of Bakel, Senegal. In a prior project of USAID/Senegal's, the Bakel Small Irrigated Perimeters Project (BSIP), there had been a growing concern that traditional land tenure and land allocation arrangements had been an obstacle to agricultural performance and harmonious operation of the perimeters, and USAID/Senegal wished to ensure that its information about these arrangements was sufficient to ensure that such problems would not have negative effects on implementation of IWM-I. The University of Wisconsin Land Tenure Center (LTC), which has a Cooperative Agreement with the Bureau of Science and Technology, Office of Rural Development, was asked to design and conduct a research program for this purpose.

One of the research themes under which LTC was working at the time was entitled "Land Tenure Issues in River Basin Development." As LTC's Coordinator of the research theme, Peter Bloch wrote a State-of-the-Art paper, Land Tenure Issues in River Basin Development in Sub-Saharan Africa (Bloch et al. 1986). The paper was based in part upon field visits by Bloch and others to seven sub-Saharan African countries (Kenya, Madagascar, Mauritania, Mali, Senegal, Sudan, and Zimbabwe) in 1984 and 1985, and in part upon a comprehensive review of the literature covering the entire continent.

The River Basins report contained chapters dealing with each of the seven countries visited, and an overview/policy chapter defining the issues of river-basin land tenure and suggesting avenues for research and policy development to confront the issues. The principal issues discussed in the report are: (1) the importance of tenure security, which enables farmers to take a long-term view towards irrigation, thereby investing in and maintaining their holdings; (2) the choice of appropriate holdings size, appropriate from the points of view of productivity and of

correspondence to labor availability of farm households; (3) the care with which participant selection should be made, to ensure access to those most capable of farming successfully without systematically excluding dispossessed groups, notably women; and (4) the necessity to maximize farmer participation in design and management of irrigation to ensure the compatibility of farmer and project objectives.

These considerations became a part of the Bakel research program's design. The program began in December 1986 to January 1987, with a three-week visit to Bakel. Long-term fieldwork was conducted from January to December 1988. The program succeeded in addressing nearly all of the questions specified in the Project Paper. Due to timing and priorities of the prime contractor for the IWM-I Project, LTC was unable to participate in the pre-feasibility study of the medium-scale irrigation system, one of the components of IWM-I with the most fascinating long-term implications for Senegal River Valley development.

B. Institutional Background

1. Land Law and Agricultural Policy

a. The Laws

Enacted in 1964, the Loi sur le Domaine National (Law on the National Domain) was an attempt to place the best aspects of customary African tenure systems on a modern egalitarian and democratic foundation. The law did not recognize the right of private ownership of land and made the state the manager of the national domain, which was virtually the entire land area of the country. The state received the right to designate any part of this domain as being of public utility and thus to take it from its previous users.* However, in the absence of the exercise of this power, farmers maintained their use rights without condition other than that they continue to cultivate the land actively. At the same time, the law made illegal the inegalitarian aspects of customary land tenure. It dispossessed traditional landowning nobilities, present in most of the nation's ethnic groups, of any claims such as tithes and rents which they had on farmers in return for access to 'their' land.

While the law made the state the guarantor of the national domain, it envisioned the establishment of a system of local government, one of whose major tasks was to manage rural land in a way that reflected local priorities and conditions. The administrative reform of 1972 established

* The State can take land under eminent domain for purposes of "public utility," such as road construction roads or other programs of national interest. It recently took a substantial amount of land in the Department of Matam for an Italian project involving irrigation and related activities. If the State continues to do this, the putative authority of the CRs will increasingly be perceived to be circumventable by anyone with influence on the State.

a system of communautés rurales (rural communities--CRs), organized according to geographic and ethnic concerns, with a locally chosen conseil rural as the legislative body responsible for land distribution. Until the reform, Senegalese local government, like the French, was merely a manifestation of the central government, a quasi-military corps of governors and préfets. Under the old system, the lowest level was the arrondissement, administered by a sous-préfet. The new system established the communautés rurales as subdivisions of the arrondissements in order both to bring local government one tier further down and to increase local participation in it.

The administrative reform was implemented region by region over the decade after 1972. Eastern Senegal, in which Bakel is located, was the last area to hold elections for the rural councils. These took place in 1982. The councils have done very little thus far, but it is clear that they will play a larger role in the future, assuming that the state continues its present policy of disengagement and decentralization. The rural councils may also serve as a modern means for traditional elites to maintain their dominance, legitimized by the trappings of democratic processes. In the Bakel Department, the same families who held the land in most of the villages firmly controlled the rural councils.

b. Agricultural Policy

The announcement of the New Agricultural Policy in Senegal in 1984 has completely transformed the institutional context for agricultural development in the Senegal River valley. The policy does not permit private ownership, but encourages individuals and groups to gain access to land from a CR for commercial agricultural development. There has been a rush to acquire irrigable land by people from outside the valley, and tensions are high as local people strive to retain control over as much of "their" land as they can.

The New Agricultural Policy puts much more responsibility onto farmers, and much less onto the state and its development agencies. In the Senegal Valley, SAED had served as extension service, engineering and construction firm, supplier of inputs, purchaser of output, and supplier of credit to the irrigated perimeters everywhere in the Senegal Valley. Concomitant with the New Agricultural Policy was the dépérissement, or withering away, of SAED and its analogues in other regions. Farmers are now responsible for acquiring their own inputs from an emergent private sector or from SONADIS, the parastatal wholesale/retail agency. The only formal-sector credit available is through the newly-established Caisse Nationale de Crédit Agricole du Sénégal (CNCAS), which operates under quite rigorous financial terms. The private sector is also supposed to provide output marketing services. SAED retains its extension and construction roles, though the latter is also supposed to be phased out in the future. The position of the farmer has therefore been dramatically changed: previously she or he was a passive recipient of government services, essentially supplying labor to projects defined at the national level; henceforth he or she must become a farm manager, making decisions about everything from crop choice to marketing arrangements. The transition is likely to be difficult.

2. Traditional Soninké and Toucouleur land tenure systems

a. The Soninké (see Discussion Papers (DP) 4 and 10)

The Soninké are concentrated in the region surrounding the three-way boundary of Senegal, Mauritania, and Mali. They are dominant along an 80-kilometer stretch of the Senegal Valley on the Senegal side, from Ballou to Waoundé. Bakel, the principal town, is roughly midway. Soninké social structure is rigidly stratified into three broad groups: nobles, subordinate castes, and descendants of slaves. Table 1 has a simplified schema of the caste system.

TABLE 1

Summary of the caste structure of the Soninké of the Gajaaga

<u>Caste Name</u>	<u>Description</u>
<u>Hooro</u>	<u>Nobles</u> ; the kingly BACILI are termed <u>tunka</u>
<u>Moodini</u>	<u>Maraboutic</u> (clerical) families
<u>Mangu</u>	<u>Warriors</u> and military advisors to the BACILI
<u>Somono</u>	<u>Fishermen</u>
<u>Nyaxamala</u>	<u>Artisans</u> ; several subgroups are found, notably:
Saxo	woodworkers
Tégu	blacksmiths
<u>Jaagarafu</u>	<u>Descendants of slaves</u> attached to the royal family of the Bacilis who have been assigned responsibility to manage the Waalo, Falo, and Kollangal lands still retained by the Bacilis and to collect payments for use of those lands. Also called <u>kolyadio</u> .
<u>Komo</u>	<u>Descendants of slaves</u> without the above distinction.

In the past, the nobles, clerics, and warriors did not farm themselves, instead relying on the labor services of slaves. This practice has disappeared now, and virtually everyone farms. Nobles, however, retain ultimate control over farmland. Members of the subordinate castes, descendants of slaves, and ethnic minorities gain access to farmland in return for one or more of a variety of payments, depending on the type of land and the relationship between its owner and the farmer. The principal payments for use of land are diaka, ñiñagumkande, muso, and debiguminkande. Diaka is the Islamic zakat, generally 10 percent of the crop. Supposedly a religious tithe, this

payment is more frequently a very secular land tax paid to landowners. Nifagumkande is a small crop share (literally a basketful) paid to the landowner. Muso is the same as the Toucouleur njoldi, a variable crop share paid to the landowner, the amount depending on the relationship between landowner and user. Debigumkande is a small crop share (a basketful) paid to the village chief. Historically these payments could add up to more than half the crop. According to Traoré (DP4) the system is breaking down now, so that everyone is becoming 'maître de son champ' (master of his field).

The fundamental unit for production and consumption is the ka, a lineage segment which may consist of a father and his sons or several brothers. The oldest male, the kagumme, heads it and is responsible for land management. In dryland agriculture, the ka farms a large part of its land as a common field (téxooré), with the kagumme organizing work and distributing its product. Individual men and women usually have their own, separate plots which they farm when the kagumme does not need them to work on the téxooré; the women's individual fields provide them with their only independent income. Control of land is not the same in each village. The history of the relationship of each of them to the Bacili kings over the past 200-300 years dictates which families own, control access to, and collect use payments on the lands within its boundaries. Tables 2, 3 and 4 summarize this situation for the Soninké villages in the Bakel Department.

Thus we see the complexity and diversity of traditional landholding arrangements within a very small geographic area. There are three types of villages, those (shown in Table 2) where the Bacili have yielded their essential rights on all types of land; those (shown in Table 3) where they have given a part of their rights, usufruct, on a part of the land (jeeri) while retaining them on the valuable land; and those (shown in Table 4) which are either the resident villages of the Bacili or villages which for historical reasons have always been completely independent of Bacili control. It is not only nobles who control or administer land; families from all castes do so in one or more of the villages. The Tuure of Gandé and the Kamara of Golmy are the only descendants of slaves listed, and they are from a specialized sub-caste appointed by the Bacili to deal with land administration, collecting payments from the users.

TABLE 2
Families granted direct land rights by the BACILI

Village	Family Name	(French spelling)	Caste
Manael	JALLO	(Diallo)	Mangu
Diawara	SAAXO	(Sakho)	Moodini
	BA	(Bâ)	"
	DUKKURE	(Doucouré)	"
	BOMMU	(Bomu)	Nyaxamala: tégué
	KOYITA	(Koïta)	Moodini
Yelingara	SUMAARE	(Soumaré)	Horo
	SIIBI	(Sibi)	Mangu
	DUKKURE	(Doucouré)	Moodini
	FAADIGA	(Fadiga)	Nyaxamala: tégué
Yafeera	JIMMERA	(Timéra)	Mangu

TABLE 3
Villages granted usufructuary rights to JEERI land by the BACILI

Village	Land-administering family		Caste
Mouderi	NJAAY	(N'Diaye)	Horo
	SEK	(Seck)	Mangu
	DARAAME	(Dramé)	Moodini
Gallacé	BACILI	(Bathily)	Horo
	GUNJAM	(Goundiam)	Mangu
	DARAAME	(Dramé)	Moodini
Gandé	TUURE	(Touré)	Jaagarafu
Golmy	KAMARA	(Camara)	Jaagarafu
	TANJIGOORA	(Tandjigora)	Moodini

TABLE 4
Villages directly controlled by the BACILI or independent families

Village	Family Name	(French spelling)	Caste
Tuabou	BACILI	(Bathily)	Hooro (Tunka)
Kounghani	GEY	(Guèye)	Somono
	TANJIGOORA	(Tandjigora)	Moodini
	JIMMERA	(Timméra)	Nyaxamala: tégué
Arundu	BACILI	(Bathily)	Hooro (Tunka)
Baalou (Ballou)	NYANGAANE	(Nianghané)	Hooro
	GAKKOU	(Gakkou)	Hooro
	DARAAME	(Dramé)	Moodini

b. The Toucouleur (see DP 13)

The Toucouleur are the dominant ethnic group in the middle Senegal Valley, the region which begins immediately downstream from the Soninké zone. They also are in the majority in the Bundu, the valley of the Falémé from Sébou upstream beyond Sénoudébou, all in the Department of Bakel. They are sedentarized Pulaar-speaking people, with a strong tradition of livestock-raising which has been deeply affected by the recent droughts. They share the Bundu with Peul herders, with whom they share the Pulaar language.

The Toucouleur have a system of land tenure with some similarities to that of the Soninké, but some fundamental differences as well. Society is highly and rigidly stratified into the same three broad groups: nobles, casted people and captives, as Table 5 shows. Only the torobé possess large quantities of land, although here, unlike the Soninké case, it is not inconceivable that the other groups own land. Like the Soninké, the Toucouleur devolve land management responsibility upon one member of the family, the joom leydi; unlike the Soninké the position is inheritable from father to son rather than being a strict gerontocracy.

TABLE 5

Summary of the caste structure of the Toucouleur of the Bundu

<u>Caste Name</u>	<u>Description</u>
<u>Nobles (Rimbé)</u>	
<u>Torobé</u>	The highest-status group; control land and political and educational processes. Analogous to Soninké <u>hooro</u> , but also take clerical role.
<u>Subalbé</u>	Fishermen. Analogous to Soninké <u>somono</u> .
<u>Cebbé</u>	Warriors. Analogous to Soninké <u>mangu</u> .
<u>Artisans (Nienbé)</u>	Analogous to Soninké <u>nyaxamala</u> .
<u>Descendants of Slaves (Jiabé)</u>	
<u>Maccubé</u>	Analogous to Soninké <u>komo</u> .

Also, there is no tradition of cultivating in common: land is farmed individually or by the adult members of a nuclear family. In dryland agriculture, men grow the basic grains--millet, sorghum and maize, with little assistance from their wives and daughters. Women have access to individual plots to grow peanuts for food and small amounts of cash. Women's primary productive economic role is, however, livestock, a vestige of the transhumant or nomadic past of their people. The value of the milk in some Pulaar families with substantial herds is very great, and women generally control the income flowing from this source.

The Peul are not as rigidly organized into castes as are the Toucouleur. The nomadic or transhumant mode of production is not likely to exhibit as great a degree of social differentiation as does a sedentary farming mode: one can have someone else farm one's land and keep pretty good track of his performance in order to ensure that the surplus will be delivered as required, but if someone else has one's cattle on a six-month-long transhumance, it would be very hard to control offtake (or permanent emigration, given the value of the herd). Thus status among Peul is determined by herd size, but dependency relationships among Peul are limited in scope.

As is the case for the Soninké, there is a single leading family which has dominated the Toucouleur of the Bundu region. A member of the Sy family (the Sisibé) has served as Almamy (traditionally a spiritual leader, but more recently the political and administrative head) for well over one hundred years. They were the undisputed owners of the land in the Bundu; the chiefs of each village were responsible for allocating dryland, but the Almamy controlled the pale land along the banks of the river and received the Islamic tithe, the assakal (Soninké diakka) in addition to other secular taxes on land.

The Sisibé eventually accepted the dominance of the French, who installed them as chefs de canton after 1891. Even though the Sisibé collaborated with the French, the colonial era saw a reduction in the revenues they collected from the land they controlled: the French demanded first one-third, and then one-half, and then nearly all of the land taxes (for more details, see Ngaido's analysis in DP 13).

Today, land tenure in the Bundu is characterized by three relationships between people and land (this also is excerpted from DP 13). The first is the ownership right (jey), concentrated in the hands of the Sisibé except that certain families, notably the Peul of Dialiguel, claim to have purchased their pale land from the Sisibé at the end of the nineteenth century. The second and third relationships are use rights: the samba rémourou, the holder of an indefinite, long-term, inheritable lease, and the jom jalo, the holder of a very insecure rental arrangement similar to sharecropping. Given the predominance of descendants of slaves, these two types of use rights are the most common forms of tenure in the Bundu. There are also several types of contracts, ranging from short-term leases to grants and purchases, which appear to give their beneficiaries a claim to ownership rights during the contract period, but are conditional on the payment of a variety of traditional taxes to the lessor or grantor.

As in the Soninké area, villages in the Bundu have a wide variety of tenure patterns which are explained by the relationship of each village to the Sisibé. There are many villages, such as Guitta, which are primarily composed of descendants of slaves who own no land and are required to make most of the customary payments to the landowners. There are several villages of Peul, who are more independent of the Sisibé and, as in the case of Dialiguel, have purchased their land. The traditional seats of the noble families, like Sénoudébou, are dependent only on their own leaders.

3. The development of irrigation in the Senegal River Valley

The Senegal River is one of the largest in Africa, and in the Sahel is second only to the Niger; its basin drains 289,000 square kilometers. The principal tributaries of the Senegal, the Bafing, the Bakoye, and the Falémé, rise in the moist uplands of the Fouta Djallon in Guinea. The river system is highly seasonal: at Bakel, which is considered the dividing line between the upper basin and the valley, the average flow in September, the height of the flood season, is 3,320 cubic meters per second (cumecs); in May and June, it drops to about 10 cumecs. There is also substantial inter-annual variation in the river's flow. This century, the largest average rate over a year was 1,241 cumecs in 1924, and the lowest was 264 cumecs in 1972. During the drought cycle which appears now to have ended, the average was rarely above 500 cumecs.

To regularize flow both within and between years, a dam has been built at Manantali in Mali. A complementary anti-saltwater intrusion dam has been completed at Diama, near the mouth of the river. Together these dams are to provide enough water for nearly one-half million hectares of

mostly double-cropped irrigated land. In addition, Manantali will eventually generate hydropower and permit year-round navigation as far upstream as Kayes.

Most of the new irrigation development will take place on land which is now devoted to flood-recession farming during good years. This land, the so-called walo, is held by a minority of the population, mostly from the noble castes of both the Soninké who form the majority group in Bakel and of the Toucouleur who dominate the Middle Valley.

The Bakel small irrigated perimeters (BSIP) were established as a result of local initiative. Migrants returning from years of work in France and the former French Empire, notably Diabé Sow of the village of Kounghani and Seydou Nianghané of Ballou, wished to use the funds they had accumulated during their years abroad for some useful purpose at home, to prepare for the inevitable time when France's demand for African manual labor would dry up. A French NGO helped to develop small irrigation systems in several villages in 1975, and approached USAID to finance pumping equipment. Flush with Sahel drought-related funds, USAID converted this small request into a \$3.1 million project, which became \$7 million by the time it was contracted out in 1977. The project's purposes were to provide immediate drought relief and to permit learning-by-doing for an eventual expansion to medium- and even large-scale irrigation systems. Simultaneously, SAED, the parastatal agency created to execute the ambitious program of Senegal River Basin development, asserted its control of all irrigation in the Bakel Department, even that which had preceded its arrival. From a self-generated and modest effort, BSIP quickly became bureaucratized, capital-intensive, and outward-oriented. The Soninké, led by Sow and Nianghané, organized a Federation of Farmers to counter what they perceived as SAED's efforts to convert peasants into agricultural laborers. For a variety of reasons, the Senegalese government refused to recognize the Federation as an official organization until 1984. Adams (1985) provides an insider's chronicle of this situation, eloquently telling the story from Sow's perspective.

Sow's original idea was to generalize the family-wide téxooré to the entire village production group, approaching a socialist model of cooperative production. Thus the earliest irrigated perimeters were collective in nature, with all participants equally contributing labor on a schedule determined by the head of the groupement (the production group), the analogue of the kagumme. The participants equally divided the produce as well. In contrast, SAED pushed for individualization of parcels, of farming decisions, and of distribution of rewards, though it would have left the groupement as a whole responsible for reimbursement of input loans. In practice, in most of the Soninké villages after the first two or three years, the perimeter extensions have consisted of the creation and expansion of family plots, frequently but not always managed as téxooré fields, with the village collective field becoming decreasingly important. The trend away from collective farming is primarily the result of the inability of the groupements to induce farmers to contribute their labor enthusiastically. Thus production suffered and farmers began to lose interest in participating in irrigation.

It is important to note that both systems, the collective one espoused by Diabé Sow and the individualist one promoted by SAED and supported by AID, are revolutionary: they are based on the principle of ignoring caste distinctions in granting access to irrigated land. By diverting attention from this fact, the struggle between SAED and the Federation may have served the interests of the landholding elites, whose concern for ideological arguments about incentives is unlikely to be deep and whose desire to maintain or restore their authority over land and the revenues it generates remains strong. The drought made irrigation possible. As the head of a Soninké groupement has said:

'A drowning man will grab onto any object you reach out to him to save his life, even if it is a knife; this is how we felt when we accepted SAED's help'.

In the past few years, people in the region have begun to believe that the drought is over. As this belief intensifies, irrigation's sharp edge may not be grasped as tightly as before by an elite whose fear of drowning has diminished. If the traditional agricultural system, combined with remittance flows, can once again provide a fairly reliable basis for the restoration of the elites' control over land, they may prefer this to continued risky experimentation with innovations. Insofar as their power has not been broken yet, irrigation may therefore face eventual failure.

However, there is a new dynamic which works in the opposite direction. The inhabitants of the Senegal River Valley have become very conscious of the implications of the après-barrages, the economic potential of the Manantali Dam. It will make water available for double-cropped irrigation in most of the Bakel region, and the nation will be under pressure to develop such systems rapidly to generate revenues to pay off the huge costs of river basin development. As we have seen, the land law allows the state to exercise eminent domain for development purposes, and villagers fear that if they do not respond to the opportunities for irrigation, the state will invite outsiders to do so. In the past three years, several individuals resident in the region have asked for land from the rural councils and have been given assistance with land preparation by SAED. They are invariably well-connected politically, both locally and nationally. However, they are also members of the traditional landholding elite, nobles or their representatives. Thus a part of the traditional elite is responding to the new opportunities and exercising a new type of control over economically valuable land.

SAED was well aware of the need to clarify landholding issues. While its technicians identified irrigable land according to technical considerations, it always consulted the village chief and always requested and usually received the agreement of the traditional landowners. In all cases, the owners ceded to the groupement the right to use the land, without relinquishing claims of ownership. There appears to be a consensus in the villages that if the groupement stops irrigating, the owners may take back their land, even though national law has invalidated all such traditional claims.

SAED imposed a condition of equal access in return for its assistance in developing the perimeter. In other words, the groupement was to be open to all residents of the village who wished to join, regardless of caste or gender. The only initial condition was participation in the land preparation work which needed to be done before the works could be installed. In no village did all households participate, though at the outset the majority usually did. Non-participants are, according to participants, the most conservative, xenophobic villagers, who feared that they would merely be working for white people or other Senegalese.

At the outset, village groupements farmed the land collectively, as Sow had envisioned. For one or two years most succeeded quite well. Then the universal problem of collective agriculture, the free-rider, raised its head and many responded to SAED's recommendation to individualize the perimeter and divide the available land among the willing participants. On consultation with the villagers, SAED instituted a lottery system for plot choice, with no discrimination between castes.

Notwithstanding the condition of equal access, there is a great deal of variation among villages in women's access to irrigated land. Married women are almost always counted in the ka for the purposes of membership in the irrigation groupement. Sometimes, as in Ballou I, their participation awards the ka the same amount of land as men's participation does. Sometimes, as in Aroundou, it counts only half as much. Sometimes, as in Diawara II, wives and other dependent women are not permitted to participate at all, although female heads of households do. Because households generally have more married adult women than married men due to polygyny, the amount of irrigated land it can have depends strongly on how women are treated.

Two other principles upon which SAED and the village groupements agreed were equality of plot size per participant and of land quality. This too was to ensure equity of land distribution. These conditions appear to have been observed, at least to some extent. In a few cases the groupement leaders received extra land or the first choice of it, but the design of most perimeters tried to minimize differences in quantity and quality, as well as in access to water.

II. Hypotheses at the Start of the Research Program

A. Access to Irrigated Land May Change over Time

The first working hypothesis was that access to irrigated land is unlikely to be static. Farm households undergo cycles of labor availability and income requirements which make them more or less interested in farming on the perimeters, and therefore membership in the producer groups is likely to change over time. In the Soninké area, where the ka is a multifamily group of large size, such cyclical fluctuations are likely to be damped, but they still may exist. In addition, the irrigated area of most of the village perimeters has expanded over time, opening opportunities either for new members or larger plots for existing members. In villages such as Moudery where several new perimeters have been created in the past few years, the membership of the new groupements is likely to be different from that of the original village perimeter.

B. Social Stratification May Determine Access to Irrigated Land

The second working hypothesis was that the social stratification which still prevails in the two ethnic groups covered by the BSIP And IWM-I Projects would have an effect on access to irrigated land. Given the fact that much of the social and political authority of elite groups is manifested through control over the use of and the revenues from farmland, it is possible that access to perimeter membership may be affected by the still-strong influence of customary elites.

C. Women's Access to Land May Be Affected by the Creation of Irrigated Perimeters

In several parts of Africa, including the Senegambia, it has frequently been found that women do not benefit proportionately with men from the introduction of irrigated agriculture. They may even lose absolutely, especially in the case of rice, a customary subsistence crop cultivated by women, if the land they farm is taken over by the project and men gain disproportionate shares of the perimeter plots.

D. The Success of Irrigation May Be Influenced by Constraints to Access

If everyone has the opportunity to become members of irrigation groups, it is likely that the best farmers will be among those who join. On the contrary if some groups are excluded (such as women, youth and low-status people), it is not clear that the best farmers will be members. If not, the perimeters may not be as productive as they could be.

The relationship between access and productivity may exist in more subtle ways as well: even if they belong to the irrigation groupements, members of subordinate groups may have land of worse quality, receive less favorable water scheduling, or experience more difficulty in acquiring

inputs. They may also be required to continue making customary payments of cash, produce or labor to the elites who traditionally controlled their access to land.

III. Description of Activities of Personnel

Peter Bloch was Coordinator of the program. Together with Marianne Bloch and Tidiane Ngaido, he initiated the research with a December 1986-January 1987 trip to Bakel, during which interviews were held with irrigation groups in 14 villages, and perimeter censuses were conducted. He subsequently visited Bakel four times (August 1987 and May, August and December 1988) to establish and monitor the progress of the long-term field research team. He wrote five of the fourteen Discussion Papers.

David Miller, a graduate student in the Anthropology Department at Boston University (his adviser is Allen Hobon, a member of LTC's Advisory Board), was selected as a long-term field researcher in December 1986. He served as Research Assistant to the program from June to December 1987, and conducted field research from January to December 1988. He continued to be supported by the program until June 1989. Apart from what promises to be an excellent doctoral dissertation, Miller has written a Final Report, and has provided data which are analyzed in the present report.

Monica Sella, a graduate student in the University of Wisconsin Department of Agricultural Economics, was selected as a long-term researcher after the resignation of the original appointee, Barbara Griglak, in December 1986. She served as Research Assistant to the program for the calendar year 1987, and began what was to have been one year's worth of field research in January 1988. Personal difficulties led to her early departure, but her contribution was still positive, as measured by her three Discussion Papers.

Marianne Bloch, a professor in the University of Wisconsin School of Education and an Associate of the Women's Studies Program and the Land Tenure Center, participated in the initial field visit along with Peter Bloch and Tidiane Ngaido. Her focus at that time was the impact of irrigation on women's access to land, about which she wrote one Discussion Paper. She also assisted in the data analysis for the present report.

Tidiane Ngaido, a Mauritanian citizen and holder of two Master's degrees from the University of Wisconsin (where he studied under a USAID/Mauritania Research and Training project, was hired as a consultant on two occasions. He accompanied Peter Bloch and Marianne Bloch on the initial field visit to Bakel in January 1987, and contributed to the preparation of the first Discussion Paper. Upon Monica Sella's resignation, he was asked to conduct sample surveys similar to those Sella would have undertaken, on labor and land tenure in three perimeters, and also to describe the traditional Pulaar land tenure system. His contributions are shown in his two Discussion Papers, and in the rich data which are analyzed in the present report.

Samba Traoré, a lecturer in the Faculty of Law of the University of Dakar, was asked to participate in the project as the result of the desire of the program Coordinator (and the Land Tenure Center in general) to work as much as possible with local research institutions. He made several field visits to the Bakel region, of which he is a native, and contributed careful descriptions of traditional Soninké tenure arrangements and insights into the effects of tradition upon the operation of the irrigated perimeters. He has contributed three Discussion Papers.

IV. Results

The research program has gathered a varied set of information on the Bakel perimeters and the village societies in which they operate. In this section we present the most important findings stemming from the research effort. First, we summarize the Discussion Papers which have been written during the past two years; second, we give a synopsis of the companion report by David Miller, and third, we present and discuss the results of data analysis which goes beyond that addressed by the authors of the reports and Discussion Papers. In the succeeding section, we confront the results with our initial hypotheses, and then make a summary assessment of the principal research findings.

A. Bakel Discussion Papers Series

The research program has issued Discussion Papers over the life of the program. They have been circulated within AID and in Senegal, and several have been presented to scholarly conferences in the U.S. Short summaries of their contents are presented here; persons wishing the full text of any or all of them should contact Peter Bloch at the Land Tenure Center.

- DP 1. The Dynamics of Land Tenure: The Case of the Bakel Small Irrigated Perimeters by Peter C. Bloch (June 1987). A version of this paper was presented at the Senegal Country Conference at Johns Hopkins University School of Advanced International Studies, Washington D.C., in April 1987. Translated into French.

DPI set the research agenda, developed some of the hypotheses to be tested in further field work, and reported on several case studies conducted during the first field visit in January 1987. Its principal theme was the evolution of land tenure arrangements on the irrigated perimeters in the light of the stratification of Soninké and Toucouleur society. It suggests that irrigation has been as successful as it has been in Bakel only because of a coincidence of factors, some of which have since disappeared: the drought, the threat to continued migration to France, the implementation of the national Law on the National Domain, and the outpouring of development assistance from donors in response to the drought. The cases presented in the paper,

from Ballou, Gangala, Sénoudébou, Guitta, and Wouro Himadou, demonstrated preliminary evidence that traditional elites were acting either to control the perimeters for their own benefit or to limit their success.

- DP 2. An Exploration of Alternative Land Tenure and Organizational Arrangements for the Bakel Small Irrigated Perimeters by Monica Sella (July 1987).

DP2 summarized the previous literature on land tenure and the organization of irrigation producer groups in the Senegal River Valley, and explored forms of organization found elsewhere in Senegal, notably that of the Mouride marabouts in the Peanut Basin, in an effort to delineate the range of farmer organization and tenure arrangements which might be compatible with traditional Senegalese practice. The small plot size on the Bakel perimeters was identified as an important constraint to full farmer participation in irrigation.

- DP 3. The Role of Women in the Bakel Small Irrigated Perimeters by Marianne N. Bloch (July 1987). A version of this paper, with additional analysis drawn from DP7, was presented at the annual meeting of the American Anthropological Association, Phoenix, Arizona, in November 1988, under the title "Women's Access to Irrigated Land: Intentions and Realities on a Project in Bakel, Senegal" by Bloch & Bloch. Translated into French.

DP3, based on the first field visit in January 1987, explores the effect of the Bakel perimeters on women's access to land. It identifies the situation particular to each of the fourteen villages visited, and makes the important distinction between participation in irrigation (defined as merely working on the perimeters or being titular members of the producer groups) and the right to control use of the produce or the revenues stemming from it. It is found that Toucouleur women have been largely excluded from irrigation, whereas Soninke women have succeeded, in many cases, in gaining access to irrigated land in their own names.

- DP 4. Le Système Foncier Soninké du Gajaaga by Samba Traoré (October 1987). Translated into English.

DP4 provides the definitive description of traditional land tenure arrangements in the seven Soninké villages downstream from Bakel. It highlights the historical processes which have led to the extraordinary diversity of traditional tenure among and within each village, deriving from the Bacili monarchy and the caste structure that it created. It suggests that while many of the rights and privileges of the traditional elites have been attenuated by time and government pressure (notably slavery and its economic concomitant of substantial labor contributions by slaves on masters' fields), the customary patterns of reciprocal obligations remain a force to be considered when planning development activities.

- DP 5. Land Tenure Structure of the Bakel Small Irrigated Perimeters-- Baseline Survey Report Part I by Peter C. Bloch (December 1987). Translated into French.

DP5 is a compendium of information about each village which has one or more irrigated perimeters in the Department of Bakel. It presents a summary of tenure arrangements on each perimeter, and a narrative description of the specific problems and issues of land access and allocation which each village has experienced. It also asks general questions about the future of irrigation, and addresses some of the issues (persistence of traditional inter-caste obligations, land acquisition problems, the impact of the Law on the National Domain, privatization and access to credit) which have constrained and may continue to constrain irrigation in Bakel.

- DP 6. An Egalitarian Development Project in a Stratified Society: Who Ends Up with the Land? by Peter C. Bloch (April 1988). A version of this paper was presented at the symposium on Land in African Agrarian Systems, at the University of Illinois African Studies Center, Urbana, Illinois, in April 1988.

DP6 builds on the analysis contained in DP1, and adds additional information gained over the first year of the research program. It re-emphasizes the concern expressed in the earlier paper about the strategies followed by traditional elites to control or hamper the operation of the perimeters, and suggests a new dynamic: that a nontraditional elite, composed of politically-connected individuals, may be taking advantage of their position to gain access to disproportionate amounts of irrigated land and influence within the new land-allocation structures.

- DP 7. Land Tenure Structure of the Bakel Small Irrigated Perimeters-- Baseline Survey Report Part II by Peter C. Bloch (August 1988). Translated into French.

DP7 reports on the results of a census of perimeter producer groups, conducted during 1987 on all but a few of the perimeters. It focuses on the distribution of irrigated land by gender and caste, demonstrating that the irrigated perimeters project has had a substantial equalizing effect on access to productive land, but expressing concern that future development may be less equitable than that of the past.

- DP 8. Irrigation and Dynamics of Access to Land Among the Soninke: Field Research Impressions from Tuabou and Moudery by Monica Sella (November 1988).

DP8 is based on five months of field research in Tuabou, the ancient capital of Soninke kings, and the surrounding villages. It highlights the dynamics of the conflict between traditional land privileges and the dictates of the Senegalese Law on the

National Domain. It suggests that the Law has in many cases made it easier for traditional elites to secure control over valuable land, and enabled the newly formed producer groups, especially in Moudery, to select participants rather than making participation open to whomever wishes to irrigate. Soninke women are seen to be vulnerable to loss of access to land in two ways: if land they have farmed traditionally is taken for a perimeter and if their irrigated plots are merged into family fields and thus are controlled by household heads.

DP 9. Competing Uses of Labor in Rainfed and Irrigated Agriculture in Three Soninke Villages by Monica Sella (January 1989).

DP9 shows that under present circumstances, especially the small size of irrigated plots combined with alternative demands on household labor for dryland farming, farmers with access to irrigated plots may (and do) choose to devote most or all of their labor to dryland farming. The explanations for this phenomenon are: first, that there are substantial marketing constraints to the sale of high-valued irrigated crops; second, irrigation is perceived as risky because of inadequate quality of construction of the perimeters, uncertain input and credit availability, and poor management; third, the recent return of good rainfall has raised the perceived returns to dryland farming; fourth, farmers seek to retain tenure rights to both irrigated and rainfed land by continuing to farm both; and finally, the uneven quality of perimeter leadership helps to explain uneven enthusiasm for and success in irrigation.

DP 10. Le Casier Foncier Traditionnel du Kammera by Samba Traoré (January 1989).

DP10 outlines, in a manner similar to that in DP4, the traditional structure of land tenure arrangements in the Kammera (Upper Goye, from Kounghani to Ballou). As was found in DP4, the most striking fact is the diversity of traditional tenures among villages; this diversity is explained by the historical development of caste relationships as well as relationships with the neighboring Toucouleur of the Bundu. The conclusion is it is extremely important to understand traditional tenure arrangements in each locality where irrigation development is to occur.

DP 11. Les Périmètres Irrigués Villageois: Nouvelle Organisation du Travail et Nouveaux Problèmes Juridiques by Samba Traoré (January 1989).

DP11 covers much the same ground as DP8, but from a legal/institutional viewpoint rather than an economic/anthropological one. Using information gathered in Ballou, Tuabou, Moudery and Manaël, the paper demonstrates how conflicts between tradition and modernity have arisen and, in some cases, been resolved. It suggests that the principal constraints to improved productivity are the small size of individual holdings and the difficulties of

management on perimeters composed of large numbers of individualistic farm operators.

- DP 12. Labor and Tenure Study in Three Village Perimeters: Bakel Collengal, Moudery II and Selling by Tidiane Ngaido (April 1989).

DP12 reports the results of surveys conducted in August and December 1988 on family structure, the dynamics of land tenure and the possible labor constraint on three representative perimeters. Collengal, the urban perimeter, is shown to have developed an active system of land transactions, with over 40% of parcels having changed hands at least once over the six-year existence of the perimeter. Moudery II, which began only in 1985, has excluded women and has allocated substantially larger fields to a minority of members. Selling, the only Pulaar perimeter in the study, has also excluded women, and is tightly controlled by noble families. On the labor question, members of the two Soninke perimeters appeared assign priority in the allocation of household labor to irrigation, whereas in Selling rainfed farming dominated and the perimeter was a minor component of the farming system.

- DP 13. Etude sur les Périmètres Irrigués Villageois du Boundou by Tidiane Ngaido (May 1989).

DP 13 addresses the question of why the Pulaar perimeters along the Falémé have had such little success compared with the Soninké perimeters. It is based on three field visits from January 1987 to December 1988 and on a study of the history of the Bundu region. Its principal finding is that the historical development of the Bundu since the 1850's, which is reflected in the present socio-economic structure (including a caste system more oppressive than that of the Soninké), explains a great deal of the reluctance of the Pulaar to commit sufficient resources and energy to irrigation.

- DP 14. Land Issues in the Senegal River Valley: Report on a Reconnaissance Trip, December 1988 by Peter C. Bloch (January 1989).

DP14 extends the type of assessment undertaken during the Bakel research to other parts of the Senegal Valley. At the request of the Mission Director, the author traveled the length of the Valley, interviewing a range of people involved in the development of irrigation: farmers, local officials, SAED, other researchers, perimeter contractors, in an attempt to assess the dynamics of access to land in the Middle Valley and the Delta. The paper focuses on three issues: the conflict between modernization and traditional forms of land control; the land aspects of the Senegal-Mauritania border conflict as it appeared in December 1988; and the extraordinary changes in control over land in the Delta stemming from Senegal's decision to devolve land administration to the Rural Councils. The conclusions are that government and donor policy should seek to find ways of supporting, rather than constraining, the evident recognition on the part of farmers that

the Après-Barrages era is one of great opportunity to initiate productive and profitable commercial agriculture.

B. Irrigation and the Dynamics of Access to Land in the Village of Moudery,
Final fieldwork report by David Miller

Miller completed one year residence in Moudery in December 1988. In addition to serving as a researcher on LTC's research program, he was gathering information for his Ph.D. dissertation in the Department of Anthropology of Boston University. The report summarized here is, therefore, only the first output from his work; copies of the dissertation will be sent to USAID/Dakar upon completion.

The choice of Moudery was made in 1987 because the village appeared to be the most enthusiastic about irrigation: it was one of four villages with more than one perimeter in operation at the time, and was the only one with several others on the drawing board. The choice was very appropriate: developments since 1987 have clearly demonstrated that (1) Moudery remains the most committed to irrigation and (2) as seat of one of the two Rural Communities where irrigation is possible in the Department of Bakel, Moudery is an excellent vantage point from which to observe the transition from traditional to modern local institutions of land administration.

The report focuses on three fundamental aspects of land access institutions and outcomes: (1) the operations of the Rural Council, the governing body of the Rural Community; (2) the functioning of irrigation producer groups and the perimeters' land distribution; and (3) case studies of the two central personalities involved in making Moudery as dynamic as it has been.

(1) The Rural Council

Established in 1984 in accordance with the Law on the National Domain of 1964 and the Law on Rural Communities of 1972, the Rural Council decides whether to allocate land upon request by individuals, producer groups or SAED, in a process which completely supplants traditional landholding authorities. Yet it is clear that the Moudery Rural Council is dominated by individuals with links to the traditional elite, and its decisions frequently reinforce traditional claims by giving them the cover of national law. The Council has also looked after its own members--all of the Moudery members have large holdings on two or more perimeters. On the other hand, there is strong evidence, both quantitative and qualitative, that the Rural Council has enabled formerly dispossessed groups--descendants of slaves, casted people, youth and women--to gain access to irrigated land in proportions much greater than the traditional authorities would have done.

(2) Producer Groups: Operation and Membership

The original idea for the Bakel perimeters, formulated by SAED and USAID and adopted by the villagers, was to create producer groups

comprising everyone in the village who wished to join, disregarding caste, age, and gender. The leadership was to be elected, and farming was to be done cooperatively. The first fatality was cooperative agriculture, which except for small collective fields farmed desultorily to raise revenue for the producer group, had disappeared by the early 1980's. The second fatality was open elections: none of the perimeter heads in Moudery have had to stand for reelection even though the original perimeter is fourteen years old.

Universal access to irrigated land has disappeared more gradually. In Moudery, the first perimeter had over 500 members at the start, with representatives from most houses. Membership declined rapidly before individualization of farming was instituted. Every perimeter since then has been open only to selected participants: Moudery II was for household heads, i.e., males, only (and of them, a disproportionate number of lower-status individuals); Moudery III was for the National Assembly député and his family; Moudery IV was for the members of the Al Fala Moslem sect; Moudery V was for the President of the Rural Council and his allies; Moudery VI was for youth; and Moudery VII was for women. It should be noted that dispossessed groups have managed to gain access to land in the new perimeters, but only on a "separate but somewhat equal" basis.

Statistical analysis of participation in irrigation, based on a sample survey of Moudery households, demonstrates that the most important determinant of differences is not caste, but rather access to financial resources as measured by the number of migrants in the household. A second important determinant, which was unexpected, is the household's participation in farming flood-recession (falo) land; the relationship was positive, i.e., households farming falo had more irrigated land as well (even after correcting for family size). Since access to falo is still controlled via traditional landholding institutions, this suggests that those institutions still matter.

(3) Case Studies: the President and the Député

The dynamic situation in Moudery can be largely attributed to these two men, who have been active in promoting the creation of perimeters in Moudery. In addition to their contributions to the development of irrigation for others, however, they have also done very well for themselves. The député, a member of the jaagarafu caste which administered and collected taxes on land for nobles, has strong political connections in Dakar, and has ambitions to develop a substantial commercial farming operation on his 30 hectares. The President of the Rural Council is responsible for the creation of all the perimeters except for I and III (the député's), and for the allocation of land to women's and youth groups in all the villages of the Rural Community. On his "own" perimeter, V, he has begun farming 10 ha. with an eye towards commercial farming. The case studies demonstrate the difficulties of beginning on a large scale (with little prior experience in intensive farming): high land development costs, the need for supervision of hired labor, and worries about marketing of perishable crops. The two individuals are, however,

determined to succeed, and they are better placed than anyone else in Moudery to do so.

(4) Conclusions

Miller's report focuses on institutional and individual performance in the distribution of irrigated land, with an emphasis on men's access. The principal finding is that the introduction of the Rural Council has attenuated, but not severed, the traditional link between caste status and access to land; being of noble caste no longer guarantees control of traditionally-held land, and being of subordinate caste no longer excludes people from access. While individuals are more likely to gain irrigated land if they have financial resources and connections to the new elite, the creation of "special-interest" perimeters appears to permit anyone with ambition to undertake irrigation. Thus it is possible that the foundation for a social system which permits more productive investment in agriculture has been laid.

C. Further Analysis of Data Collected During the Fieldwork

Miller's report is partly based on initial analysis of three sample surveys conducted in Moudery in late 1988: (1) a landholding and tenure questionnaire administered to a sample of 80 kane containing 88 households, stratified by size of ka and caste; (2) a production and tenure questionnaire administered to a sample of 26 fields in the Moudery I perimeter; and (3) a tenure and landholding questionnaire administered to all members of the Moudery I perimeter (115 users of 282 plots). Ngaido's Discussion Paper no. 12 tabulates labor and tenure data from sample surveys of 45 member families of Moudery II, Bakel Kollengal and Selling.

While the information presented in these reports is valuable, they do little hypothesis testing; thus here we push the analysis somewhat further in order to address the hypotheses outlined in Section II, above.

1. Access to Irrigated Land

Miller's and Ngaido's surveys of the perimeters of Moudery I and II, Bakel Collengal and Selling, and Miller's sample survey of Moudery households, permit a more detailed analysis of the determinants of access to land on the perimeters than was possible through our case studies conducted over the life of the LTC research program.

a. Moudery Village Survey

Miller's report explores access to irrigated land in Moudery, and finds that the most important determinants are the number of migrants in the household and the household's access to falo land. Caste did not seem to be a significant predictor of households' irrigated holdings. Table 6, reproduced from Miller's report (his Table 3), presents the results of multiple regression analysis conducted on the 88 households he surveyed;

Table 6
Alternative Explanations of Household Holdings of Irrigated Land
Least Squares Regressions

Dependent Variable: hectares of irrigated land

(t-statistics in parentheses--a value of about 2 or more denotes statistical significance)

Explanatory Variables	<u>Regression number</u>					
	1	2	3	4	5	6
Constant	.766	.683	.599	.543	.521	1.005
Family size	.023 (2.40)	.003 (0.23)	.001 (0.08)			
Migrants		.095 (2.34)	.089 (2.23)	.094 (3.13)	.094 (3.16)	
Farming Falo			.284 (1.99)	.257 (1.68)	.306 (2.13)	
Caste: Kome				.131 (0.77)	.136 (0.97)	.009 (0.05)
Jaagarafu				.177 (0.73)		.213 (0.82)
Other				-.148 (-.600)		-.313 (-1.25)
Adjusted R ²	.052	.099	.129	.130	.138	.002

Sample size: 88 households, all those sampled in village survey.

Variable definitions:

Family size: number of members aged 20 or more.

Migrants: number of migrants (all destinations).

Farming Falo: whether respondent farms falo (yes=1).

Caste: as elsewhere in this report. Dummy variables with yes=1. As is required by statistical procedure, one category must be excluded (we chose xooore); thus coefficient implies difference between included castes and xooore.

the dummy variables for caste explain virtually none of the variation in households' irrigated land.

The positive effect of access to falo land was somewhat surprising: one could have expected that families which farmed the falo would be less inclined to farm the perimeters because the valuable falo land should provide them with sufficient produce. Miller's regressions did not, however, investigate the relationship of access to irrigated land with the other types of farming possible in the area: dryland (xaxodunte), flood recession other than falo, i.e., in marigots rather than on the riverbanks (collenga), and house gardens (galle). One might hypothesize that families active in one or more of these types of farming would have less irrigated land, other things being equal.

Here we present more detailed analysis of access to irrigated land, based on the same data analyzed by Miller. Given some of the findings from earlier work, especially the results of our census of 24 perimeters presented in DP7, we expected there to be a more important effect of caste than Miller's analysis showed. Furthermore, we suspected that the effect might be different for women than for men (see DP6 and Bloch and Bloch 1988). We ran similar regressions on several different measures of access: the area of irrigated land in the household plus several measures of male and female participation in the producer groups. Those results are presented in Tables 7 through 10.

In Table 7, the regressions use the same dependent variable as Miller's Table 3, the number of hectares of irrigated land held by the household. It adds the three farm-type variables discussed above--xaxodunte, collenga and galle--and another variable (CULT.AVANT) which measures whether household women had previously farmed the land on which the perimeters were constructed. Regression no. 1, excluding caste, confirms Miller's results, and further shows a strong tradeoff (as would be expected) between households' participation in rainfed farming and the amount of irrigated land they hold. Caste dummy variables are included in Regression no. 2, and add little explanatory power to the equation. The "other castes", however, have a negative sign and a coefficient greater than the standard error. Prior cultivation by women has no significant effect. The interpretation of the results in Table 7 is that households with larger numbers of migrants and more participation in falo farming have more irrigated land, and those involved in rainfed farming have less.

TABLE 7

Additional Explanations of Household Holdings of Irrigated Land

	Regression 1		Regression 2	
	<u>Coeff.</u>	<u>t-stat</u>	<u>Coeff.</u>	<u>t-stat</u>
CONSTANT	0.836	5.18	0.870	4.50
MIGRANT	0.100	3.47	0.103	3.56
FOLO	0.302	2.24	0.264	1.84
COLLENGA	1.350	1.04	0.104	0.75
XAXODUNTE	-0.450	-3.15	-0.442	-3.07
GALLE	-0.158	-1.12	-0.196	-1.36
CULT.AVANT	0.053	0.43	0.055	0.44
KOME			0.057	0.36
AUTRES			-0.249	-1.10
Adj. R ²	0.239		0.240	

In Table 8, the dependent variables are several measures of participation: the number of perimeters of which at least one person in the household is a member (TOTAL PARTICIPATION); the number of perimeters of which at least one male in the household is a member (MALE PARTICIPATION); and the number of perimeters of which at least one female in the household is a member (FEMALE PARTICIPATION). The TOTAL regressions are very poor--they explain less than 10 per cent of the variation in participation. The only significant variable in Regression no. 1 is CULT.AVANT (positive); in Regression no. 2 the dummy variable on "other castes" is significant and negative. The regressions on MALE and FEMALE are somewhat better, explaining more of the variation in participation and having more significant variables. To facilitate evaluation, Table 9 compares the signs and significance of the variables in the three sets of regressions.

TABLE 8
Household Participation in Irrigation
(in number of perimeters per household)

a) TOTAL PARTICIPATION									
	<u>Coeff.</u>	<u>t-stat</u>		<u>Coeff.</u>	<u>t-stat</u>				
CONSTANT	1.874	4.89		2.323	4.89				
MIGRANT	0.042	0.61		0.045	0.67				
FOLO	0.366	1.14		0.123	0.37				
COLLENGA	-0.304	-0.98		-0.233	-0.72				
XAXODUNTE	0.128	0.38		0.093	0.28				
GALLE	0.250	0.75		0.214	0.64				
CULT.AVANT	0.573	1.95		0.491	1.66				
KOME				-0.392	-1.05				
AUTRES				-1.138	-2.15				
Adj. R ²	0.039			0.070					

b) MALE PARTICIPATION					c) FEMALE PARTICIPATION						
	<u>Coeff.</u>	<u>t-stat</u>		<u>Coeff.</u>	<u>t-stat</u>		<u>Coeff.</u>	<u>t-stat</u>		<u>Coeff.</u>	<u>t-stat</u>
CONSTANT	1.437	7.13	1.303	5.45	0.220	0.97	0.679	2.63			
MIGRANT	0.089	2.48	0.095	2.66	-0.021	-0.51	-0.023	-0.60			
FOLO	0.233	1.39	0.258	1.45	0.218	1.16	0.013	0.07			
COLLENGA	0.246	1.51	0.135	0.79	-0.286	-1.57	-0.134	-0.72			
XAXODUNTE	-0.451	-2.53	-0.413	-2.33	0.386	1.93	0.326	1.70			
GALLE	-0.058	-0.33	-0.133	-0.75	0.239	1.21	0.279	1.45			
CULT.AVANT	0.112	0.73	0.158	1.01	0.439	2.54	0.337	2.00			
KOME			0.326	1.66			-0.587	-2.76			
AUTRES			-0.058	-0.21			-0.810	-2.68			
Adj. R ²	0.138		0.156		0.111		0.195				

TABLE 9
Signs and Significance of Coefficients in Participation Regressions

<u>Variable</u>	<u>TOTAL</u>		<u>MALE</u>		<u>FEMALE</u>	
	<u>sign</u>	<u>sig.*</u>	<u>sign</u>	<u>sig.</u>	<u>sign</u>	<u>sig.</u>
MIGRANT	positive	NO	positive	YES	negative	NO
FALO	positive	NO	positive	NO**	positive	NO
COLLENGA	negative	NO	positive	NO	negative	NO
XAXODUNTE	positive	NO	negative	YES	positive	YES
GALLE	positive	NO	negative	NO	positive	NO**
CULT.AVANT	positive	YES	positive	NO	positive	YES
KOME	negative	NO	positive	YES	negative	YES
OTHER	negative	YES	negative	NO	negative	YES

* significance level of 90% (t-statistic greater than 1.66).

** coefficient greater than its standard error in both regressions (with and without caste).

It is clear from this table that determinants of access to irrigated land are quite different for males than for females:

- 1) MIGRANT affects male participation positively, due to the financial resources available to households with migrants, but does not affect female participation.
- 2) XAXODUNTE farming reduces male participation in irrigation, but increases female participation; the tradeoff between irrigation and dryland exists only for men.
- 3) Women who previously farmed land on which perimeters have been constructed participate more than those who did not; the effect for men is not significant.
- 4) KOME men participate more than does the "average" male; Kome women participate less than the "average" female.
- 5) Women of OTHER castes participate significantly less than the average; the effect for men is not significant, but is still negative.
- 6) For COLLENGA and GALLE, neither male nor female coefficients are significant, but they have opposite signs.

Women's participation in the perimeters was measured another way as well: women were asked if they worked on the perimeters, whether they were members of the groupement or not. The regressions using this dependent variable (FEMWORK, whose value is the number of perimeters on which women in the household worked) are given in Table 10. The significant variables are MIGRANT (positive, as for male participants), FOLO (positive, as for total irrigated holdings of the family), GALLE (positive, as for women participants), and CULT.AVANT (negative--unique to these regressions). The picture appears quite confusing at first glance, but can be partly explained as follows: women work with their husbands on the perimeters even when they are not members of the groupements (and the reverse is not true), but they are still women, so work on the perimeters goes hand in hand with work on the home gardens (the galle). There is no obvious explanation for why women who formerly cultivated land on which the perimeters were constructed would work less on the perimeters themselves.

TABLE 10
Female Participation as Measured by Working on Perimeters
(FEMWORK)

	Regression 1		Regression 2	
	<u>Coeff.</u>	<u>t-stat</u>	<u>Coeff.</u>	<u>t-stat</u>
CONSTANT	0.659	1.96	0.914	2.27
MIGRANT	0.154	2.56	0.156	2.59
FOLO	0.656	2.34	0.516	1.73
COLLENGA	0.058	0.21	0.094	0.33
XAXODUNTE	-0.015	-0.05	-0.034	-0.11
GALLE	0.648	2.22	0.624	2.08
CULT.AVANT	-0.544	-2.12	-0.590	-2.25
KOME			-0.210	-0.65
AUTRES			-0.660	-1.41
Adj. R ²	0.162		0.162	

To summarize the results on access to irrigated land from the Moudery village survey, the most striking finding is that there appear to be different rules for women than for men. The effect of caste operates entirely through women's participation--women of lower-status castes are members of significantly fewer producer groups than are women of higher-status castes. The contribution of migrants, and thus of remittances which permit greater participation in irrigation, accrues only to men. Women do appear to have been compensated for loss of farmland to the perimeters, at least in part, in spite of their exclusion from Moudery II.

b. Census of Moudery I Parcels

The questionnaire asked a limited number of questions about the 282 parcels in Moudery I (farmed by 115 different people): size, cropping pattern, origin of access, ownership status, and gender of the user and the owner. This section presents tables highlighting some of the significant relationships which the census identifies.

Table 11 shows the 1988 rainy-season cropping pattern and the size distribution of parcels in Moudery I. All but four of the parcels on the perimeter were irrigated (not abandoned or in traditional rice or peanuts); cropping intensity was therefore close to 100%. The data demonstrate clearly that rice is not the preferred crop on the perimeter; only 84 of the 282 parcels (30%) are planted to rice. There are two explanations for the strong preference for sorghum (65% of parcels): soil conditions are appropriate for rice only on the heavier soils found near the lowest point of the perimeter, and sorghum requires substantially lower expenditures on inputs and labor than does rice.

TABLE 11
Cropping Pattern by Size of Parcel

	(size of casier = .25 ha)						TOTAL
	sorghum	rice	maize	abandoned	trad.rice	peanuts	
missing	1	0	0	0	0	0	1
< .25	10	3	0	0	0	0	13
.25-< .50	28	14	1	0	0	0	43
.50-< .75	68	25	0	1	0	0	94
.75-<1.00	4	1	2	0	0	0	7
1.00-<1.50	58	38	4	0	2	1	103
1.50-<2.00	4	1	1	0	0	0	6
2.00-<4.00	9	2	2	0	0	0	13
4.00 and +	2	0	0	0	0	0	2
TOTAL	184	84	10	1	2	1	282

The overall size distribution of parcels exhibits a wide range, although most parcels are clustered at two sizes: one-half a casier, or 0.125 ha., and one casier, or 0.25 ha. There appears to be little relationship between the size of parcels and the cropping pattern, with both rice and sorghum being grown on large and small parcels in approximately the same proportions.

Another determinant of the choice of sorghum rather than rice may be the farmer's experience on the perimeter. As Table 12 shows, farmers who have been in Moudery I since the beginning grow a larger proportion of rice than those who have joined more recently (except for the newest farmers, but there are relatively few of them). This may be due, however, to soil type as well as experience: the Moudery I farmers who did not leave the perimeter may have been those who got the best land.

TABLE 12
Cropping Pattern by Years Farmed, Major Crops
(percentage of parcels)

<u>Years Farmed</u>	<u>Sorghum</u>	<u>Rice</u>	<u>Total No. Parcels</u>
2 or less	59	41	22
3 - 5	86	14	117
6 - 9	65	35	43
10 - 12	48	52	84
TOTAL			266

Tables 13 and 14 present the size distribution of parcels by the gender of the parcel holder (the "owner") and of the parcel user. The difference between the two is due to the fact that some parcels are lent out. Men own and use all of the large parcels (more than one casier), and also a disproportionate share of the smallest parcels (less than 1/2 casier). 76% of the parcels are owned by men, and 71% are used by men. This suggests that the informal land transfer system works to increase women's access to irrigated land, but it is clear that most of the parcels transferred from one sex to another are small.

TABLE 13
Parcel Size by Gender of User

	female	male	TOTAL
missing	1	0	1
< .25	4	9	13
.25-< .50	12	31	43
.50-< .75	30	64	94
.75-<1.00	0	7	7
1.00-<1.50	34	69	103
1.50-<2.00	0	6	6
2.00-<4.00	0	13	13
4.00 and +	0	2	2
TOTAL	81	201	282

TABLE 14
Parcel Size by Gender of Owner

	female	male	TOTAL
missing	1	0	1
< .25	1	12	13
.25-< .50	6	37	43
.50-< .75	27	67	94
.75-<1.00	0	7	7
1.00-<1.50	32	71	103
1.50-<2.00	0	6	6
2.00-<4.00	0	13	13
4.00 and +	0	2	2
TOTAL	67	215	282

Table 15 shows the cropping pattern by gender of the user. Women cultivate rice more frequently (42% of their parcels) than do men (25%), and men devote 70% of their parcels to sorghum as compared to only 53% of women. There is, however, no indication of a strong gender differentiation in cropping; this may be due to the cancelling out of two effects: women have experience in growing swamp rice, but men may have greater access to cash to buy the inputs required for rice production.

TABLE 15
Cropping Pattern by Gender of User

	female	male	TOTAL
sorghum	43	141	184
maize	1	9	10
rice	34	50	84
trad.rice	2	0	2
peanuts	0	1	1
abandoned	1	0	1
	81	201	282

Of the total of 1,863 plots (subdivisions of parcels) farmed by the members of Moudery I, 149, or 8%, are not owned by the user of the land. This is not a very large percentage, but it does demonstrate some flexibility in land allocation which may facilitate transfers of land as family needs change and irrigation continues to expand. Table 16 shows, for the 113 plots for which information is available, from whom the borrowers of plots received their land. Nearly half of the plots were borrowed from people other than family members, one-fourth each from friends and from "others." In other words, the ability to transfer land (to lend and borrow) is not limited to within-family transactions. The survey did not succeed in gathering consistent information on the conditions of borrowing from the different sources; anecdotal evidence gathered by Miller and Ngaido suggests that the borrower, in general, does not pay the lender anything, but merely pays the fees for diesel and whatever other inputs he or she uses.

TABLE 16

Source of Borrowed Plots on Moudery I

The same <u>ka</u>	27	23.9
The same <u>xabila</u> *	10	8.8
Relative	21	18.6
Friend	29	25.7
Other	26	23.0
TOTAL	113	100.0

* xabila = lineage

c. Surveys of Moudery II, Bakel Collengal and Selling

Ngaido's Discussion Paper no. 12 reports the results of two-pass questionnaires administered to 45 families belonging to these three perimeters in late 1988. The two Soninké perimeters are noteworthy for their high percentage of komé (57% in Moudery II and 70% in Collengal, according to our 1987 census--see DP 7), and Selling is one of the few active perimeters along the Falémé. The data Ngaido collected about the perimeters are not as detailed as Miller's, but they go further in exploring the family farming systems of the perimeter members. Therefore we are unable to conduct re-analysis with the same rigor for these three perimeters, and will instead highlight and interpret Ngaido's major findings.

Bakel Collengal

Access to irrigated land has been open to all strata of Soninké society, as we have shown previously. Nowhere is this more true than in Bakel Collengal, whose membership is composed of individuals rather than extended families due to the different demographic patterns which prevail in urbanizing areas such as Bakel. Many residents of Bakel are natives of the surrounding villages who have come to the city in search of greater economic opportunity; they are therefore independent of their ka. Performance of this perimeter may therefore be a harbinger of things to come everywhere in the valley, as extended families break down with urbanization.

The dynamics of access to land and tenure arrangements in Bakel Collengal are unique. The perimeter was founded in 1982, due to technical and social problems on Bakel Gassambilakhé and the city's desire to use some of the latter's land for urban expansion. Collengal quickly became one of the largest perimeters in terms of membership (539, over half of whom were women, according to our 1987 census) and irrigable area (178 ha.). Yet Ngaido's detailed study of the perimeter in late 1988 showed that only 185 farmers were actively cultivating. Ngaido attributes this

to two factors: (1) the disengagement of SAED and the consequent lack of input credit, and (2) the better rainfall conditions prevailing since 1986, which led farmers to return to dryland farming which requires no expenditures on inputs. While these two factors are not unique to Collengal, they may have had a more dramatic effect there because of the lack of mutual support systems provided by extended families.

The remaining farmers have responded to the mass abandonment by increasing the area they farm. Collengal is the only perimeter which permits formal transfers of land,* and farmers took advantage of this--one-third of the land they farmed in 1988 had been purchased over the previous two years. They increased their area from 40.8 ha. in 1986 to 70.8 ha. in 1988, mostly through purchase but also through loans (3% of plots) and gifts and inheritances (2%). As Table 17 shows, the decrease in membership was spread uniformly among all castes. Komé members still farming in 1988 increased their holdings by 50%, xooré members by 92% and intermediate castes by over 300%, so that the share held by komé fell from 71% of the total to 61%, and the xooré share rose from 23% to 26%, and the others from 6% to 13%. It is not possible to tell if this trend will continue; given the origins of the perimeter (a land grant by the Ndiaye Ganke family of Bakel for the benefit of its former slaves--see DP12), one would expect that there would be social pressures against a continued relative loss of the komé share. There are still over 100 ha. of unfarmed irrigable land; the dynamics of the next few years will be very interesting. While one would like to predict that some or all of the present farmers would continue to expand their holdings at the same rapid rate as they have in the past two years, the flooding of 1988 will probably discourage many from doing so.

The sample of 19 families devote most of their effort to irrigation: Table 18 shows that 36 of the 65 fields they farm are on the perimeter. Still, even though these families are among the "survivors" of the great abandonment, they continue to farm their dryland holdings. Ownership (whether the plot was acquired at the beginning or subsequently purchased) predominates on the perimeter as well as in dryland farming.

* As Ngaido notes, all perimeters permit new members to join if there is land available and if they pay an entrance fee to the producer group (10,000 F. CFA in Collengal), but only Collengal calls this a sale of land. Collengal is also the only perimeter which recognizes sales from one member to another; the others require that the new member purchase the land from the group, and the previous holder of the plot is not reimbursed.

TABLE 17
Changes in Membership and Area Farmed, Collengal

CASTE	No. of Members			Area Farmed by 1988 members (ha.)		
	1986	1988	% change	1986	1988	% change
xoore	110	37	-66.4	9.6	18.4	91.7
moodi	14	2	-85.7	0.8	3.2	300.0
somono	12	2	-83.3	0.4	3.4	750.0
artisans	16	5	-68.8	1.0	2.6	160.0
kome	379	139	-63.3	29.0	43.2	49.0
misc.	8	0	-100.0	0.0	0.0	--
Total	539	185	-65.7	40.8	70.8	73.5

Sources: 1986 membership from DP7; all other data from DP12.

TABLE 18
Irrigation in the Farming System, Collengal sample
(number of fields)

Field Type	Men		Women		Total	
	Owned	Rented	Owned	Rented	Owned	Rented
Irrigated	17	2	17	0	34	2
Dryland*	9	2	15	0	24	2
Flood**	1	2	0	0	1	2
TOTAL	27	6	32	0	59	6

* Jeeri and fonde.

** Flood recession land: walo and falo.

Source: DP12, Tables 9 and 11.

Moudery II

This perimeter was established in 1985, on land partly used by the Forest Service and partly farmed by women. Membership was limited to heads of extended families (kagumme), which implies that women were essentially excluded from holding parcels: the share of female membership of Moudery II is by far the lowest of the Soninké perimeters. Komé represent the majority of members, with xoore only comprising 16 percent.

Ngaido's survey of eleven members shows that, as in Bakel, irrigation is the primary farming activity. Table 19 shows that of 62 fields they farmed, 35 were irrigated; given the low social status of most of the members they have little access to flood recession land, and rent the little they have. Renting is a very important phenomenon: barely half of the fields farmed by the sample are owned by the households (two-thirds of the irrigated fields). While this extraordinarily high share of rented land is concentrated among women, even the men rent over one-fourth of their fields. All the renters make some form of traditional payments to the owner of the land. The predominant type of payment is the ninan ciage, which is not fixed either in value per field or in percentage of the crop; it can be purely symbolic or substantial, depending on the relationship between owner and renter.

TABLE 19

Irrigation in the Farming System, Moudery II sample
(number of fields)

<u>Field Type</u>	<u>Men</u>		<u>Women</u>		<u>Total</u>	
	<u>Owned</u>	<u>Rented</u>	<u>Owned</u>	<u>Rented</u>	<u>Owned</u>	<u>Rented</u>
Irrigated	20	5	3	7	23	12
Dryland*	8	3	1	12	9	15
Flood**	0	2	0	1	0	3
TOTAL	28	10	4	20	32	30

* Jeeri and fonde.

** Flood recession land: walo and falo.

Source: DP12, Tables 9 and 11.

Selling

The only Pulaar (Toucouleur) perimeter we have studied in detail, presents contrasts to the Soninké perimeters in many respects. It is much smaller (15 ha. compared to 62 and 178 for Moudery II and Collengal, respectively), with a membership of only 30, none of whom are women. Only 15 of them cultivated in 1988; of these, 7 were torodo (nobles), 2 were ceddo (clerics), one was saké (woodworker) and 5 were maccudo (former slaves).^{*} Thus high-status people dominate the Selling perimeter; the

* There is an inconsistency between our census figures and Ngaido's, or perhaps the situation has changed in the past two years. The census shows only two maccudo among the thirty members, whereas five of the fifteen families farming in 1988 were maccudo. We have no explanation for this difference.

President is from the chiefly family of the village, and he owns 2 ha. of the 8.5 ha. farmed in 1988.

Ngaido interviewed fifteen families in Selling, ten of whom participated in the perimeter in 1988. Table 20 makes it clear that irrigation is a much less important part of the farming system in Selling than in the other villages: only 15% of the fields these families cultivated were on the perimeter. This is partly due to the higher rainfall in the Falémé zone than further downriver, and (probably) partly due to the limited attention paid by SAED to the Falémé. Since most of the Falémé perimeters are not operating at all, that of Selling stands out as a relatively successful one even though its contribution to the village's production is quite modest.

TABLE 20
Irrigation in the Farming System, Selling sample
(number of fields)

<u>Field Type</u>	<u>Men</u>		<u>Women</u>		<u>Total</u>	
	<u>Owned</u>	<u>Rented</u>	<u>Owned</u>	<u>Rented</u>	<u>Owned</u>	<u>Rented</u>
Irrigated	9	1	0	0	9	1
Dryland*	31	2	12	0	43	2
Flood**	5	3	0	0	5	3
TOTAL	45	6	12	0	57	6

* Jeeri and fonde.

** Flood recession land: walo and falo.

Source: DP12, Tables 9 and 11.

Is there a labor constraint?

One of the most frequently-heard explanations of the difficulties experienced by irrigation in the Bakel zone as compared to downriver areas is a severe labor shortage, primarily caused by high levels of emigration. The result of the labor constraint is that families are forced to choose where to allocate their labor, and the traditional dryland farming is less labor-intensive than is irrigation. Except in the worst drought years, therefore, it is argued that families will devote most of their effort to dryland.

We had originally hoped to conduct a periodic survey of family labor use during the 1988 rainy season, in order to quantify labor allocation practices. Due to the early departure of one of our field researchers, this could not be done. Ngaido's surveys attempted to recoup part of the loss, and succeeded in painting a detailed picture of the complexity of

labor relationships and of the strategies used to compensate for labor constraints. In Table 21 we condense DP 12's presentation in order to see the overall picture.

Ngaido distinguished three types of farmers: the kagumme, who has responsibility for the ka's basic food supply; other household heads, younger men of the ka who farm independently when they are not needed on the family fields; and women. There are three groups of labor sources: the nuclear family (sons, daughters and spouses); the extended family (all resident relatives other than the nuclear family); and external labor (friends, women's and young people's associations, and hired labor).

In the latter category, temporary hired labor dominates, representing about 80 per cent of the workers; since we do not have data on labor hours or days, quantitative comparisons between family and external labor are subject to some caution. It is evident, however, that external labor is extremely important for Soninké farmers, and much less so in Selling. There is an apparently ample supply of such labor, primarily young men from Mali, so that farmers who have access to relatively little family labor can compensate adequately.

It is clear from Table 21 that the kagumme controls the bulk of the labor used, both within the family and outside. He uses an average of nearly five family members to help him, equally divided between the nuclear and the extended family. Other household heads and women are much more constrained, and therefore make relatively greater use of external labor. This is not surprising, given the family organization of both ethnic groups. The Soninké kagumme customarily has the right to his family's male

TABLE 21
Sources of Labor for 45 Families
(number of people other than the farmer)

	<u>Labor type</u>	<u>Moudery II</u>	<u>Collengal</u>	<u>Selling</u>	<u>Total</u>	<u>Average per farmer</u>
Kagumme (44) *	Nuclear	35	42	25	102	2.3
	Extended	36	43	22	101	2.3
	External	91	178	12	281	6.4
Other House- hold Heads (15)	Nuclear	2	1	3	6	0.4
	Extended	0	0	2	2	0.1
	External	16	5	2	23	1.5
Women (43)	Nuclear	15	27	3	45	1.0
	Extended	3	10	6	19	0.4
	External	34	98	32	164	3.8

* Number of individuals interviewed.

Source: DP12, Tables 17-22.

labor whenever it is needed for the family field (at least every morning), whereas women and subordinate men must fend pretty much for themselves. What this means is that labor supply decisions in the Soninké family are centralized in one person. If the kagumme decides that a perimeter plot is part of the family field, he will be able to mobilize enough labor to ensure that the necessary work is done; if he decides the opposite, subordinate family members wishing to irrigate will be forced to rely on external labor. Our feeling is therefore that there is a family labor constraint, but the market for hired labor is active enough that people determined to irrigate can do so with little difficulty. Future analysis of the survey data by Ngaido could demonstrate this question more directly than we have been able to do here.

2. Productivity

1988 was a year of good rainfall. This had two impacts on the performance of irrigated agriculture: first, the incentives to farm the jeeri were large relative to farming the perimeters (as they had been in 1986 and 1987 as well); and second, the rainfall was heavy at times, leading to substantial flooding of perimeters which had been designed for drought conditions. When combined with the continued unavailability of credit for input purchases, these two consequences of the good rainfall made 1988 a bad year to study the production of the perimeters. Unfortunately, two of the the perimeters we chose for intensive study, Bakel Collengal and Moudery II, were among the most affected by the flooding; little production data could be gathered, and most of what we could gather was not representative of "normal" conditions.

The information we consider sufficiently reliable to analyze production is therefore limited to that obtained from Miller's sample of 26 parcels in Moudery I. In spite of the small size of the sample, the analysis presented here gives some insight into production relationships. The questionnaire yielded information on expenditures on inputs (diesel fuel, fertilizer, and pesticides), labor (both family and hired, but only the number of people involved), and production on the sampled parcel as well as characteristics of the farmer and his household and production on other irrigated and dryland plots.

Table 22 presents estimates of Cobb-Douglas production functions for rice on the sampled parcels, with and without dummy variables distinguishing the farmer's gender and caste. Regression 1 is the "classic" production function, treating output as a function of inputs applied to the land. Fertilizer and labor are both significant and positive, as expected, and are of approximately the same magnitude; this suggests that they are equally important contributors to output. The coefficient on diesel fuel is negative and "close" to being significant; we have no explanation for this result. The sum of the coefficients is greater than one, suggesting increasing returns to scale, i.e., that increases in input use would bring forth greater than proportional increases in output. The regression explains a respectable 70 per cent of the variation in output.

TABLE 22
Production Function Estimates for Rice

<u>VARIABLE</u>	<u>Regression 1</u>	<u>Regression 2</u>	<u>Regression 3</u>	<u>Regression 4</u>
Constant	-4.893 (-5.08)	-4.068 (-4.14)	-4.075 (-3.58)	-4.091 (-4.49)
Fertilizer	0.657 (6.58)	0.671 (7.61)	0.669 (6.23)	0.670 (7.74)
Labor	0.717 (2.20)	0.357 (1.02)	0.356 (0.96)	0.303 (0.93)
Diesel Fuel	-0.105 (-1.67)	-0.111 (-1.90)	-0.109 (-1.54)	-0.130 (-2.36)
Gender		-1.645 (-2.07)	-1.627 (-1.76)	-1.509 (-2.03)
Kome			0.007 (0.01)	
Other Castes			0.059 (0.06)	
Area				0.708 (2.03)
Adj. R ²	.703	.743	.715	.778

NOTE: Dependent variable is the logarithm of rice output in kilograms;
Fertilizer and Diesel Fuel are logarithms of expenditures;
Labor is the logarithm of the number of adults in the household;
Gender, Kome and Other Castes are dummy variables (other = all but
nobles, clerics and kome);
Area is the logarithm of the number of casiers farmed in rice.

Adj. R² is the proportion of the variation in output explained by
the regression.

T-statistics in parentheses: a value greater than or equal to 1.72
indicates statistical significance at a 90% confidence level on
a two-tailed test.

Regression 2 adds a dummy variable for gender, with female = 0. The negative and significant coefficient suggests that, other things being equal, women produce less rice than men. Interestingly, the coefficient on labor is cut in half and loses significance, suggesting that the reason why women produce less is that they have less labor to work with. The fertilizer coefficient remains the same, implying that women and men use equal amounts of fertilizer, other things being equal. Regression 3 adds dummy variables for subordinate castes, and demonstrates that there is no caste difference at all in the production process. Regression 4 adds a variable representing the area farmed. It is positive and significant, but does not affect the values of the other coefficients, suggesting that, for example, women's lower productivity is not a function of the smaller area they farm. In regressions not reported here, expenditures on pesticides were included; they had no noticeable effect on output.

These regressions demonstrate that Moudery I farmers produce rice according to a production process which is well-defined and "rational." Output responds to input use as it should. In Regressions 2 and 3, the sum of the coefficients is close to one, suggesting constant returns to scale once the gender effect is taken into account. In Regression 4, if one treats area as an input the sum is substantially greater than one, which means that farmers could produce substantially more if they had access to more irrigated land (i.e., access to other inputs such as labor is not a constraint to increasing the size of irrigated holdings). It would have been extremely interesting to compare the Moudery I results to those of the other perimeters we studied, but unfortunately the production data on the latter were too strongly influenced by extraneous factors like flooding.

V. Conclusions

In this section, we first assess the research program's initial hypotheses in the light of our findings, and then summarize the program's conclusions.

A. Access to Irrigated Land May Change over Time

Most of our Discussion Papers have presented data and cases which support this hypothesis. Many of the original perimeters have grown in size, generally to the benefit of existing members rather than to that of new entrants. New perimeters have been created, and their members are frequently people who previously belonged to the original perimeters (or still belong). Only very recently have efforts been made, especially in the CR of Moudery, to reach out to groups whose participation in irrigation has thus far been minimal. Mass abandonments have occurred over time, in such diverse perimeters as Moudery I, Gassambilakhé, Collengal and Ballou I--the latter clearly the result of social conflict. The Falémé perimeters operate fitfully at best, so that the high participation as measured by membership lists conceals a reality of very limited, and decreasing, access.

Access to irrigated land should not be static. Household labor availability and food needs vary over the family life cycle, even within extended family systems such as the ka. Some perimeter members may wish to "go commercial," and others may wish to reduce or abandon their irrigated farming. Mechanisms for the transfer of land exist, but except for Collengal they are unofficial and against the producer groups' rules. The very low incidence of renting and leasing uncovered by our surveys, in combination with a high incidence of abandoned parcels and a strong demand for new irrigated land, suggests that there are barriers to land transfers which constrain productive use of the existing perimeters. Producer groups should be encouraged to develop rules which facilitate transfers, but which guard against the possibility of coercive dispossession.

B. Social Stratification May Determine Access to Irrigated Land

Our initial hypothesis that traditional elites will attempt either to control or subvert the development of irrigation is only partially verified. We have reported a great deal of evidence that nobles have either fought to retain their traditional claims to land and hence to prevent irrigation (especially in Diawara), and that they have maintained control over the land allocation process through the leadership of producer groups and through domination of the CRs. Producer group officers usually have the choice of the best land, and frequently have larger holdings than other members. In the Falémé zone, noble families appear to be in complete control, and in one case (Wouro Himadou) have essentially taken over the perimeter infrastructure for themselves.

On the other hand, traditional elites have not been completely successful in retaining control. The newer perimeters have larger proportions of subordinate social groups, including komé (though fewer women), than the original perimeters. The Ballou schism resulted in the creation of a second perimeter rather than the exclusion of komé from access to irrigated land. The President of the CR of Moudery, a noble himself, has formed alliances with members of subordinate groups, first sponsoring the creation of Moudery II (prior to the establishment of the CR), and then allocating land to youth, women and others who had not been able to obtain perimeter plots previously.

The principal reason why elites have not succeeded in maintaining their absolute authority over land allocation is the application of the national land law and the concomitant creation of the CRs. Even though nobles appear to control the CRs, the decision-making patterns do not always follow caste lines. The CR of Moudery has had confrontations with traditional landed families in Diawara and Moudery, and the CR of Ballou granted the Ballou schismatics' request for a perimeter over the opposition of the village's chiefly family. Only in the CR of Kidira, whose President is, paradoxically, a former slave (of the ruling family), has the customary system of control remained unchallenged.

C. Women's Access to Land May Be Affected by the Creation of Irrigated Perimeters

The impact of irrigation on women's access to land has been mixed. In the Lower and Upper Goy, women have been listed as members of the perimeters in large numbers, forming a majority in most cases. In the Falémé, on the other hand, they have generally been excluded. Yet membership of producer groups is not sufficient evidence of control of land. The extended family farming system of the Soninké leaves it to the kagummé to decide which of the family's lands are part of the téxoore, and signing up women as producer-group members is frequently a means of expanding the téxoore rather than of allowing women to control their plots. No women are officers of a producer group, and no women are members of the CR.

In addition, there is evidence that women have lost access to land which they farmed traditionally. Many of the perimeters were constructed in areas where women had been growing swamp or rainfed rice, indigo and peanuts. In most cases they were permitted to become members of the perimeters as compensation (although rarely to control the use of their plots), but in two cases at least, Moudery II and Sinthiou Débékhoulé, they were excluded from participation in irrigation on land they used to farm.

Recent developments, notably the CR of Moudery's decision to set aside land for women's groups in all the villages, promise to increase women's opportunities to irrigate. Thus far, however, the construction of women's perimeters has been delayed, apparently by national-level politics.

D. The Success of Irrigation May Be Influenced by Constraints to Access

It is difficult to attribute the spotty success of the Bakel perimeters to any one cause, because there are so many possible candidates. The inconsistency of SAED management, its struggles with the Federation, and recent changes in policy have certainly contributed to poor performance. The debt burden has constrained producer groups from continuing to irrigate. The return of the rains has enabled people to resume the dryland farming which appears to suit their resources and customs better than irrigation does. Finally, the social conflict which has arisen in the course of irrigation development has divided villages and thereby hindered cooperative production (this is not nearly as serious in the Bakel zone as, for example, in Dembankané).

Our data do not permit a direct evaluation of the relationship between differential access to land and productivity. Our production data cover farmers on only one perimeter, and do not permit an evaluation of, for example, the relative value of labor time in irrigated farming. These data, for Moudery I, suggest that there are no significant productivity differences among social groups (except for women, who appear to have a labor constraint). Our Moudery village survey, while demonstrating statistically significant differences in access to irrigated land by gender, caste, and access to other types of farmland, does not help us to learn whether some farmers who are not now irrigating would be more productive irrigators than current perimeter members.

Miller's dissertation will include in-depth analysis, both quantitative and qualitative, of the operation of Moudery I in the context of the society of the entire village. Since this perimeter has had a varied history, comprising phases of collective operation, individualization, abandonment, and--currently--consolidation, it is one of the best laboratories available to explore the relationship between access practices and success. Unfortunately we must wait for those results.

VI. Policy Implications

A. The Importance of Consistent Project Objectives

BSIP and IWM-I have had multiple objectives: the increase of agricultural production to help to attain food self-sufficiency; the drought-proofing of the farming systems of the Upper Valley; the increase in access to irrigable land by all strata of local society; and the preparation of farmers for the new realities of the Après-Barrages, when irrigation water will be available year-round and flood-recession agriculture will be reduced. These are all appropriate, even laudable, but any evaluation of the perimeters must recognize that interactions among the objectives may diminish measures of success (such as output or yield) which speak to only one of them.

The Bakel irrigated perimeters have not contributed very much to national food self-sufficiency; SAED never succeeded in purchasing significant quantities of rice from Bakel farmers. On the other hand, there is plenty of evidence, both quantitative (SAED data on production) and qualitative (increasing consumption of perimeter rice and sorghum in the villages where irrigation has succeeded), to demonstrate that the first objective has been at least partly fulfilled. Certainly, however, a cost-benefit analysis of the two projects based entirely on production and consumption benefits would show very large economic losses.

The drought-proofing objective is the one to which the farmers themselves seem to have responded the most eagerly. Most of our Discussion Papers have indicated that farmers have been most interested in irrigation during the periodic droughts, and have reduced their participation to a minimum during rainy years. As shown above, even the most enthusiastic irrigators continue to farm the dryland as a hedge against the persistent uncertainty of input availability and threats of pump and dike breakdowns.

Access to irrigated land is spread much more broadly throughout the villages than is access to other valuable land, falo and collengal. Farmers of subordinate status on the perimeters are beholden to nobody, generally paying no tithes and making no labor contributions to their former masters. Women have become members of producer groups, and in a few cases have direct control over their parcels. In some sense, however, access was too broad, because in the early years there was insufficient land per farmer for families to be willing to devote substantial energies to irrigation.

The use of small perimeters to prepare the population for the changes in water availability due to the Manantali dam has proved itself. Many farmers have more than a decade's experience with irrigation and are experimenting with double-cropping, and the CRs are ensuring that most of the irrigable land will be assigned to residents. Without USAID's and SAED's presence there would have been many fewer farmers involved in water-control agriculture, and therefore the communities might have lost

control over their land resources to outsiders (as has been the case in the Delta).

These four objectives have all been fulfilled to some degree, but they are somewhat contradictory. The best way to contribute to food self-sufficiency would have been to institute perimeters on the Delta model, with fewer farmers on larger plots so that surpluses could have been generated. Preparation for the Après-Barrages would have been more effective if the projects had substituted a more active extension program for continued increases in irrigated area, but that would have limited access or kept individual holdings smaller. All the objectives are desirable, but the projects would have been more likely to succeed if choices among them had been made. Our suggestion, for what it is worth at this point in the project cycle, is to emphasize the fourth objective--better preparation of farmers for the future--rather than simply attempting continually to increase area or to rehabilitate perimeters.

B. The Incorporation of Tenure Arrangements in Project Design

1. Know who claims the land on which perimeters are built

Despite the Land Law and the New Agricultural Policy, traditional influence over the control and allocation of land is far from dead. This is especially true on the Falémé perimeters in the Bundu, where the complex relationship between the Sy family and the former-slave majority has paralyzed the perimeters in several villages. The Sy and their allies have undisputed authority over land along the Falémé, and their political influence extends, it appears, to the types of land where irrigation takes place. The problem of traditional claims to land in the Bundu will not be easily resolved, but on the other hand the potential economic returns to irrigation there are quite low. We recommend that serious consideration be given to excluding many of the Bundu perimeters from rehabilitation or expansion.

Even in the Soninké area, however, where traditional land rights have been overlaid with control by a new elite, the power of customary landowners remains strong. The incessant litigation by the Saaxo of Diawara, detailed in Miller's report, has at the very least slowed and distorted the development of new perimeters. The conflicts within the Nianghané clan in Ballou over land they claimed to control were played out within the clan for a considerable amount of time before the CR allocated land to the breakaway group. The inability of the residents of Golmy to form a groupement and therefore to get a perimeter can be at least partly explained by the strength of the marabout's customary hold over land (not countered, as is that of his Koungany relative, by a strong modernizing leader).

The lesson to be learned from the first fourteen years of experience with irrigation in these stratified societies is that even if customary control and resistance to the economic emancipation of subordinate people is strong, it is not absolute (the Falémé is thus far an exception). If

it is not absolute, it can be overcome, but to minimize economic and social costs the process should be careful and sensitive to local variations. We suggest that the following steps be taken before any perimeter is established and at the same time engineering studies are being done (if not before):

a. Identify any and all persons, whether living in the beneficiary community or not, who have customary claims to the land where development might occur. This can be accomplished by interviews with village notables and other key informants; the interviewer should not be beguiled by declarations that the National Domain Law has made traditional claims irrelevant--our research clearly shows that they are not.

b. Meet with the people identified in step 1, and discuss the development proposal with them. In the same time period, meet with CR leaders (see below) to discuss their perceptions of any likely difficulties arising from the claims. Enter into both sets of discussions with a set of possible solutions, such as asking the claimants to yield their claims formally (the fact that the law considers them invalid is beside the point); proposing that members of their families become perimeter members; offering other types of compensation (such as hiring members of their families at SAED). One should also not accept assurances by the claimants that the law has invalidated their claims: the Saaxo family has not bowed to the law, nor, of course, has the Sy family.

2. Understand the dynamics of CR decision-making

The Rural Councils are now the most important actors in determining who has access to irrigable land, in what quantities, in which locations and under which conditions. Our detailed study of the operations of the Rural Council of Moudery has demonstrated the importance of strong personality and of political connections in determining the outcomes of the land allocation process; our information about the CR's of Ballou and Kidira, while limited, suggests that the absence of these two qualities helps to explain the slower growth of irrigation development in the Upper Goy and the Falémé.

The Rural Councils will be a strong influence on the success of IWM-I. As Miller's report showed, the CR of Moudery has managed to allocate large amounts of land in a very short time, to a wide variety of groups and individuals, including its own members. Women and youth have--even where they have not made specific requests for land--been reserved modest quantities of land. But allocation has not been impartial. For example, by blocking specific land allocation to the Tuabou women's group because its President was not a member of the ruling party, the CR of Moudery has made it impossible for that group to take advantage of the offer of a pump by an FAO project, and the offer expires when the project ends. The Djibi Ndiaye case (see Miller's report) shows the opposite: the CR can allocate land to individuals with dubious rights, and receive support from SAED for perimeter construction.

USAID, its TA contractor and SAED should work out a formal relationship with the three CRs in the project area. The relationship

should recognize the CRs' primacy in land allocation questions, but USAID and the TA contractor should reserve the right to decide which of the producer groups and Economic Interest Groups (GIEs) to support by constructing perimeters and providing technical assistance. This implies that USAID and its TA contractor will have to devote substantial efforts to understanding the sociopolitical background of producer groups and GIEs.

3. Understand land distribution procedures within producer groups

Our census, as reported in DP5, was able to gather qualitative information on the land tenure arrangements and practices of most of the producer groups in existence at the time. There are sufficient variations among perimeters to suggest that a seminar be organized at which the merits of various alternative procedures could be discussed by representatives of producer groups. In preparation for such a meeting, it would be very useful for USAID and its TA contractor to assemble additional detail on the land administration policies of all producer groups, including, if possible, any written documentation possessed by the officers.

The seminar should focus on two issues: the ease of transfer of parcels from one farmer to another and the decision between increasing individual parcel size and incorporating new members as perimeters are extended and rehabilitated. The first issue is of particular concern in the present situation, where many parcels are abandoned even on thriving perimeters and even though there appears to be a strong demand for new perimeters. The second issue is related to the consideration of multiple objectives discussed above; while each producer group should have the right to determine its own priorities, it is not as evident that USAID funds should support perimeters whose goals are too much at variance with its own. First, though, USAID should decide what its goals are.

4. Decide whether to expand current perimeters or to create new ones

Assuming that IWM-I will continue to support increases in irrigated area, there is a choice to be made between increasing perimeter size (where possible) and creating new perimeters. In the 1970's, when the producer groups were supposed to be open to people from all strata of society, there was no reason to make this choice on social grounds. Now, however, the solidarity which prevailed in the early days has broken down. In Moudery, Diawara and Ballou, as well as in Sénoudébou even though it is not operating, extensions of village irrigation systems have been organized by identifiable subgroups of the population: women, youth, membership in a religious sect, residential district with caste implications, relatives of the organizer. This means that publicly-supported construction and extension activities may be assisting particularist interests rather than contributing to overall village welfare, as donors could assume they were before. Information available at SAED does not distinguish between open-access and closed-membership groups; perimeters are identified simply by the village name and a roman numeral. Therefore USAID and its TA contractor should seek additional information before approving plans to assist a given perimeter.

Clearly, supporting some of the exclusive groups, such as women and youth, should not be controversial. Also, USAID's policy of encouraging private enterprise development should favor support for entrepreneurial individuals and GIEs. Given the complexity of social and political dynamics in Bakel, however, it is important that USAID understand whose activities it is funding. The Social Scientist on the TA team should prepare descriptions of the legal status and membership composition of each perimeter wishing to receive project assistance, so that informed decisions can be made in each case.

It is also no longer true that extending the original perimeters necessarily means support for the entire village. For example, nearly all the former slave members of Ballou I left to join Ballou II, and the mass abandonments of Moudery I, Gassambilakhé, Collengal and probably others including Tuabou mean that the current membership is a subset of the original group. Again, it is important to know who the members are and not to assume broad sharing of benefits.

C. Can the Bakel Results Be Generalized to the Valley?

In many ways Bakel's situation is distinctive. It is remote, thus with high transportation and communications costs. It is primarily populated by the Soninké, an ethnic group which does not reside elsewhere in the Senegal Valley, other than in a small part of the Department of Matam. It has considerably less flood-recession land than does the Middle Valley. Its male population has substantially more experience in international migration than does that of other zones. It has higher and less variable rainfall than do the downstream zones. All these factors suggest caution in applying the findings we have presented here and in our other reports.

On the other hand, Bakel's situation is similar to that of other parts of the Valley in several ways. Its remoteness has diminished with the completion of the (admittedly horrible) paved road and the expansion of telephone service. Soninké farming practices are not very different from that of the Pulaar and Wolof--use of hand hoes and family labor prevails everywhere except on the large Delta perimeters. Up to now, village perimeters everywhere in the Valley have been primarily constructed on fondé soils where flood recession was not possible (and therefore serious conflicts with traditional owners were minimized). Pulaar men have also migrated, though primarily to Dakar rather than to France. The recent return of more normal rainfall has led to substantial increases in dryland farming in the Middle Valley as well as in Bakel. In other words, Bakel's distinctiveness is considerably less than the preceding paragraph implies.

Social conflicts are, if anything, more serious in the Middle Valley than in Bakel, as DP 14 described. The caste cum migrant-nonmigrant confrontation in Dembankané is a dramatic case, as is the plight of Diatar near Podor. The beginning of development of medium perimeters in Matam and Podor has run into opposition from traditional elites who control the flood-recession land which has become valuable again now that the floods

are better. These conflicts can only be worsened as Mauritians arrive and seek means of supporting themselves in already-populated areas.

Therefore the need to understand local social and political realities before proceeding with irrigation development is even greater in the Middle Valley than in Bakel (it should be noted that the Italian team constructing a medium perimeter at Ourosogui had not bothered, as of December 1988, to meet with the traditional leaders of the villages whose land was involved). If USAID is interested in pursuing the construction of a medium perimeter in the Middle Valley, it should take care to conduct detailed socioeconomic studies of several alternative sites, asking the questions posed in section VI.B., above.

VII. Specific Recommendations and Guidelines on Land Tenure and Related Policies for Irrigation Development in Bakel

A. Support for Village-Level Irrigation and Private-Sector Involvement

The purpose of IWM-I is "to expand and improve village-level irrigated farming in Bakel, involving greater private sector participation that can be replicated throughout the River Basin." (PP, p.15) There are two components of this statement: (1) development of village-level irrigation and (2) promotion of the private sector. These two objectives must be considered separately, because of the different institutional structures under which village-level and individual enterprises operate.

1) Village-level irrigation

Until recently, the organizational form under which all PIVs were established was the Groupement de Producteurs (Producer Group--GP), a group with a collective interest in irrigation farming, in which land is distributed among members by lottery and whose leadership is selected democratically. The first GPs were inclusive: they were open to whomever expressed an interest in participation in irrigation, subject only to labor contributions for land preparation. In recent years, several GPs whose membership is restricted to women, to youth, to household heads, and to members of a religious sect have been established, notably in Moudery and Diawara, but they are still GPs. With the New Agricultural Policy (NAP), GPs are to evolve into Sections Villageoises (Village Sections--SVs), which in turn are the precursors of true cooperatives. The concept of village-level irrigation implies that GPs or SVs will be the beneficiary institutions.

While land within GPs is distributed to individuals or to individual households, and while individual members are responsible for the payment of inputs they use collectively (such as diesel fuel) as well as individually (such as seed and fertilizer), the GP remains a collective organization with all the problems of coordination and interdependence which collectivism implies. Individuals have limited scope for initiative

in crop choice, for expansion or contraction in farmed area, and for technical improvements. At least during the rainy season, farmers must grow similar crops on contiguous areas of the perimeter because of the demands of water scheduling. Tenure is subject to formal restrictions: purchases and sales of land are prohibited everywhere but Bakel-Collengal; on the other hand members have no legal tenure security in the form of a registered individual deed, title or even a written permit to occupy. Formal credit, through the CNCAS, is not available to GPs, and therefore is obviously unavailable to individual members. Up to now, plot sizes have been too small for most members to consider irrigation as the exclusive source of family income or even of food; thus they dilute their efforts in irrigation by allocating labor to dryland crops.

To fulfill its purpose of expansion and improvement of village-level irrigation, the project will have to operate with GPs in spite of these drawbacks, as the PP recognizes (p. 65). GPs are the only structure available within which large numbers of farmers can gain access to irrigated land. With the recent trend towards GPs composed of women or youth, village-level perimeters can guarantee access to productive land for members of these groups, whose access has heretofore been indirect--through their relationship to family heads. They can also serve as training grounds, where highly motivated individuals can learn irrigation techniques which would help them subsequently to initiate private commercial irrigated farming enterprises.

We recommend that the project continue to provide services to village-level GPs, whether they are open to all villagers or restricted to certain subgroups. As perimeters are rehabilitated and expanded, priority should be given to achieving the PP's target of about 0.35 hectare per adult participant before increasing membership. An exception might be perimeters established for the specific purpose of providing training in irrigated farming; in that case, plot sizes should be flexible, with individual allocations starting at, say, 0.1 ha. with the possibility of expansion to as much as 1 ha. as farmers become more knowledgeable. Another exception might be perimeters established for specialty crops such as bananas or vegetables. As irrigation development proceeds, however, especially after the formulation and implementation of the Upper Valley Master Plan, we consider it likely that the village-level GPs will represent a decreasing proportion of irrigated area, and some GPs may disappear altogether as some of their members move on to commercial farming.

2) The private sector

The private sector can increase its involvement in two ways: by participating directly in irrigated farming and by creating support enterprises ranging from construction contracting to input supply, marketing, maintenance services and sales or production of equipment. These two types of activity are completely different because of the laws and policy relating to private access to land: there are few government restraints on the establishment of nonfarm private enterprise, but individual access to land can be problematic.

a) Private irrigation

To participate directly in irrigated farming on National Domain land, individuals must be able to acquire land in their own right. Until the New Agricultural Policy came into effect this was not possible, but since then there has been an institutional form available: the Groupement d'Intérêt Economique (Economic Interest Group--GIE). Formally, a GIE cannot be a purely individual enterprise: it must have at least two members. This is no real obstacle to individuals, however, as they can list their relatives or friends as members without any effective dilution of individual control. A GIE can apply to a CR for land just as a GP can, and receives access under the same conditions: permanent use rights without payment and without the ability to transfer the land to someone else except through the intermediation of the CR; the only conditions are full development of the land (mise en valeur) and continuous use. The Moudery CR has granted several pieces of land to GIEs, most notably to the GIE of the President of the CR himself.

A GIE does have access to formal credit through the CNCAS, which gives it an obvious advantage over GPs in upgrading farming technology by purchasing tractors, for example. This, in turn, helps to eliminate the labor constraint which hinders individuals and families from farming areas large enough to generate significant surpluses for commercial sale. The GIE has become very popular in the Delta; well over one hundred of them have received land allocations from the CR of Ross-Béthio alone (see DP 14).

We think that the project can best contribute to the promotion of private enterprise in irrigated agriculture by making direct technical assistance available to GIEs, including farm management techniques, accounting, and marketing information. While there are few GIEs in operation in Bakel now, it is likely that the availability of project support will encourage others to begin operations. In fact, the project can actively promote the establishment of GIEs. Working closely with the Rural Councils, the project's technical assistants can identify promising individuals, ensure that they are awarded good land, help them to plan and to finance startup, and provide extension services.

There is one serious problem with this strategy of promoting private irrigation: the individuals who will be helped at first are those who will have the easiest time getting land from the CRs. Up to now this has meant CR members or other well-connected people, and not necessarily people with the best qualifications or motives for becoming successful commercial farmers. There is some danger that the result will not be a dynamic private sector producing for commercial sale efficiently with modern technology, but rather a new class of landlords who produce with traditional methods by hiring cheap, unskilled labor or by subleasing pieces of their land to small farmers. We consider that this problem can be averted if the project pays attention to the types of GIEs it supports.

b) Private nonfarm enterprises

There is little evidence to date that the private sector has responded strongly to the opportunity to replace SAED's construction, marketing and maintenance services. SAED and the Ministry of Public Works have done all the perimeter construction in Bakel to date (the latter in only one case we are familiar with). Crop marketing remains minimal, and may even have decreased since SAED stopped giving input credit. Diesel fuel is usually purchased at SONADIS, another parastatal. Well-placed individuals, including the National Assembly deputy from Moudery, are becoming the local fertilizer distributors. Some of the perimeters have their own maintenance technicians, trained at SAED or elsewhere, but we are not aware of any private company in the region which provides such service. The only non-SAED plowing service available is from the Federation.

There are a few positive signs, however. Individuals in some villages have purchased small powered grain mills and sell milling services to households. In December 1988 we observed two besuited maîtrisards, representing a Dakar seed company, calling on SAED and project offices in the Middle Valley to sell vegetable seeds; when we saw them in Matam they had arrived too late to do any business for the upcoming dry season, but they were clearly paving the way for future activities. While these are small and limited activities, they are merely the beginning. Still, given the fact that the NAP has been in operation for five years already, it is unlikely that the void left by the dépérissement of SAED will be rapidly and completely filled by the modern private sector.

We have no specific recommendations for ways in which the project can directly promote private support services for irrigation development, other than having the technical assistance team making its expertise available to potential entrepreneurs. On the other hand, there is clearly scope for a separate small enterprise development project, focused on providing technical assistance and credit to individuals wishing to establish contract plowing, marketing, sales and service, and processing operations in Bakel (and elsewhere).

B. Tenure Security, Credit and Investment

We found no evidence that participants in village GPs feel insecure in their access to perimeter land, or that tenure insecurity plays any part in influencing their farming or investment decisions. Individual participants' tenure is derived from their membership in the GP, whose control of the perimeter land is guaranteed by the CR as long as the GP continues to function. Now that SAED no longer furnishes inputs on credit, the only reason why members can lose their land is by not using it (the transition to cash purchases of inputs, after an initial period of turmoil, appears to have been successful). On the other hand, the fact that GP members cannot get formal credit means that they have limited possibilities to invest in intensification techniques; therefore productivity is severely constrained and the prospects for the production of marketable surpluses are dim.

We do not think that credit should be made available to GPs as groups, but instead propose that CNCAS be asked to consider a small pilot program to provide medium-term credit to individual GP members in amounts sufficient to purchase rototillers, oxen, etc. for use on their own holdings as well, possibly, as selling tilling services to others. Reimbursement should be the individual's responsibility, not the GP's, to avoid the "free-rider" problems which have destroyed nearly all credit programs in Senegal. The issue of collateral is obviously the sticking point: the lack of a land title means the lack of adequate guarantees. On the other hand, GIEs who borrow from CNCAS do not put their land up as collateral, either: they are required to maintain a deposit account instead (unfortunately, in amounts which are probably too large for the typical GP member to contemplate).

In other parts of Africa (Gezira in Sudan, Mwea in Kenya, for example), irrigation participants hold one-year leases whose renewal is automatic, subject only to continued productive use of the land and contributions to perimeter maintenance. Farmers who default lose their land, and perimeter management can reassign it to another person. Instituting such a system for GP members would merely formalize the arrangements that currently exist on most perimeters, but it could provide CNCAS with slightly greater assurances of debt repayment and perhaps give some farmers confidence to think seriously about applying for credit. A lease document could probably be designed in such a way that no legislative change would be required. We recommend that the project enter into discussions with one CR and one or more GPs to work out the details and to design an experimental program to institute a leasehold system.

C. Land Tenure Issues in Perimeter Design

In supporting the construction of perimeters, USAID has the responsibility of understanding the social relations which may influence the success of irrigation. Here we propose a checklist of design questions which should provide the information necessary to minimize land tenure and related problems and thereby improve the chances for sustained, profitable operation of the perimeters.

1. Before choosing the specific site for a perimeter:
 - a. Determine the landholding patterns in the general area by having village elders or the CR draw a rough sketch map, making the distinction between ownership rights and use rights.
 - b. Determine land use in the area.
 - 1) If nobody is or has recently been farming the land, find out why.
 - 2) Trace out grazing patterns, including access to the river for herds (those of local residents and transhumants).

- 3) If the land is walo or collenga, learn where the water tends to collect and for how long, where it floods and how often, where recessional cultivation has usually been successful and where it rarely has been.

2. Once the specific site for a perimeter has been determined:

- a. Identify all families who claim traditional rights to the land to be developed. Map out the areas they claim.
- b. Gain a release from all these families, via a written document (which will have no formal legal basis unless current laws are changed) which clearly spells out the conditions under which the families are releasing their claims.
- c. Make a list of all people (not only household heads) who have been farming the area over the past five years. Map out the fields that they have used.
- d. Gain a release from all these people, via a written document (which will have no formal legal basis unless current laws are changed), in which the people acknowledge that they will be unable to farm the land as they did in the past.
- e. Negotiate compensation for loss of traditional claims or use rights. This could take the form of an offer to assist the individuals in joining producer groups or in organizing GIEs, or simply a cash payment.
- f. Meet with representatives of the CR and the leaders of the producer group or GIE who will be the beneficiaries of the perimeter.
 - 1) Obtain a list of all beneficiaries, specifying their previous farming experience including irrigation and their relationship (if any) to the leadership.
 - 2) Have them propose a detailed development plan for the land, and provide them with technical assistance in doing so. The plan should include:
 - a) a financial plan;
 - b) projected cropping pattern by season;
 - c) the size distribution of parcels within the perimeter, primarily for the purpose of determining if crop choice is appropriate given available techniques and labor;
 - d) assignment of responsibility for water scheduling and canal and pump maintenance.
 - 3) Provide them with information on available private-sector suppliers of inputs and services and marketing channels.