ABSTRACT

Labor Allocation Strategies of Semi-Subsistence Households in West Africa: A Case Study of The Diolas of the Lower Casamance Region of Senegal

by

Danielle Dedegbe

For the great majority of small-scale farming households in West Africa, labor is one of their most crucial factors of production. Yet, the dynamics behind these households' patterns of labor allocation are not well understood by planners and policy makers.

This study argues that (a) a household's labor allocation behavior is determined by its real opportunity set vis-a-vis the household's basic objectives, (b) a household's real opportunity set is the sum of its main constraints and opportunities after all environmental dimensions have been simultaneously considered, (c) male and female household members do not have the same opportunity sets.

The environmental circumstances of the Diola and Mandingized Diola farm households from the Casamance region of Senegal provide the quantitative foundation of the analysis. For each group, an opportunity set for an average household is derived with a special emphasis on gender differentiations. Based on these derived opportunity sets, a household's behavior regarding labor allocation is hypothesized. Hypothesized behaviors are then checked against observed behaviors of labor allocation. Among both groups, household labor allocation strategies seem to reflect a desire of farmers to use their comparative advantage to reduce the adverse effects of their main binding constraints.

With respect to farmers' ability to fulfill their basic objectives, the Mandingized Diolas appear to be better off than the Diolas and within each group, men appear to be better off than women.

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by

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To My Mother

The Greatest Blessing in My Life

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CHAPTER I

INTRODUCTION

1.1 Problem Statement

In West Africa, the large majority of semi-subsistence farming households still use traditional farming techniques, which are predominantly labor-intensive (Spencer, 1976). Thus, labor is their most critical resource, and the bulk of their strategies evolve around allocating labor to different uses. Yet, the sexual division of labor is such that labor availability cannot be determined by just knowing the number of active family members regardless of sex and age or of the type of crop (food crop, cash crop) contemplated. Female labor is available on a different basis from male labor, as men and women may face different constraints and may have different preferences or motivations. Whether the aim is to increase food security, generate income or introduce new technology, it is crucial to understand the patterns of labor allocation behavior of these small farmers and the motives behind these patterns. Therefore, a clearer understanding of labor allocation strategies is a prerequisite to any attempt to improve the economic and social conditions of these farmers.

1.2 Conceptual Model

1.2.1 Conceptual Background

The conceptual background of the present study can be described as follows: Semi-subsistence farming households in West Africa and in the Lower Casamance region of Senegal, in particular, are part of a very complex environment, which not only shapes the nature of their objectives, priorities and preferences, but also determines the range of the strategies households can adopt to reach these goals (Figure 1.1).

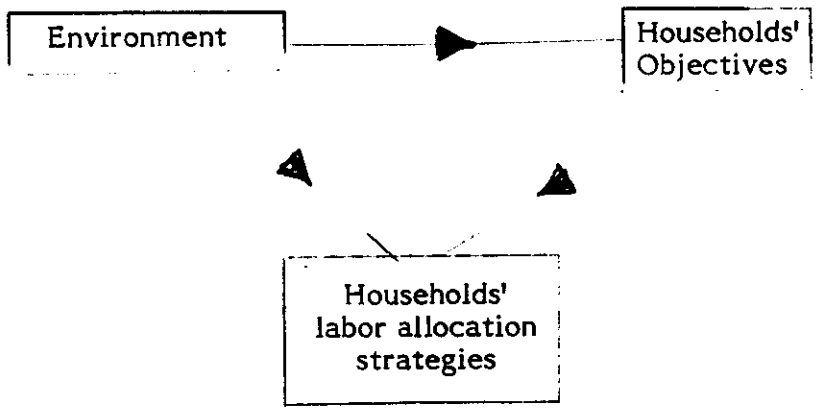

Figure 1.1 General Conceptual Framework

Households' labor allocation strategies are determined by the environment and by households' objectives, which are themselves influenced by the environment.

1.2.2 Focus of the Study

The focus of the study is to predict labor allocation strategies of Diola and Mandingized Diola households on the basis of their environmental constraints and of their objectives and then compare our predictions with the observed labor allocation strategies of these households.

1.2.3 Main Hypothesis

The main hypothesis has four main points and centers on the environment component of the general framework (Figure 1.1).

a) The environment is a non-homogeneous unit, which can be divided into three interrelated dimensions:

-- The natural environment, which includes physical and biological characteristics.

-- The socio-economic environment, which includes infrastructural and institutional characteristics.

-- The socio-cultural environment, which includes the norms of social behavior and the cultural aspects of the society.

b) Each environmental dimension has its specific binding constraints, which contribute to restrict the range of potential labor allocation strategies. Therefore, the effective strategy alternatives available to these farmers will be limited by all three dimensions of the environment, after all the binding constraints specific to each of these dimensions have been taken in account (see Figure 1.2).

Suppose that there are only five potential strategy alternatives of allocating labor, which enable the farmers of community X to reach their objectives. However, the existing natural conditions preclude the adoption of strategies 2 and 5, but 1, 3 and 4 are feasible. Meanwhile, the socio-cultural norms prohibit the use of strategies 2 and 3; strategies 1, 4 and 5 are acceptable in a socio-cultural sense. However,the socio-economic conditions are such that strategies 3 and 5 cannot be carried through, but strategies 1, 2, and 4 are possible. Therefore, given their current environment, these farmers of community X are left with only two alternatives: strategies 1 and 4 (Figure 1.2).

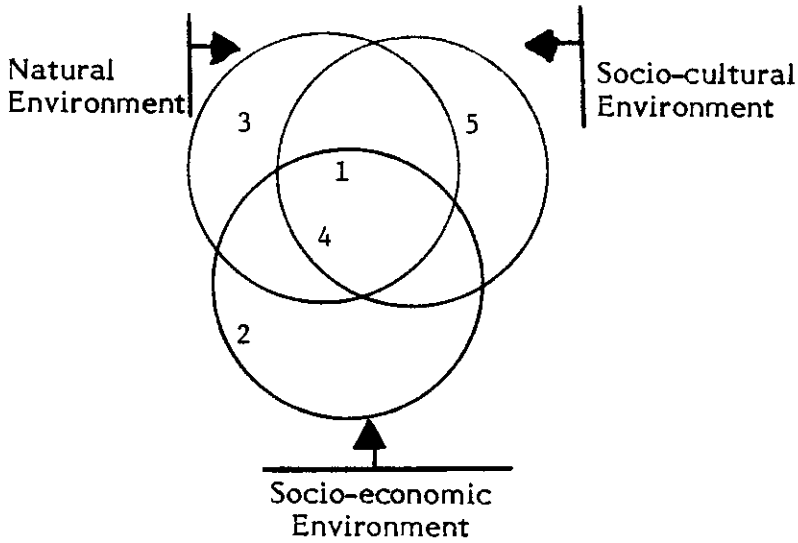

Figure 1.2: Environmental Dimensions Affecting Households' Labor Allocation Strategies

In Figure 1.2 the common area represents the feasibility region, which corresponds to the real (as opposed to potential) opportunity set of the farmers of community X. Households' labor allocation strategies will be a function of their real opportunity set.

c) The boundaries of the feasibility region are locally determined, as environmental conditions differ from country to country, and even within a country, from region to region, and from community to community. Also, a feasibility region is meaningless if it is not in the context of stated objectives.

d) The environment induces gender differentiations: males' and females' environmental conditions are not always equally stimulating or restricting, which may result in divergence in their individual opportunity sets and productive activities.

Thus, understanding farmers' relationship with their environment is the key factor in understanding farmers' behavior, especially their labor allocation behavior. Therefore, this study will be strongly influenced by the Farming Systems Research approach.

1.3 Approach

Chapter 2 will describe the environmental setting of the Diolas and of the Mandingized Diolas from a natural, socio-cultural and socio-economic point of view. Chapter 3 will bring together information on households' main objectives and households' main binding constraints in order to derive households' real opportunity sets. This chapter will also hypothesize on households' opportunity sets and the potential strategies of labor allocation they generate, when each environmental dimension is considered separately. Chapter 4 will make hypotheses (predict) about households' effective labor allocation strategies and compare them to the households' observed behavior on the basis of four aspects of labor allocation strategies. Finally, Chapter 5 will summarize the findings of the

study and draw some conclusions and policy implications.

1.4 The Data Base

Our case study deals with the Diolas of the Lower Casamance region of Senegal. However, several groups of Diolas can be distinguished, depending on the characteristics of their systems of production. I.S.R.A. (Senegalese Institute for Agricultural Research) distinguishes five groups, corresponding to five farming system types located in five geographical zones (see Posner et al., 1983; Sall et al., Fevrier, 1984 and Sall et al., Campagne Agricole 1982-83 and figure 1.3). Our analysis will be limited to the two most characteristic groups: The Diolas of zone I, whose system of production is typically Diola, and the Mandingized Diolas of zone IV, whose system of production is typically Manding. The area of concentration of the Diolas is located to the South of the Casamance River and will be referred to as the "south" or the "southern region" (see Figure 1.3.) The area of concentration of the Mandingized Diolas, on the other hand, is located to the north of the Casamance River and will be referred to as the "north" or the "northern region." Most of the data used in this study are drawn from ISRA publications on this part of the country. Two representative villages have been selected for each zone. Zone I, situated in the southwest of the region, corresponds to the Oussouye Zone and includes the villages of Boukitingo and Loudia-Ouolof. Zone IV, situated in the northeast of the region, corresponds to the Sindian-Kalounayes Zone and includes the two villages of Boulandor and Medieg (see Figure 1.3). As concerns the quantitative data, average values of the two villages will be used for each zone unless otherwise stated. As regards terminology, "Riziculture Aquatique" will be translated interchangeably as "lowland transplanted (flooded) rice cultivation" (LTR), "wet rice" or "swamp rice". "Riz de nappe" will be translated as "lowland directly seeded rice cultivation" (LDSR) or "phreatic rice."

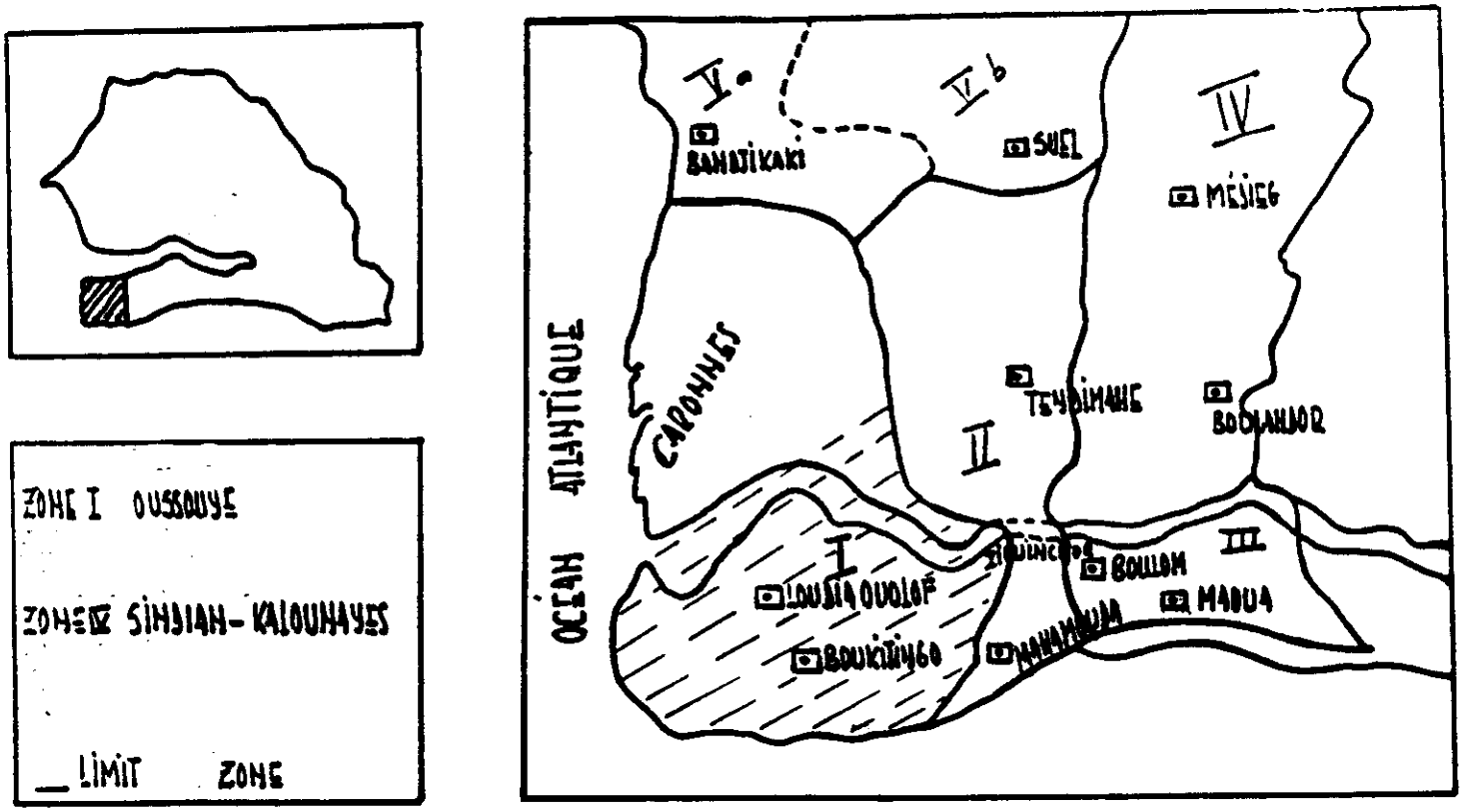

Figure 1.3 Location of the Different Farming System Types

Source: Sall et al., ISRA, Department Systemes et transfert, Rapport Annuel d'Activites No. 2, Campagne Agricole 1983/84, Document de Travail No. 1985-13, p. 4, Ziguinchor/Dakar, Mars 1985.

I.5. Need for the Study

Although it is now generally recognized that women contribute a substantial amount of the labor input in agricultural production, their role as decision-makers is not well understood (Guyer, 1984; Jones, 1984). The head of the household, usually the husband, is perceived as the direction-giver. Therefore, the alleviation of constraints facing the household is associated with the alleviation of the constraints facing the head of the household. Hence, the constraints specific to women are generally overlooked. Thus, there is a need to be gender-specific when studying the constraints faced by the farm household. More precisely, a better understanding of factors affecting labor allocation by gender is needed to conceptualize, design and implement more efficient programs and projects aimed at improving the economic and social conditions of these subsistence households.

One may have seen, heard or read cases of projects to which farmers were not very responsive, or where farmers used the resources of the project for other purposes; or cases where a policy change had several unintended effects, which in some instances may have been detrimental. Therefore, it is crucial when formulating designing and implementing policy changes to be aware of the fact that farmers are part of an environment which has several interrelated dimensions and that a change in any of these dimensions may have repercussions on the other dimensions and may alter farmers' opportunity sets, inducing changes in farmers' priorities. Consequently, it is necessary to have a good understanding of how farmers' environment affects their needs, priorities, motives and decision making for a good assessment of technological, infrastructural and institutional priorities and for more effective research design and implementation (Shaner et al., 1982).

CHAPTER 2

ENVIRONMENT

2.1 Introduction

The purpose of this chapter is to summarize the living conditions of farmers in the Lower Casamance in terms of the resource constraints and opportunities inherent in their environment. As already mentioned, the environment has been divided into three dimensions: the natural environment, concerned with variables such as rainfall pattern, topography and soil texture; the socio-cultural setting, concerned with variables such as customs and traditions (social norms, religious beliefs, etc.); and the socio-economic setting, which encompasses economic, infrastructural and institutional variables such as transportation and marketing facilities, the pricing system, the labor market, and extension services. The following discussion will be presented in the context of the Diola and Mandingized Diolas' farming systems.

The Lower Casamance region, situated in the southwestern corner of Senegal, covers 75,000 km^2 of low-lying terrain on both sides of the Casamance River. Cut off from the rest of the country to the north by Gambia, the Lower Casamance is separated to the east from neighboring Manding Middle Casamance by the Soungrougrou River (Linares, 1981). The Diolas, the major ethnic group (85%), occupy the inland deltas of the Casamance River. There are two major Diola groups: the coastal swamp cultivators, located in the southwestern part of the Lower Casamance Region, and the Mandingized inland Diolas, found in the northeastern part of the region where the influence of the Mandings (5% of the population) is most strongly felt (Posner, et al., 1985). The Lower Casamance includes the departments of Bignona, Oussouye and Ziguinchor. The total

population was estimated to be 196,636 inhabitants in 1976 (Sall, et al., Campagne Agricole 1982-1983).

2.2 The Natural Environment

The Lower Casamance has a low relief and a large part of it is at sea level. It has low plateaus that rise to no more than 15 to 20 meters above sea level. Skirting these sandy plateaus are numerous marigots (tidal river channels), some of which are quite large. These marigots extend through valleys or depressions (also called talwegs), covered with rich alluvial material deposited on a clayey base. Badly drained, these valleys are easily inundated during the rainy season, providing ideal conditions for an aquatic plant such as rice. However, there may be a severe drainage problem (Linares, 1981).

As one moves from the south to the north of the region, ecological characteristics vary. The further north and east one goes, the drier the climate, the fewer the rivers and marigots, the sparser the settlements, and the more prevalent the plateaus. Thus, in the northeast wet rice cultivation gives way to the Sudanic complex of plants grown in sandy soils elsewhere in Senegal: millet, sorghum, and groundnuts (Linares, 1981). As one moves southwest, rainfall increases, marigots extend well inland, population density increases, and wet rice cultivation becomes predominant (Linares, 1981). Termite hills dot the plateaus of the Lower Casamance. Their intensity increases as one moves south and constitutes an obstacle to mechanization (Sall, et al., Campagne Agricole 1982-1983).

2.2.1 Climate

"The climate of the Lower Casamance is strongly seasonal. Although the annual rains are expected to begin in June and end in October and reach a minimum of at least 1000 mm everywhere, they are highly variable in volume and timing" (Linares, 1981, p. 560). Generally, the rains begin in the North before

reaching the South, where they start at a slower pace. Yet, the amount and duration of rainfall increase and rainfall variability diminishes as one moves from North to South (see Table 2.1). August is generally the rainiest month and allows for the flooding of the paddies. The success of lowland transplanted rice is closely related to the presence of heavy rains during the last part of August and the beginning of September and to a sufficiently rainy end of season. On the other hand, June and July are the critical months for the planting and weeding of the upland crops (Posner, et al., 1985). For a given month, the amount of rain may fluctuate enormously in consecutive years. For instance, Boulandor received 250 mm of rainfall in July, 1982, 128 mm. in July, 1983, and 318 mm. in July, 1984. For Loudia-Ouloff, rainfall in September totalized 178 mm.in 1982, 313 mm. in 1983 and 149 mm. in 1984 (see Table 2.1). Of the last five years, 1983 was the driest in the north, whereas 1982 was the driest for the south.

Like other regions of Senegal, the Lower Casamance has experienced a dramatic decrease in rainfall during the past 25 years. From 1940 to 1960, the Lower Casamance was situated on the 1500 isohyet. However, since 1960, average rainfall has fallen to the 1300 mm. mark for the department of Oussouye (Zone I) and to the 900 mm. mark for the department of Bignona (Zone IV), (Posner, et al., 1985 and figure 2.1). In the department of Oussouye, the agricultural system becomes very vulnerable below 1300 mm. of rainfall due to the predominance of wet rice cultivation. Yet, since 1970, only five years have been above the 1300 mm. mark (see figure 2.1). In the department of Bignona, it is only under the 900 mm. market that the agricultural system becomes so vulnerable, thanks to the emphasis in this region on upland production, which has lower water requirements. Yet, since 1970, only six years have been above that mark (figure 2.1).

Table 2.2 shows positive correlation between rainfall, area under cultivation and agricultural production. These correlations are strongest for rice, showing that rice cultivation is the most vulnerable to rain shortages.

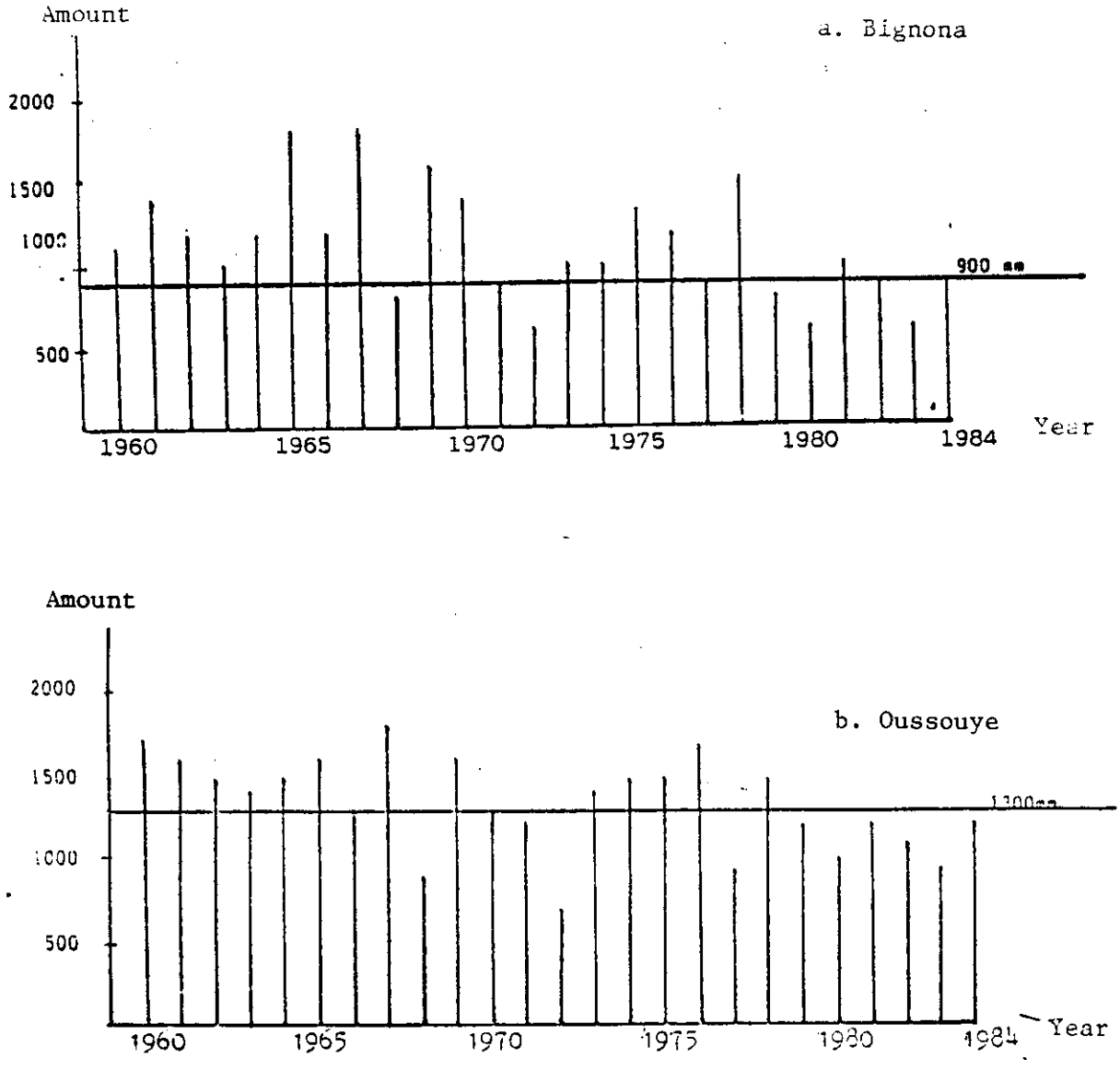

Figure 2.1. Evolution of annual rainfall over 25 years in the Departments of Oussouye (Zone I) and Bignona (Zone (IV)

Source: Posner et al., Travaux et Documents No. 4 (p.4), 1985.

Because of its low relief and its great number of marigots and rivers, this deficit in rainfall has severely affected agricultural production in Lower Casamance, as the salinization of the rice paddies has constituted an acute problem. "If the rains are sufficient, the salty water is pushed downstream during the rainy season. If the rains are insufficient, salts accumulate in the rice fields, with disastrous consequences for the rice crop" (Linares, 1981, p. 560 and Table 2.3). And this is essentially what has been happening as a result of the Sahelian drought of the 1970s. Before then, " ...when rains were abundant the Diola villagers were still working the deep fields. In later years salinization had killed even the highly resistant mangrove vegetation" (Linares, 1981, p. 560). The higher paddies, where phreatic rice cultivation is practiced, are also affected. By the end of the rainy season, the water table, which has dropped in recent years, becomes salty from the high tide and through capillary infiltration (Posner, 1985).

Table 2.1

Rainfall Pattern in South and North of Lower Casamance for the Years 1982, 1983 and 1984
(Rainfall amounts in millimeters)

	SOUTH						NORTH					
	BOUKITINGO			LOUDIA-OULOFF			BOULANDOR			MEDIEG		
Monthly Total	1982	1983	1984	1982	1983	1984	1982	1983	1984	1982	1983	1984
JUNE	-	57	185	-	91	195	-	97	249	-	77	163
JULY	234	322	308	253	281	324	250	128	318	212	173	293
AUGUST	360	384	314	338	314	279	399	174	195	379	147	172
SEPT.	153	270	199	178	313	149	138	169	230	102	216	114
OCT.	148	4	94	152	19	181	55	11	20	88	25	17
NOV.	-	-	15	-	-	27	-	-	3	-	-	8
TOTAL	896	1037	1115	921	1018	1155	842	579	1015	781	638	767

Source: Sall et al., 3e Rapport Annuel, Campagne 1984-1985 (p. 48, annexe 1) and Rapport Annuel d' Activites no. 2, Campagne 1983-1984 (Annexe 1) ISRA, Djibelor.

Table 2.2

Simple Correlations Between Amounts of Rainfall and Some Agricultural Statistics in the Departments of Bignona and Oussouye

Statistics	DEPARTMENTS (1963-1983)	
	BIGNONA	OUSSOUYE
Total Area Cultivated	.63**	.59**
Rice: Area Cultivated	.71***	.59**
Groundnuts: Area Cultivated	.42	.14
Millet & Sorghum: Area Cultivated	.36	.06
Cereal Production	.62**	.53*
Rice Production	.75***	.54*
Groundnut Production	.52*	.15
Millet & Sorghum Production	.14	.004

Source: Posner et al., "Les Systemes de Production en Basse Casamance et les Strategies Paysannes face au Deficit Pluviometrique,"Travaux et Documents no. 4 (table 1, p. 5). ISRA, Department Systemes et Transfert, Dakar, Aout, 1985.

* Significant at 5%
** Significant at 1%
*** Significant at 0.1%

Regarding the plateaus, there are substantial risks of October drought, which may cause crop failure in case of late planting (Posner, 1985). Taking the rice cycle as a whole, the optimal temperature conditions are approximately between 28 and 30°C. A minimum of 14-16°C is required. Over 40°C can be lethal for the plant (Republique Francaise, 1974). Thus, the temperature characteristics of the Lower Casamance are well suited to rice cultivation (see Table 2.3).

Table 2.3

Average Temperatures (in Degrees C.) during the Rainy season in Ziguinchor for the Period 1931-1960

Month	Minimum Average	Maximum Average
June	23	31+
July	23	33
August	25	30
September	23	31
October	23	32
November	21	32

Source: Republique Francaise, Ministere de la Cooperation, Memento de l'Agronome, Nouvelle edition, Techniques Rurales en Afrique, Paris: 1974.

2.2.2 Soils and Topography

Soil characteristics vary depending on their position on the toposequence. The toposequence exhibits three major zones: the plateau or upland; the transitory zone, skirting the plateau; and the tidal floodplains (see figure 2.2).

Upland soils are generally ferralitic, deep, low in organic and clay content. Upland fertility is inversely related to depth of soil and duration of cultivation. In the transitory zone, where phreatic rice is grown, soils are sandy and poor in organic matter. In the tidal floodplains, soil characteristics are a function of the evolution of the mangrove. At their first stage the mangrove soils are potentially acid-sulphatic. They are very fertile and high in clay content and can yield, with no fertilization and weeding, up to three tons of paddy/ha. At the second stage of their evolution, these mangrove soils become acid-sulphatic with a low PH and a high electric conductivity preventing cultivation. At their last stage, these soils are para-acid-sulphatic, very sandy, with the low organic matter content (see Posner, 1985).

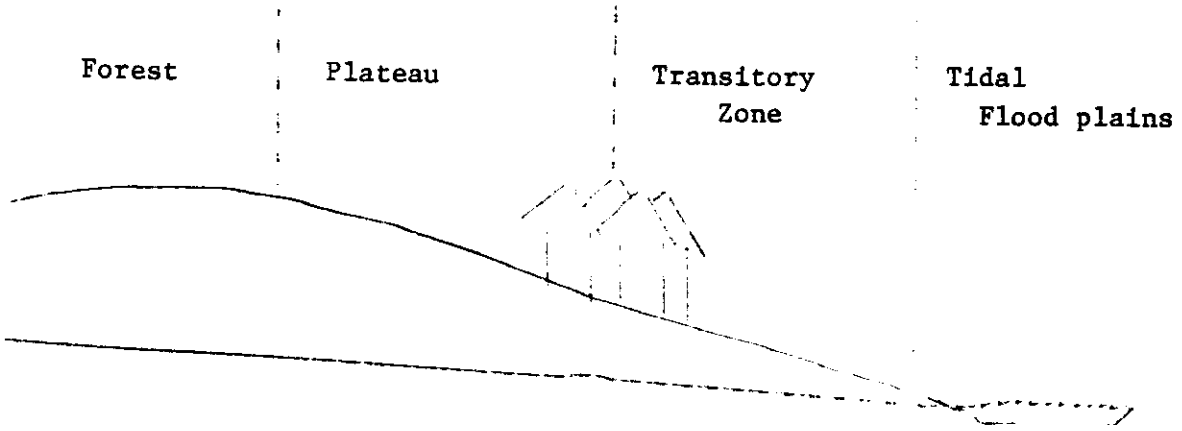

Figure 2.2 The Toposequence of the Lower Casamance

Source: Sall et al., Campagne Agricole 1982-1983.

On clay soils, the water requirement of rice diminishes. Rice adapts to a variety of soils, but light textured soils with a high clay content are preferable under wet cultivation. On upland cultivation, for rice as well as for other cereals, loose, silty, rich soils are preferable. However, rice will adapt better to an excess of humidity than to excessive dryness. For more details on the requirements of the main crops in Lower Casamance, see table 2.4.

To summarize, the Diolas are located in the southwestern part of the Lower Casamance region, where plateaus are scarce and where riceland predominates. Average rainfalls, although higher in this part of the region, have been decreasing as the result of the Sahelian drought and have caused salt intrusion in the most exposed paddies, the lowest ones especially. However, the rains are less variable in this part of the region, and August and September are generally the rainiest

months. On the other hand, the Mandingized Diolas are located in the northeastern part of the region, where uplands are predominant, lowland areas are scarce and are rarely inundated. Average rainfalls are lower in this part of the region, and rains are more variable and are shorter. June and July are the rainiest months. Thus, this type of climate is more adapted to plants with relatively low water requirements.

Table 2.4

Basic Soil Type and Rainfall Requirements of the The Main Crops of Lower Casamance

Crop	Soils	Water
Upland[1] Rice	PH between 5 and 8 mellow, clay	160-300 mm/month during the vegetative period (total of 1000-1800 mm for the season).
Swamp Rice[1]	alluvial, clay (40-50%) (delta soils, mangrove seasonally flooded areas) salt content over 1% and sulphide and sulphate not favorable	8 mm/day. The soil must be flooded until maturation.
Millet	less demanding than sorghum prefers sandy-clay, well drained soils	min. 200 mm, optimum 400-700 mm; over 1200 mm unfavorable, high risks of black rust.
Sorghum	requires more clay soils than soils reserved to millet, very sensitive to excess humidity, requires well drained soils	around 550 mm water requirements of sorghum lower than water requirements for maize
Maize	very demanding and very sensitive to varying soil fertility	min. of more than 600 mm for 120 day varieties
Groundnuts	PH between 4.5 and 8; light well-drained soils, well aerated	between 400 and 1200 mm.; drier end of cycle preferable for maturation; greatest water need during flowering and fructification stage

Source: Republique Francaie, Ministere de la Cooperation, Memento de l'Agronome, Nouvelle edition, Techniques Rurales en Afrique, Paris: 1974.

[1]Water requirement diminishes with clay-alluvial soils.

2.3 The Socio-cultural Environment

Socio-cultural variables include such things as the land tenure system, definition and organization of households, and religious and social norms. In a later chapter, we will study the extent to which the socio-cultural setting is an adaptation to the natural and socio-economic environment (see chapter 5).

2.3.1. The Diolas of the South

In the Diola society, marriage means autonomy of residence, production and consumption. At the time of his marriage, a man is expected to move out of his parent's home into his own house (Gueye, 1967). A household is formed by a man, his wife and their children. The typical Diola is monogamous. The young household is expected to be economically and residentially autonomous and thus must keep its production and consumption activities separate from the extended family (Pelissier, 1966; Linares, 1981 and 1985). In the Diola system, family labor constitutes the main source of labor. As a result of the Diolas' emphasis on autonomy of residence and production, Diola households are small, with an average of three workers per household. Thus, a woman constitutes her husband's main source of labor and vice-versa (Sall et al., Campagne Agricole 1982-1983). Furthermore, spouses' mutual labor is secured by a customary law which forbids divorcing during the agricultural season (Pelissier, 1966; Linares, 1981).

Most rice field work is done by the conjugal unit. For the most arduous tasks such as land preparation, transplanting, and harvesting, additional individuals may be recruited singly or in groups (village work associations) to provide extra labor (Pelissier, 1966; Linares, 1981; Posner, et al., 1985). This extra labor may be recruited on a formal or informal basis for payment in kind or in cash, or for free in special instances such as illness. However, "a great deal of group labor is informally recruited on a voluntary basis, following traditional rules of kinship reciprocity and friendship "(Linares, 1981, p. 567). These village work associations

may be male or female associations, and are often composed of members from the same generation. However, more and more, unmarried young men's and women's associations seek work outside the village in order to ensure payment in cash (Linares, 1981).

In the Diola households, husband and wife each customarily contribute about half of the family food supplies. Each keeps a separate granary. The wife's granary is reserved for the family's daily consumption during the dry season, while the husband's granary is reserved for use during the agricultural season and for special occasions such as religious ceremonies or receptions of guests, or as a source of capital used for the purchase of livestock (Pelissier, 1966).

Cash expenditures for men and women usually differ. Men's expenditures tend to involve mostly taxes, agricultural inputs, marriage expenses, cloth, housebuilding, and livestock, the latter being a symbol of wealth and a mandatory item of sacrifice at circumcision ceremonies. Women's expenditures comprise clothing, which constitutes a growing proportion of women's expenditures; and simple manufactured items used daily, such as peanut oil, sugar, soup, kerosene and matches, for which the women are usually wholly responsible. In addition, a substantial part of women's income is spent on transportation, medicine and children's school needs, but depending on the individual household's circumstances, men also may participate in these expenditures (Hamer, 1981).

The land tenure system is under the men's management. At the end of his initiation, each son is allocated cultivable riceland from the patrimony of his father's lineage. This allows him to prepare for his upcoming wedding. The riceland each son is allocated is composed of several rice plots of different qualities, which gives him the opportunity to balance his production as rainfall and relative soil fertility may vary depending on location (Pelissier, 1966; Linares, 1981). This parcelling out of rice plantations between a number of sons and

grandsons results in small-sized ricefields in the Diola country. After his marriage, a man may be allocated extra land, if the need arises. Another way for men to get access to land is through inheritance. At the father's death, his ricefields are equally divided between all his sons (Linares, 1981). Only men are allocated land; women may only be allocated land under exceptional circumstances. Yet, even though the husband nominally owns the land, the wife has extended usufructory rights on her husband's riceland (Linares, 1981 and 1985). Each year, the husband allocates to his wife about half of the available rice plots to cultivate, harvest and store the rice produced in her own granary. The production from the other half of the paddies goes to the husband's granary (Pelissier, 1966). Hence, females' access to riceland is essentially subject to two conditions: the women must be married to a member of the agnatic group and they must be able to farm the paddies they are allocated.

Rules governing allocation of upland areas are recent and were brought about by the development of upland crops (groundnuts especially). In fact, in the traditional subsistence economy, when the paddies could suffice to satisfy the food needs, the upland forests were only exploited for hunting, palm wine harvest, fruit gathering and wood collection. Even now in the areas rich in swamp and mangrove ricelands, the areas of the forest that have been cleared for upland cultivation (mainly for goundnuts) are limited (Pelissier, 1966).

Women's usufructory rights on riceland do not extend to the uplands where groundnut production, which is considered a male crop, takes place (Linares, 1985). Women are thus excluded from Senegal's most lucrative cash crop. Unlike rice, there are no socio-religious functions attached to groundnuts, which among the Diolas are grown primarily for cash (Linares, 1985). Therefore, there is no real socio-cultural obligation for a wife to help her husband in his groundnut production, and that is why she receives cash and/or in kind compensation from

her husband for her assistance. However, this compensation, which is usually not very substantial and at the husband's discretion, is variable and therefore does not constitute a reliable source of income for women(Linares, 1985; Journet, 1981).

In short, the Diola land tenure system has the following characteristics:

(1) "Land usage is based on the inalienable right of every resident male to cultivate paddyfields in his agnatic environment. Residual rights to those fields lie with each patrifilial group. The eldest functioning male of each patrifilial group must redistribute these fields equitably among his sons and/or nephews in strict response to the needs generated by the developmental cycle of each domestic group" (Linares, 1981, p. 568).

(2) As a general rule women do not have direct access to land but have usufructory rights on their husband's paddies, or may "temporarily borrow parcels if they go back to their natal villages to live. But lending is never by close agnates from her own patrifitial group for this is considered taboo; it is always by distant agnates or other kin." (Linares, 1981, p. 570).

(3) Out of an equity concern with respect to quality of land allocated to each male kin, a man's holdings will be scattered, causing time losses as the farmers travel from one parcel to the other. This scattering may also impede land mechanization, as it is difficult for any one individual to consolidate his holdings into a large continuous piece of land.

(4) The traditional Diola land tenure system is essentially based on riceland.

(5) Under the same traditional system, land may be borrowed but never can be bought or sold.

In Diolaland, rice is the preferred staple food and the basis of all diets. A

typical Diola may eat rice two or three times a day (Pelissier, 1966). However, in the Diola tradition, there are also religious and social functions attached to rice. Rice cultivation generates a series of religious rituals which draw both men and women into rice cultivation (Pelissier, 1966; Linares, 1985). Furthermore, rice is a key religious symbol and at ceremonies such as initiation, funerals, and presentations to the shrines, substantial quantities of rice may be used (Pelissier, 1966 and Linares, 1985). However, it is not just any rice which can be used for religious purposes, as date and location of production may be significant. Therefore, imported rice may not qualify. Moreover, Diola socio-cultural norms encourage rice production, as one's respect and admiration from one's peers are positively correlated with one's rice farming qualities (Pelissier, 1966; Journet, 1981). Thus rice production is of prime importance among the Diolas, given the multifunctional role of rice.

The typical Diola is animist and has a deep respect for the traditions. As such, he or she is expected to conform to a given set of socio-religious norms and rules (Pelissier, 1966; Gueye, 1967; Linares, 1981). For instance, because cows are religious symbols in the Diolas' ceremonies of circumcision and funerals, it is not acceptable to use them for agricultural labor. This has constituted a great impediment to the expansion of animal traction in this part of the Lower Casamance (Posner et al., 1985). On the other hand, considering that contributions of livestock are mandatory in these types of ceremonies, and considering that in emergency situations (e.g., famine, illness, debt reimbursement, bail, etc.) selling livestock is often the only solution to the crisis, owning a large and healthy herd acts as an insurance policy, a savings account and a way of increasing one's social prestige and economic status. This is particularly true for the Diolas because these types of events are not always predictable and because of the Diolas have a

narrow resource base. Moreover, livestock provide manure. This can be of great importance when access to chemical fertilizers is difficult.

While men have complete freedom of movement during the dry season, independently of their marital status, the mobility of married women is restricted by their daily domestic duties (working, child care, firewood gathering, water fetching, etc.). However, social norms do not restrict the mobility of unattached females, who can migrate to the cities during the off-season if they like (Pelissier, 1966; Linares, 1985).

2.3.2. The Mandingized Diolas of the North

The definition of an household among the Mandingized Diolas is not the same as among the Diola's of the South. The households of the Mandingized Diolas are usually large and more formally structured on the basis of age and famlial status (Linares, 1981).

Agnatic ties link the men of the households. For instance, a father may cohabitate with his married or single sons, nephews or grandsons in a single compound. All the members of the household, including some residing married or single males who don't belong to the patrilineage and have the status of "stranger", are under the authority of the head of the household. The head of the household is usually the oldest male member of the patrilocal descent. Being socially and economically responsible for the entire household, he is the supreme decision maker. He controls and manages upland cereal cultivation, family livestock and groundnut production (Linares, 1981). Upland cultivation is exclusively attended to by the male members of the household, working collectively on the raising of groundnuts, millet and other crops by bush-fallow shifting cultivation. On the other hand, rice cultivation is entirely in the hands of

the women, who may work alone, with co-wives, or in small ad hoc groups (Linares, 1981). Whereas the upland production of the compound is owned in common and stored in a single granary under the management of the head of the compound, rice produced is managed and stored at the conjugal unit level or at the consumption unit if the latter includes more than one conjugal unit. Meals are sexually segregated, as all the men of the household eat with the head of the household, sharing dishes prepared by their respective wives. Women sharing the same granary eat together with their children. Thus, while there is only one granary per compound for the upland cereals, there are several for rice.

Contrary to the typical Diola system, land tenure in the Mandingized setting is very centralized with respect to upland areas. The plateaus of a village are exclusively controlled and managed by the heads of the different compounds of the village (Dey, 1982; Linares, 1981 and 1985). Even though land can be only inherited by males, seniority is the determining criterion for ownership and not initiation or marriage. As to riceland, when a male agnate gets married, he is allocated some fields from the family's patrimony which he will pass on to his wife or wives, who handle the subsistence rice production, even though she or her daughters cannot inherit the ricefields. However, a husband is responsible for procuring rice fields for his wife. For instance, the "strangers" who nominally don't "own" land, may borrow, rent or exchange cattle against rice fields, which they give to their wives to cultivate. These acquired rice fields may be inherited by their male heirs (Linares, 1985).

In the Mandingization process, the Diolas of the North have adopted the Muslim faith and as a result, have deemphasized the socio-religious importance of rice and cattle. Similarly, the collection of palm wine, which used to be a substantial source of income, has been abandoned (Linares, 1985). Also, being

Muslim explains the occurence of some polygenous households among the Mandingized Diolas. Whereas in the household relations are fairly equalitarian among the Diolas (women have rights of disposition over the rice crop, even though they may not own the land), in the Mandingized system, "women's submission to the authority of their husbands, and their lack of participation in wider economic cash cropping endeavors is sanctioned by Islam and by the all pervasive ideology of an imported ranked social system." (Linares, 1981, p. 589.)

The Mandingized society is indeed very hierarchical. According to Linares, "most Mande speakers, as well as the groups they have influenced, are characterized by formal social classes, including in the past, domestic slaves engaged in agriculture, a centralized authority based on chiefs and lineages that are ranked in such a way that founding lineages 'own' the land and distribute it to strangers" (Linares, 1981, p. 587). Work groups, although less frequent than in the Diola context, also exist here. In fact, "It is common for the village women's society to help men with the millet harvest, for which they are paid in cash" (Linares, 1981,p. 572).

2.4 Socio-Economic Environment

In this section, we briefly describe the socio-economic setting of the farmers of the Lower Casamance. The focus will be on economic, infrastructural and institutional variables and their effects on farmers' situations.

2.4.1 Land resources

The low population density in the North (fewer than 15 inhabitants/km^2) constitutes an advantage in terms of per capita land availability for the Mandingized Diolas over the Diolas of the South, where population density is over 60 inhabitants/km^2 (Posner et al., 1985). Average farm size among the Diolas is about 1.5 ha as opposed to about 4 ha for the Mandingized Diolas (Sall et al., Campagne Agricole 1982-83). When land is abundant, farmers have the option of

extensive methods of cultivation to increase their production and the option of a bush-fallow system to restore soil fertility. However, the type of land available may not all be suitable to agricultural use. For instance, the predominance of lowlying land in the Diolas' environment imposes constraints on their agricultural production. Not only are they limited in their possibilities of crop diversification on these badly drained, heavy clay lowlands because most crops require drier conditions and lighter soils, but the drought and the subsequent salinization of the land also contribute to restrict rice production.

2.4.2 Labor Resources

Family labor constitutes the bulk of these farmers' labor resources. As explained in the previous section, due to their emphasis on household's economic independence, the Diolas have smaller family size, hence smaller family labor supply than the Mandingized Diolas. The number of workers in an average Mandingized Diola's exploitation is about six as opposed to three for the Diolas (Sall et al., Campagne Agricole 1982-83). However, farmers throughout the Lower Casamance can rely on village work associations as a supplemental source of labor. Labor productivity among the Mandingized Diolas of the North, where animal traction is commonly used, is higher than among the Diolas, where agricultural equipment generally includes only a few hand tools.

Average labor productivity over the agricultural seasons 1982/83 - 1984/85 was about 270 FCFA/person for the Diolas, as opposed to about 520 FCFA/person for the Mandingized Diolas (Sall et al., Campagne Agricole 1982-83, table 12 and Campagne Agricole 1984-85, table 16). Yet, it should be mentioned that the female Mandingized Diolas do not generally have access to animal traction and are restricted to using hand tools; hence, their labor productivity is below the average for the Mandingized Diolas as a group.

Table 2.5

Average Income Values (in FCFA), Diolas and Mandingized Diolas, 1983/84 and 1984/85

	Diolas		Mandingized Diolas	
	1983/84	1984/85	1983/84	1984/85
Net Agri. Income (FCFA) (monetary portion)	65,720 (21,883)	92,515 (21,016)	263,816 (222,681)	476,600 (193,676)
Unit values				
Net inc/ha	37,130	51,948	49,404	66,471
Net inc/day/ household	281	358	494	615
Net inc/worker/yr.	16,029	33,041	37,688	43,327
Contribution of non-agri. inc to family inc (%)		38%		10.5%

Source: Sall et al., 3e Rapport Annuel, Campagne Agricole 1984-85, Tables 16 and 17.

2.4.3. Income

The Diolas, who have smaller farms and whose agricultural focus has traditionally been on subsistence rice production, have experienced lower levels of agricultural income than the Mandingized Diolas (see table 2.5). Not surprisingly, non-farm activities have been more important among the Diolas.

2.4.4. Self-sufficiency in Cereals

Taking as a reference value the FAO consumption norm of 200 kgs of cereals/capita/year, the Mandingized Diolas and especially the Diolas, have not been able to achieve family self-sufficiency in cereals(Posner et al., 1985 and see table 2.6).

Table 2.6

Cereal Produced per Consumption Unit (in Kilograms) for a Representative Farm Household in Zones I and IV[a]

Zone	Villages	1982/83	1983/84	1984/85
Zone I	Boukitingo	95.7	63.7	172.3
	Loudia-Ouoloff	92.1	59.6	115.6
Zone IV	Boulandor	264.9	103.1	382.1
	Medieg	180.4	67.6	244.8

Source: Sall, et al., 3e Rapport Annuel Campagne Agricole 1984/85, Table 15.

[a]A CU represents an adult-equivalent consumer

These low levels of cereal production suggest that farmers will have to rely increasingly on their non-agricultural earnings to survive and that there will be a stronger incentive for farmers to migrate to the cities.

2.4.5. Input Supply Constraints

This section draws heavily on the Abt report on Senegal Agricultural Policy Analysis published in April 1985.

2.4.5.1 Seed and Fertilizer

"In Senegal, the word 'seed' usually means peanut seed" (Abt, 1985, p. 120). As a result, seed for other crops tends to be neglected. There is a general unavailability of pure seed of improved varieties of foodcrops. "Shortage and uncertainty characterize the cereal seed situation at present" (Abt, 1985, p. 121).

Uncertainty also marks the fertilizer situation in Senegal. "The government is faced with the stark reality that it is unable to finance fertilizer subsidies and that there is presently no system, either governmental or private, with proven ability to distribute fertilizer, even at full cost, to farmers in a timely fashion. Prior to 1982, chemical fertilizers were generally available at highly subsidized prices on seasonal credit terms" (Abt, 1985, p. 121). In 1975, farmers paid only 15 FCFA per kilo which represented only 25% of the cost price. In 1980 and 1981

farmers paid only 25 FCFA. However, after the poor harvest in 1980, fertilizer distribution at the national level dropped by 50% in the following year (from 102,000 to 51,000 tons) and actual use to 33,000 tons. From then on, uncertainty, changes in the system, and further declines have characterized the fertilizer supply system. From November 1982, fertilizer was to be sold for cash at an average price of 50 FCFA per kilo. Official producer prices were not raised concommitantly. In 1984, the full cost of fertilizer was to rise to about 120 FCFA per kilo and distributed amount was to be less than 35,000 tons (Abt, 1985). Meanwhile, credit was unavailable in most areas, and farmers could not usually afford cash purchases at the beginning of the crop season. Yet, farmers growing groundnuts were in a better position to obtain fertilizers since access to inputs was directly linked to groundnut production and marketing. However, with the advent of the withholding system for groundnuts, also called the retenue system, farmers were obliged to pay in advance for inputs, rather than after harvest, with no insurance that they would receive the amount to which they were entitled. The retenue system, by withholding a certain percentage of farmers' groundnut proceeds, tied seed and fertilizer distribution to the amount of groundnuts marketed the previous year. However, this situation changed in 1984 with the creation of a credit program for the farmers of the Lower Casamance (see section 2.4.5.3 on credit).

2.4.5.2 Equipment

Prior to 1980, the government distributed animal traction equipment to farmers under a credit program called the "Programme Agricole" (see the section below on credit). Distribution was concentrated on the already better equipped Peanut Basin. Farm implements were not going to farmers in other zones who needed them. Furthermore, government subsidies were nowhere near as significant for animal traction equipment as they were for fertilizers. "In the

Middle and Lower Casamance there is evidence that some types of animal traction equipment currently made available are not suited to local conditions" (Abt, 1986, p. 131). "Repair and replacement of implements is problematic" (Abt, 1985, 130). Also, most animal-drawn implements available in Senegal were designed for working conditions prevailing in the "Peanut Basin", where soils are lighter and weeds less of a problem than in the Lower Casamance. However, since 1984 farm equipment has been made available to farmers through the credit program mentioned in the above section and there has been a growing concern about the need to take into account agro-climatic differences between zones when introducing agricultural equipment.

2.4.5.3. Credit

Until 1984, the government has had no national credit program since the collapse of the "Programme Agricole" in 1979", which was brought about by low repayment rates. During these five years, agricultural credit was scarce in Senegal. "Informal sources provide loans for a number of purposes, all on a short-term basis and virtually none for agricultural production. With regard to the banks, only three percent of total bank credit benefits agriculture in Senegal. These loans go largely to the parastatals for the purchase of peanuts and cotton" (Abt, 1985, p. 131). Under the "Programme Agricole" (1970-1979) the government furnished short-term or seasonal credits and long-term production credits. The program allowed farms to obtain seed and fertilizer before the cropping season and repay at harvest time. The latter was for animal traction equipment, with repayment spread over three or four years (Abt, 1985). Considering that farmers' monetary resources are usually very modest, the fact that farmers were obliged to buy fertilizers and seed for cash was an additional financial strain for farmers. Yet, in most cases (except in drought years) farmers could manage to come up with the resources to buy seed and fertilizer, which was not the case for the

resources needed to purchase equipment. However, the need for equipment was steadily growing (Abt, 1985). For instance, since the suspension of the "Programme Agricole," farmers of Zone IV have been complaining about their difficulties in acquiring animal traction equipment. It is important when using animal traction to have a complete set of implements and none of the farmers did (Sall et al., Mars, 1985).

In order to improve farmers' access to agricultural equipment in the Lower Casamance, a new credit program called the "Special Credit" was launched in 1984. This credit program is financed by USAID and administered by the P.I.D.A.C. (Project Integre de Developpement Agricole en Basse Casamance). The "Special Credit" requires farmers to be members of an organized group of at least 25 members, called a "Groupement de Producteurs," because credits are only allocated to groups and not to individuals.

2.4.5.4. Marketing

The extent of government intervention in the marketing of Senegal's food and cash crops varies considerably from crop to crop. Since independence, the government has been more interested in stimulating, regulating and controlling the marketing of export crops (peanuts and cotton) than in doing the same for foodcrops (Abt, 1985, p. 135). "State involvement has been greatest in the groundnut marketing system because of the traditional role of groundnuts as the motor of the Senegalese economy" (Abt, idem) Senegalese groundnut pricing has not been tied very closely to changing world market conditions. Over the years, the government has used pricing policies to subsidize or tax peasant incomes. During the early 1980's, to stimulate production, the government raised the producer price to 70 FCFA per kilo, which was well above the world market price, even with 10 FCFA/kilo withheld to cover seed distribution costs. While the decision pleased groundnut farmers, it created financial problems for the state

and subsequently led the government to reduce the real groundnut price to 50 FCFA in 1983/84, by increasing withholding to 20 FCFA per kilo to cover seed and fertilizer distribution costs (Abt, 1985, p. 135). Nevertheless, farmers tend to regard the retenue as a tax on their groundnut production rather than a means for obtaining needed inputs.

The State's record in promoting marketable surpluses of domestically produced cereals has not been very impressive due to several factors: (a) low official producer prices in relation to Senegal's main cash crops, with price controls that ignore seasonal variations and encourage parallel markets, (b) lack of financing to the parastatal to purchase crops at harvest, when farmers most need the money, (c) the existence of better organized non-official markets for crops such as millet and (d) the absence of a large marketable surplus because most farmers rarely produce more than enough food to feed their families and provide a security stock for the following year. In the Lower Casamance, for instance, swamp rice production has been declining and there is virtually no surplus to be sold. Beside, "the Diolas traditionally have been reluctant to sell their surplus rice production" (Abt, 1985, p. 144).

Another factor is the lack of legal, transport and storage infrastructure in which these markets can operate efficiently. The Casamance, for instance, lacks regional grain storage facilities and has road systems that are serious constraints to the delivery of inputs and the movement of harvests to markets (Abt, p. 150). The cost of transport from the producing areas to market centers is, where known, several times higher than over improved roads. Thus, the cost structure of delivered produce has a high transport cost component (Abt, 1985, p. 149).

Transportation bottlenecks also affect the availability of imported rice to farmers in the Lower Casamance. Imported rice, which is already processed, is available in most small towns in Senegal. However, transportation costs are added

to the official price of imported rice. Imported rice is delivered at the port of Dakar and because of the relative isolation of the Lower Casamance, transportation to the Lower Casamance is costly. Furthermore, many villages may not have easy access to a small town because of lack of transportation facilities. These transportation constraints are exacerbated during the rainy season, when the whole area becomes very swampy due to flooding. These transportation bottlenecks create time constraints which may reduce purchases of rice. The agricultural season corresponds to the hungry season, when supplies of food are low and when the need to buy food may be greater. Yet, the agricultural season is also the busiest period of the year for the farmers, whose time has a high opportunity cost during this period. Thus, time costs inherent in the transportation system constitute another component of the cost of buying imported rice in Lower Casamance.

The marketing system influences farmers' production, consumption and investment decisions a great deal. In Lower Casamance, due to the relative isolation of this region vis-a-vis the rest of Senegal, marketing system reliability is hampered by transportation bottlenecks. Moreover, the efficiency of the marketing system has been undermined by its bias toward groundnut production. For instance, ONCAD (National Office of Cooperation and Assistance for Development) was a government agency responsible for marketing all agricultural outputs and for ordering and distributing inputs including seeds, fertilizers and ox-drawn tools. Yet, most of the ONCAD storage facilities were located in the Peanut Basin, where 80% of the Senegalese groundnut crop is produced. As a result, farmers in Lower Casamance, because of their geographical marginalization, away from ONCAD storage facilities, had great difficulties getting needed inputs and getting them on time. Also, for the same reasons, they experienced delays in marketing their agricultural production. In addition, the

retenue system (now abolished) reinforced the traditional peanut bias by linking access to inputs directly to peanut production and marketing.

2.4.6. Research and Extension

This section also draws on the Abt report. Several factors have hampered research efforts over the years in Senegal. First, the bias of research toward the groundnut industry has slowed down diversification and cereal crops research. Second, extension agents have been unable to understand the technical packages developed by research because they are espoused in terms that are too technical. Third, budget problems and lack of financial resources have served as a barrier to research efforts. The upkeep and maintenance of research centers with their equipment is generally inadequate. Productive research efforts, such as the work on cowpeas in the late 1930s, have quickly lapsed as soon as key personnel departed. Fourth, often research themes are of little relevance to the problems encountered by farmers and have had their emphasis on trials at research stations rather than on farmers' fields.

Among the many pressing problems that face ISRA (Senegalese Institute for Agricultural Research), the most difficult as well as the most important concerns the deterioration of the environment. The dilemma for research, as for extension, is that the problems of soil degradation are so multifaced that no solution seems both achievable and adequate. The country requires new technical approaches as well as new policies. One response to the increasingly frequent drought years has been shorter-cycle varieties for most crops. These varieties have the advantage of requiring less moisture over the cycle. However, they have the disadvantages of requiring as much labor as the longer cycle varieties for most field operations, yet often do not yield as much; and if the rainy season is long, they are subject to attacks by mold and other pests.

2.4.7. Cash-income Opportunities Outside Agriculture

Numerous rivers and ponds, palm groves, and forests favor extra-agricultural activities for farmers in Lower Casamance, such as fishing, fruit gathering, and crafts. Vegetable gardening is made possible due to a high residual moisture of the soil after the rains, especially at the edge of the ricefields. However, due to the drier climatic conditions in their natural environment, the extent to which the Mandingized Diolas can carry out these activities may be more restricted than the Diolas. For instance, a traditional occupation of Diola women is fishing for oysters, which they sell fresh, dried or smoked. Also, taking advantage of the surrounding forest, women throughout the Lower Casamance are active in wood handicrafts.

In Senegal, non-agricultural wage employment is scarce in rural areas (e.g., factories are concentrated in the cities). When it is available, women are usually disqualified, as a great deal of these jobs require no particular skills but great physical strength, such as in the case of construction work or road building. Consequently, with respect to non-agricultural activities, the revenues females get are generally lower and more variable than men's revenues. Alice Hamer (1981) reports that "according to one estimate, where the average daily wage for individual labor construction in areas surrounding Bignona and Ziguinchor is 300-400 FCFA, the mean daily income from market vending fruits and vegetables is 100-200 FCFA." She also observes that "even these possibities for women have been minimized by the historically difficult problems of transporting their products to the markets in Bignona and Ziguinchor, where potential profit margins are greater" (Hamer, 1981, p. 194). However, that is not always the case with women's vegetable gardening. Although women can carry out their vegetable gardening operations individually, the most common approach consists of two or three friends working a common garden together or joining a larger cooperative

sponsored by some agency for rural development, which markets the production and advances materials such as buckets, watering cans, and chicken wire, to be reimbursed after the sales. The small associations of two to three friends have proven more profitable, as each member may earn from 10,000 to 35,000 FCFA per year, which is as much or more than the men's average earnings from the marketing of their peanut production. On the other hand, the women members of the cooperatives earn on average less than 5,000 FCFA each before reimbursement of the material provided by the cooperative (Journet, 1981).

With the increasing monetization of the economy and as a result of a widened exposure to more varied commodities, the cash needs of the farming community are increasing, as purchasing tastes and habits change. This creates a disproportionate growth of consumer demands vis-a-vis rural revenues.

Substantial income differences exist between urban and rural areas. For instance, whereas an average farmer would have an annual personal income of 30,000 FCFA, he or she could earn 54,000 FCFA as an apprentice in the urban sector, 237,000 FCFA as an unskilled workperson in the modern sector or 85,000 FCFA as a maid in Dakar (Rigoulot, 1979).

This situation likely accounts for the growing popularity of seasonal outmigration to the cities among farmers of the Lower Casamance, who view outmigration as a major means of improving their financial situation. One study in Thionk Essil, which is a Diola village, revealed that 65% of the households interviewed with migrants absent received remittances ranging from 4,000 to 50,000 FCFA in 1983; 45% received a combination of money and consumer goods (rice, sugar, and soap, with rice being by far the most frequently given item) (Hamer, 1981). Furthermore, for many women, migration has become the key to higher economic and social status. Indeed, their prestige emanates from the greater economic role they now play in the household; from the admiration of

their peers, as they are the most well-dressed at village festivities; and from being better informed about the outside world and other cultures (for instance, they know how to speak Wolof).

2.5 Conclusion

Having described each dimension of the Diolas' and of the Mandingized Diolas' environment, the next step is to show how the interactions between these different environmental dimensions, combined with the households' main objectives, affect the households' opportunity sets.

CHAPTER 3

OPPORTUNITY SETS

3.1 Introduction

The objective of chapter 2 was to present a general overview of the different environmental dimensions of the farming households of the Lower Casamance. The purpose of this chapter is to derive these households' opportunity sets. In other words, the chapter attempts to see what these environmental characteristics mean in terms of households' ability to fulfill their objectives. It is assumed that all these farmers share the same basic goal of assuring the well-being of their families. This basic goal can be broken down into three intermediate goals: assuring adequate family food supplies, generating cash income, and generating savings.

3.2 Derivation of Households' Opportunity Sets

An opportunity set has been defined as the sum of constraints and opportunities inherent in farmers' environment, with respect to a given set of goals. Our basic hypothesis from Chapter 1 is that given farmers' goals, each dimension of the environment has its own binding constraints, its own opportunity set which would generate certain labor allocation strategies that would be justified if the other dimensions could be ignored. These strategies have been called potential strategies (Chapter 1). However, according to our basic hypothesis, farmers' effective (as opposed to potential) strategies will be based on their real opportunity set, which is the opportunity set generated when all environmental dimensions are simultaneously taken into account. Therefore, the approach in this chapter will be first to derive the opportunity set with respect to each dimension and the potential strategies it would justify and then derive the households' real opportunity sets by simultaneously taking into account their

natural, socio-cultural and socio-economic dimensions of their environment. These opportunity set derivations will be done for the Diolas and for the Mandingized Diolas (Tables 3.1 and 3.2) and for each group, gender differences will be indicated.

In order to simplify the analysis in the following sections, we will adopt certain conventions:

1. Definition of labor allocation strategies: how, when and in what proportion labor resources are distributed or used in the different activities of farmers.
2. With respect to households' objectives:

   --food supplies: the alternatives of food production will be restricted to lowland rice, millet and sorghum.

   --buying food will be restricted to the purchasing of imported rice.

   --cash: groundnut production is treated as the only cash agricultural activity in the region.

   --savings: limited to only two alternatives: cash or in kind.
3. With respect to the socio-economic environment, it is basically the same for both groups of Diolas.

3.2.1. The Diolas

3.2.1.1 Households' Opportunity Set with Respect to the Natural Environment

Their land composition is such that diversification is not an option in food production. Consequently, a monoculture of lowland rice cultivation constitutes the only alternative for cereal production. Unfortunately, due to the decrease in average rainfall caused by the Sahelian drought, some ricefields can no longer be desalinized and have become unfit for agricultural production. Therefore, there are fewer ricefields available and there is a decrease in rice production.

Table 3.1

DIOLAS: MAIN BINDING CONSTRAINTS

Environmental Dimensions

Households' Objectives	A. Natural	B. Socio-cultural	C. Socio-economic
1. Food Supply	1. Land composition: wet bottomlands affected by salt water from wide network of marigots and rivers 2. Scarce and very humid plateaus 3. Decreasing average rainfall with increased variability in distribution 4. August rainiest month	1. Rice is basis of all diets and has multiple socio-religious functions 2. Family land divided among married male heirs who reside, produce and consume independently of each other (nuclear household system) 3. Society emphasizes that households be self-supporting 4. Responsibility of food supply within the household divided by sex 5. Use of animal traction restricted by traditional taboos	1. Low cash income as the result of their focus on rice cultivation, which is primarily a subsistence crop 2. Access to imported rice costly and difficult due to marketing and transportation bottlenecks 3. Low per capita land availability due to high population density 4. Lack of public investments (dams, irrigation schemes, research for food crops) 5. Inadequate extension backing 6. Average food production below FAO consumption norms 7. Low labor productivity due to marginal use of modern technology as a result of lack of credit and absence of adequate equipment 8. Groundnut production necessary as a result of monetization of economy
2. Cash Income	1. Scarcity of uplands 2. Extensive presence of stumps and termite hills 3. Low fertility of upland soils 4. Extensive weed growth 5. Some overlapping of labor requirements between rice and groundnuts	1. Socio-religious norms reenforce rice production as first priority of male and female farmers 2. Small size households (nuclear families) 3. Traditional taboos restrict adoption of animal traction 4. Limited experience in groundnut cultivation which was introduced in relatively recent past 5. Groundnuts considered a male crop and proceeds are owned and controlled by men 6. Sexual pooling of expenses within the household	1. Uncertainty about availability, dates of distribution and conditions of sale of inputs (seeds and fertilizers). State monopoly. 2. Uncertainty about groundnut prices, which are fixed by the government after planting dates. State monopoly. 3. Input distribution tied to amount of groundnuts marketed previous year 4. Low labor productivity 5. Inappropriateness of some current agricultural equipment. 6. Low per capita land availability.
3. Savings	1. Lowlying land constitutes bulk of land resources 2. Vulnerability of agricultural production to climatic conditions which creates yield uncertainty 3. Decrease in arable land as a result of droughts	1. Mandatory contribution to family livestock (for male heirs) 2. Importance of in-kind contributions (mostly rice and livestock) in socio-religious ceremonies and celebrations 3. Rice and cattle are prime trading goods within Diola society 4. Individualistic society 5. Risk-adverse mentality	1. Cash flow problems. 2. Lack of savings institutions. 3. Inadequate modern agricultural implements (low level productivity). 4. Lack of repair and maintenance structures. 5. Lack of credit and subsidies in addition to rising cost of living. 6. Gap between food production and food needs. 7. Some basic needs yet to be fulfilled. 8. New technologies are sometimes inappropriate, unreliable and expensive, if available.
Implications	1. Comparative advantage in rice cultivation; however, because yields are highly correlated with amount of rainfall, yields are decreasing due to decreasing rainfall 2. Since climatic conditions not suitable to millet and sorghum cultivation, rice constitutes only alternative of food production for males and females. 3. Rainfall pattern influences technique of cultivation. 4. Groundnut production limited by lack of sufficient land and by labor requirements of rice production 5. Savings positively correlated with rice yields 6. Mechanization impeded by stumps and termite hills	1. Rice plays a multifunctional role in the society and its production constitutes the no.1 priority of men and women 2. Males and females equally responsible for household's survival 3. Individualism pervasive in society 4. Groundnut production is considered necessary, but it is viewed as a crop of secondary importance, primarily benefitting men 5. Religious beliefs restrict adoption of animal traction 6. Farmers have savings inclinations due to the frequency and the unpredicatability of social obligations requiring contributions in-kind.	1. Current institutions and infrastructures are inadequate for farmers' needs and constitute a source of risk and uncertainty if relied upon. 2. Farmers have a narrow resource base, meaning all their resources are in small quantities. 3. Low income and low level of labor productivity, lack of self-sufficiency in cereals. 4. Rice is essentially grown for subsistence and groundnut for cash. 5. Modern technology is unreliable, inadequate and costly with respect to farmers' resources. 6. Public support biased toward males and groundnuts. 7. Multiple constraints restrict cash saving. 8. Purchasing food is very costly and not very reliable.

Table 3.2

MANDINGIZED DIOLAS: MAIN BINDING CONSTRAINTS

Households' Objectives	Environmental Dimensions		
	A. Natural	B. Socio-cultural	C. Socio-economic
1. Food Supply	1. Uplands constitute bulk of land resources 2. Scarce and dry bottomlands 3. Low and variable rainfall, with July rainiest month (relatively short rainy season) 4. Weed problem in upland fields and ricefields 5. Risk of drought period during agricultural season	1. Large and formally structured households (extended family system) 2. Centralized decision-making procedures as a result of hierarchical society 3. Traditional taboos on the use of animal traction by women 4. Responsibility of household food supply divided between sexes on a crop basis 5. Risk-adverse mentality 6. Diversified diet with millet, sorghum, rice (traditional staples) 7. Millet and sorghum of household stored in granery of head of household; rice stored at the nuclear family level by wives	1. Lack of technical packages for cereals production 2. Low producer prices and poor marketing structures for domestic cereals 3. Credit and input availability, and extension historically tied to groundnut production 4. Average food production slightly below FAO norms of consumption 5. Limited labor productivity inherent in limitations of current animal traction models 6. Costly acquisition of imported rice
2. Cash Income	1. Low and varible rainfall 2. Weed problem 3. Low fertility of upland soils 4. Groundnuts intercropped with millet and sorghum; there is some overlapping between the vegetative cycles of groundnuts, millet and sorghum 5. Serious time constraints imposed by rainfall pattern 6. Rice and upland crops have competitive labor requirements to some extent	1. Large and formally structured households under authority of eldest male 2. Groundnuts considered as a male crop and traditional taboos associated with use of animal traction by women 3. Groundnut production managed and controlled by head of household who owns the land 4. Risk-adverse mentality combined with distrust of government policies 5. Head of household accounts for most of general household expenses 6. Women do not have access to plateau land	1. Shortage and uncertainty constitute main characteristics of availability of inputs and distribution 2. Lack of formal credit 3. Price uncertainty associated with state monopoly of groundnut marketing 4. Lack of adequate public or private distribution system for implements and spare parts 5. Government resources focused on Peanut Basin 6. Cash flow problems
3. Savings	1. Uplands constitute the bulk of their land resources 2. Agricultural production fluctuates due to fluctuating rainfall patterns 3. Time pressures inherent in rainfall pattern	1. Crops being sexually separated, savings different for males and females 2. Risk-adverse mentality 3. Cattle represent traditional savings and investments	1. Lack of savings institutions 2. Cash flows problems 3. Inadequacy of current agricultural implements and lack of maintenance and repair structures 4. Gap between food production and food needs and some basic needs yet to be fulfilled 5. Lack of credit and subsidies in addition to rising cost of living 6. Limited labor productivity 7. Low producer prices and poor marketing structures for cereals
4. Implications	1. Comparative advantage in millet, sorghum and groundnut production 2. Scarcity of suitable riceland combined with lack of sufficient rains resulting in unreliable rice yields 3. Short and variable rainfall creates time constraints with respect agricultural tasks, influencing their intensity, nature and sequence 4. Purchasing food is very costly and not very reliable 5. Savings positively correlated with cereals and groundnut yields	1. Hierarchical and collectivist society. Decision making powers are centralized 2. Long experience in groundnut production (male crop) 3. Landlord-tenant type of relationship in upland production 4. Females are specialized in subsistence matters 5. Upland production is considered more important	1. Institutional and infrastructural public resources biased toward groundnuts and male farmers 2. Upland production is considered more important 3. Lack of public support for food production 4. Inefficiencies and bottlenecks inherent in marketing, transportation and credit systems make relying and using modern technologies risky and costly 5. Risks associated with groundnut production due to dependence on public institutions for factors of production and output marketing 6. Multiple constraints restrict cash savings

As to groundnut production, the rains are largely sufficient to cover the groundnut water requirement. Here, the main binding constraint is the scarcity of uplands, which limits production. The low level of fertility of these upland soils aggravates the problem. As to generating savings, because riceland constitutes the bulk of their land resources, savings are more likely to be correlated to rice production. Moreover, all these constraints must be seen in the context that there is only one rainy season a year, which is limited to three to five months and varies interannually with respect to absolute amount and monthly distribution. This is a very important consideration because there is some overlapping between the labor requirements for groundnuts and lowland rice and because there is a positive correlation between amount of rains and rice yields.

3.2.1.2 Households' Potential Labor Allocation Strategies Given the Natural Environment

Obtaining a good rice crop will be the first priority of the Diolas because assuring adequate family food supplies is their first objective and rice is the only food crop they can produce and there is only one cropping season each year. Farmers will be concerned about maintaining if not increasing rice yields, in order to make up for the reduction in arable riceland and in order to secure savings. However, given the importance of groundnut production for their objective of cash generation, farmers will also try to have as good a groundnut crop as possible. Therefore, farmrs will have to accept some tradeoff between rice and groundnut production.

Thus, farmers have two major motivations: first to have a good rice crop and second to have a good groundnut crop. Considering the importance of the rainfall pattern on rice yields, and considering the decrease in rainfall amount and the increased variability in its distribution, farmers would have to act in the sense

of reducing the dependence of rice yields on rainfall pattern. Since a good rice crop is their first priority, the household will be strongly motivated to provide the input necessary for a successful rice production. This means that the labor requirements of other activities will take second place during the rice cultivation period. Yet even though a good groundnut crop may not be as crucial, it is still an important objective for farmers and consequently they would have to minimize the extent to which the labor requirements for the two crops (rice and groundnut) conflict.

3.2.1.3 Households' Opportunity Set with Respect to the Socio-Cultural Environment

Rice cultivation is at the core of the Diola society and rice is present in every aspect of their lives. In addition to being the basis of all diets, rice is a mandatory item of sacrifice in traditional socio-religious ceremonies (initiations, funerals, weddings), a prime tradeable commodity, especially in transactions involving livestock acquisitions and off-farm labor supply. In addition, wealth, respect and social status are closely linked to rice cultivation within the Diola society.

The nuclear household is the norm within the Diola society. Considering that in subsistence agriculture, family labor constitutes the primary source of labor, Diola households have a limited family labor supply. Moreover, each household is entirely responsible for its agricultural production decisions and is expected to be self-supporting. However, within the household, responsibilities of food supply are divided more or less equally between husbands and wives, who manage their rice stocks separately. Under the traditional land tenure system, women cannot own or inherit land and their access to land is limited to the usufuctory rights they have on the rice plots allocated to them by their husbands. Consequently, women do not have access to uplands, and groundnuts (an upland crop) are considered a male crop. Due to their traditional focus on rice

cultivation and due to their relatively recent involvement in groundnut production, the Diolas' expertise in groundnut cultivation is limited. Furthermore, religious beliefs restrict the adoption of animal traction. Livestock and rice stocks constitute the traditional forms of savings. Within the household, usually males and females have different cash obligations and different preferences with respect to expenditures. Also domestic tasks have traditionally been a female duty.

3.2.1.4 Households' potential Labor Allocation Strategies Given the Socio-Cultural Environment

Since rice constitutes the major item in the Diolas' diet and socio-religious obligations, and since males and females within the household share the responsibility of supplying food and since each household is expected to be economically self-sufficient, attending to their rice crop will be the number one priority of both men and women. The fact that they can fulfill at least two of their three main objectives (food supplies and savings) through a single activity, rice production, motivates production surpluses. Since groundnut production benefits primarily men, and since women usually have cash obligations different from men, a good groundnut crop would be the second priority of men after rice production. Women would want to seek other cash-generating activities in which they could be the primary beneficiaries.

Therefore, obtaining a significant rice harvest is the household's most important motivation. Yet, its labor resources are very limited as a result of a small family size and mechanization constraints (use of animal traction restricted by religious beliefs and lack of consolidation of rice plots). However, since males and females share the same interest in the rice crop, and thus are working toward the same goal, it would make more sense if they cooperated and coordinated their work in order to make the most efficient use of household labor resources. Efficient use of available labor resources would demand that men and women be

ready to devote their labor to whatever tasks, whenever, and in a way which would yield maximum productivity. More importantly, the share of each household member with respect to labor input will be all the more important the smaller the family size, giving each member a greater weight in production decisions. Therefore, we will expect sexual division of labor to be balanced and flexible as far as rice production is concerned.

With respect to groundnut production, males' and females' motivations diverge. While men can produce groundnuts to meet their cash obligations, women cannot. Yet, labor constraints due to a lack of animal traction, men's obligations to the rice crop, and their limited experience in groundnut cultivation, limit the extent to which men can meet their cash obligations with groundnut production. More importantly, in a nuclear family, a wife constitutes her husband's primary source of labor. Considering that women do not directly benefit much from groundnut production, men would have to compensate their wives if they wanted to secure their labor. For women, restricted access to land and a busy schedule (agricultural work, plus household duties) impede their ability to earn cash through agriculture and during the agricultural season. Consequently, they would probably benefit more from non-agricultural activities carried out during the off-season and which are compatible with their year-around household duties, especially in the case of married women.

3.2.1.5 Households' Opportunity Set with Respect to the Socio-Economic Environment

The Diolas' narrow resource base severely restricts their potential agricultural production (food crops and cash crops). Per capita land availability is low as a result of a high population pressure (see chapter 2). Several institutional and infrastructural bottlenecks limit their access to modern land-saving as well as labor-saving technologies. Outstanding among these constraints are the lack of agricultural credit, subsidies and public investments; the inappropriateness, with

respect to farmers' present conditions, of currently available technologies; and the poor and unreliable system of input delivery. Hence, agricultural yields remain low.

Households' current level of cereal production do not cover their consumption requirements, and the households must find a way to make up for these deficits. Meanwhile, there are constraints associated with the acquisition of imported rice. Due to the geographical remoteness of the region, transportation costs inflate the price of imported rice, which is not always available. More importantly, farmers' acquisition of imported rice will depend on their cash resources, which in turn will depend on their ability to generate cash. With the increased monetization of the economy, farmers are increasingly pressured to earn a cash income. Nowadays, most transactions are carried out in cash. Moreover, farmers have a wider exposure to manufactured goods. Meanwhile, even though groundnuts are the most lucrative crop in Senegal, farmers' benefits from groundnut cultivation are very variable due to uncertainties associated with input availability. "Neither farmer, nor government extension agents have known with any certainty whether chemical fertilizers would be available and if so, at what price and under what conditions of sale. The government is faced with the stark reality that it is unable to finance fertilizer subsidies and that presently there is no system, either governmental or private, with proven ability to distribute fertilizers, even at full cost, to farmers in a timely fashion," (Abt, 1985, p. 121).

However, with respect to generating cash, farmers are still better off producing groundnuts than producing cereal since the government has been more interested in stimulating and promoting groundnut production, through higher producer prices and better marketinig facilities for groundnuts. To make things worse, job opportunities are scarce in rural areas, as industrial and commercial

activities tend to be concentrated in the cities. Also, women have traditionally had a more limited exposure to the cash economy due to their important responsibilities in subsistence agriculture and to their restricted participation in groundnut production, prompted by their non-landowner status. As a result, they have also benefited less from agricultural services, such as technological innovations, extension services, and credit.

As to the farmers' objective of savings, of concern are the lack of financial institutions in rural areas, farmers' low level of income and the high costs and risks associated with investing in the agricultural equipment currently available.

3.2.1.6 Households' Potential Labor Allocation Strategies Given the Socio-Economic Environment

Given the bottlenecks associated with buying food (imported rice and domestically produced cereals), households will have to rely upon their own food production to meet most of their food needs. Meanwhile, farmers' cash needs are growing and the pressure to generate more cash is increasing. The lack of financial institutions to channel savings and the level of risks and costs associated with current choices of agricultural investments constitute major disincentives for cash savings.

Thus, in order to assure adequate food supplies, households will have to rely a great deal on their own production. Yet, their current levels of rice production do not allow them to do so. Therefore, they have to increase their food production, either by increasing rice yields or by producing some other food(s) (e.g., sweet potatoes) to supplement their rice production. However, limitations on their land, labor and capital resources impede households' ability to increase their rice production. Per capita land availability is limited, labor productivity is low, and the capital stock is made up of a few hand tools. Therefore, the farmers try to maximize the productivity of these resources, to get as good yields as possible so that they can minimize the amount of food they would have to buy.

Farmers also need to increase their cash income. However,it is becoming increasingly difficult to do so solely through groundnut production. The lack of credit, the uncertainties associated with inputs availability, the poor performance of existing technical packages, all force farmers to rely on their own resources for the production of groundnuts. But as already mentioned, the limitations weighing on farmers' resources will not allow them to attain significant yield increases and thus they will not be able to increase cash income significantly through groundnut production. Hence, they will have to find other sources of cash outside agriculture. This means that farmers will have to undertake more non-agricultural activities to supplement their cash income from groundnuts.

3.2.1.7 Households' Opportunity Set with Respect to all Three Environmental Dimensions

Considering their environment as a whole in the perspective of their main objectives, the Diolas would be primarily motivated:

--To produce rice to meet as much of their food and savings requirements as conditions permit, given their comparative advantage in rice production. Rice production is their primary means of survival and should be the focus of their energy, despite decreasing rice returns due to decreasing average rainfall. Moreover, the earnings farmers can realize with groundnut production are very limited. Thus, farmers cannot afford to use most of these earnings on food purchases while other cash requirements are increasing.

--To be very efficient in the use of their labor resources. They are scarce and have a high opportunity cost.

What are the main binding constraints faced by Diola households if all the three environmental dimensions are simultaneously taken into account?

1. The extent to which they can fulfill their objectives with agricultural production is simultaneously limited by their land and labor resources

and by the climate. First of all, in recent years, they have seen a reduction in their arable riceland because of salt intrusion. This means that land availability per capita is restricted. Second, the average number of workers per household is low, as Diola households are nuclear. Considering that family labor constitutes the primary source of labor, labor availability is limited. However, this fact would not be as much of a constraint if labor productivity were high. Unfortunately, due to the religious proscription of using animal traction, the lack of credit with respect to the acquisition of agricultural equipment (labor-saving and/or land-saving technologies), and the doubtful performance of and the risks associated with currently available modern technologies, farmers have neither the means nor the incentive to part with their traditional hand tools. Consequently, households' labor supply severely limits the amount of land they can farm.

The problem is compounded by the existing climatic characteristics: the seasonality of the rains limits the time they have available to carry out their agricultural production to a few months a year. Furthermore, because rainfalls have been less abundant and more variable these past years, rice yields have become more uncertain and have decreased. This has serious implications if we consider the fact that rice constitutes the only major food crop they can produce, as millet and sorghum (the two other main traditional cereals) are not suitable to the local climate. Therefore, the possibilities for crop diversification are very limited. Not only are the Diola's alternatives of food production limited to rice, but the quantities of rice they can produce are limited by land, labor and climatic constraints. So is the extent to which they can meet their cash requirements with groundnut

production.

2. Socio-cultural norms are such that rice production is a requirement for both males and females. Husbands and wives are equally responsible for family food supplies and rice cultivation constitutes the only alternative of food production. There are several other socio-religious obligations, which demand that people have locally produced rice stocks and livestock. This means that farmers must save some of their rice production to be able to meet customary obligations. The Diola's social status depends a great deal on their ability to meet these obligations. Also, males and females have different cash obligations and their preferences, with respect to expenditures, are usually different. Yet groundnut, the only cash-generating agricultural activity, is not open to women. Because rice is primarily a subsistence crop, women have little opportunity to meet their cash requirements through agriculture. Meanwhile, reliable cash-earning activities outside agriculture are rare in the rural areas. Hence, the cash-earning opportunities of married women are further reduced, as their domestic responsibilities hinder their mobility. Yet, cash needs are increasing for everyone, whether to buy food to supplement their rice production or to get manufactured items for daily use or to carry out common economic transactions, most of which are done in cash nowadays.

To summarize, the Diola households' ability to fulfill their objectives through agricultural activities is restricted by their land, labor and water resources. As a result, it has limited income from agricultural activities. The situation is worse for women, whose ability to raise cash through agriculture is limited by their status of nonlandowner and by their exclusion from the highest cash yielding activity, groundnut production, and from many non-agricultural

activities by their household duties, which keep women close to home and leave them with less free time than men. Nevertheless, Diola households have a comparative advantage in rice production, through which they can fulfill part of their food supply and saving objectives. On the other hand, the socio-economic circumstances are such that farmers' opportunities to improve their land and labor activities and to water control are slim. Credit is scarce and is targeted to groundnut production. Currently available technologies constitute costly and risky investments as the result of a lack of maintenance and repair structures, and of a poor system of input distribution, and are not very adapted to farmers' natural, socio-cultural and socio-economic conditions.

3.2.2 The Mandingized Diolas

3.2.2.1 Households' Opportunity Set with Respect to the Natural Environment

The Mandingized Diolas are located in the northeastern part of the Lower Casamance where plateaus largely predominate, where bottomlands are scarce, where rains are generally less abundant and more variable than in the Diolas area, with rain shortages occurring as early as October. Nonetheless, these physical parameters allow for the production of all three main cereals: millet and sorghum grown in the uplands and rice grown in the bottomlands. Groundnuts are also an upland crop. While the upland crops have more modest water requirements and are thus relatively more drought resistant, rice is very vulnerable to rain shortages. The decrease in average rainfall, because of the drought, has been more severe in this part of the region, increasing the risk of crop failure even for the upland crops, and reducing further the availability of cultivable ricefields. The rainy season extends over a short period of time each year (3-4 months), during which the households' agricultural production must be carried out. This implies that millet, sorghum and groundnuts not only compete with each other for hectarage, as they are all upland crops, but also compete with each other for the

households' other production resources, labor in particular.

3.2.2.2 Households' Potential Labor Allocation Strategies Given the Natural Environment

The extent to which households can meet their food requirements with rice production is very limited due to the scarcity of bottomlands. The decrease in average rainfall in recent years has only reenforced this constraint. Furthermore, considering the degree of variability of the rains, rice production has become an unreliable source of food. Therefore, to meet their food requirements, households have had to rely primarily on their upland foodcrops (millet, sorghum), which are still able to survive when rains decrease and which can be produced on a large scale. The extent of households' millet and sorghum production will be a function of the amount of rains received and the soil fertility level. The extent of a households' groundnut production will also depend on the amounts of rains and soil fertility, but also on millet and sorghum hectarage (and vice-versa). However, since assuring adequate food supply is households' first objective, groundnut hectarage will depend on the perception of farmers about amounts of rains which will be received, which will affect how rice production will be able to supplement millet and sorghum production. In any case, farmers' priority will be their upland production, which alone can allow them to meet simultaneously all three of their objectives. Hence, households will tend to consider their rice crop as a bonus, not something they can consistently rely on. Savings will be correlated to upland yields.

Thus, the natural environment allows them to diversify their food production. However, given their low and variable rainfall, millet and sorghum are more secure crops than rice. Therefore, households will focus on millet and sorghum cultivation, and rice production will be considered as a secondary crop to take advantage of when climatic conditions are favorable.

With respect to generating cash income,the abundance of uplands give the Mandingized Diolas a comparative advantage in groundnut production. Yet, hectarage allocated to groundnut will be affected by the extent to which the Mandingized Diolas can produce rice. This is because food supply being their primary objective, the more rice they can produce,the less millet and sorghum they will have to produce. Thus, the extent to which they can cover their cash requirements with groundnuts will fluctuate from year to year, depending on how secure their food production is due to climatic conditions. Consequently, labor allocation to groundnut production will be inversely related to labor allocation to millet and sorghum production.

In any case, given the limitations associated with rainfall, it will be important that all crops benefit as much as possible from available rains to guarantee minimum yields. Also, it will be important that labor resources be well organized to make multicropping possible, as competitive labor requirements, inherent in overlapping cycles, may cause problems. Finally, households' ability to generate savings will depend primarily on the yields of their upland production. Hence, they will be concerned about assuring that upland crops obtain at least minimum water requirements and improve soil fertility.

3.2.2.3 Households' Opportunity Set with Respect to the Socio-Cultural Environment

Millet, sorghum and rice are part of the daily diet. The family's rice supply is women's responsibility, whereas men provide millet and sorghum. Women cannot own or inherit land, but have access to riceland through their husbands. They don't have access to upland, however.

Households are large and formally structured on the basis of kinship, age, marital status and gender. The oldest active male is the acting head of household and is ultimately responsible for the well-being of the household. He is the center of decision making, and rights to land rest with him, especially for upland areas.

While the use of animal traction may be common among men, there are taboos about women using it. Subsistence matters and household tasks have traditionally been women's duties. This has resulted in the mobility of women being more restricted.

Men collectively farm the uplands under the directives of the head of the household. The production is stored in a common granary, which is managed by the head of the household. Women produce, store and manage rice individually. The household's cash obligations tend to be men's responsibility, but women may have personal cash needs. Risk averseness is pervasive in traditional societies and people are inclined to savings, usually in the form of livestock acquisition.

3.2.2.4 Households' Potential Labor Allocation Strategies Given the Socio-Cultural Environment

Rice production will be women's first priority, as it constitutes their main means to economic independence and allows them to contribute their share of the supply of family food. Being excluded from groundnut production and having restricted mobility, women will be motivated to seek non-agricultural activities which are close to home.

For men, the priorities of the head of the household will be the only ones that really matter, since it is through him that men can get access to land and since he is the one ultimately responsible for their well-being. Therefore, the men of the household will make their labor completely available to the head of the household. The latter will have two main concerns: efficient management of family labor with respect to agriculural tasks and with respect to generating enough production via upland production to be able to cover family food requirements and generating cash income.

Therefore, women will allocate the bulk of their labor resources to rice production. Their determination to obtain high yields will vary with their cash-earning opportunities. This is because rice production, being totally under their

control, can be managed as they please, at their own discretion. For instance, they could sell part of the production to get some cash. Because women cannot use groundnuts for cash and because their mobility is restricted, they will have to find sources of cash in the area during the off season. (During the agricultural season, their time available will be restricted due to their agricultural activities and household duties.) Upland production will be a team work and organization will be important not to duplicate efforts. Since the Mandingized Diolas have a large family labor, they can potentially farm large areas if they allocate it efficiently. The fact that upland is not divided will facilitate mechanization.

3.2.2.5 Households' Opportunity Set with Respect to the Socio-Economic Environment

The Mandingized Diolas are in the same situation as the Diolas as far as infrastructural constraints are concerned. However, the situation of these two groups differs with respect to land availability, agricultural income, labor productivity and magnitude of the cereal consumption deficit. With respect to these, the Mandingized Diolas are in a more favorable position than the Diolas.

3.2.2.6 Households' Potential Labor Allocation Strategies Given the Socio-Economic Environment

Considering the lack of reliability and the high costs associated with the current food marketing system and with input acquisition, farmers would prefer to rely largely on their own food production for household food supplies and to limit their use of modern inputs.

Because of higher per capita land availability and higher labor productivity, these farmers have the option of producing extensively (as opposed to intensively), and this reduces the need for modern inputs such as chemical fertilizers. Given food acquisition bottleneck and given the fact that groundnut production does not necessarily mean readily available cash in predictable amounts, foodcropping activities must be important enough to cover most of the food needs even if it

might be at the expense of groundnut production.

3.2.2.7 Households' Opportunity Set with Respect to all Three Environmental Dimensions

What are the main binding constraints faced by the Mandingized Diolas if all the three environmental dimensions are simultaneously taken into account?

1. The Mandingized Diolas have the opportunity to farm relatively large areas and thus meet most of their objectives through their agricultural production. They face a low population pressure and have large households, which means that per capita land availability and family labor are greater than in the case of the Diolas. Moreover, the use of animal traction for land preparation is common in this part of the region. Nonetheless, they face major binding constraints which limit the extent to which they can meet their objectives through agriculture. Like the Diolas, they have a limited amount of time to carry out their agricultural production as a result of the seasonality of the rains. However, in the case of the Mandingized Diolas, these time constraints are more acute because the beginning of the rainy season (end of June-July) is the rainiest. This means that land preparation operations have to be completed rapidly to allow the crops to benefit from the rains. Furthermore, due to their location further north, the amounts of rainfall are lower and more variable, risks of rain shortage are higher and the rainy season is shorter. The drought has aggravated the situation. Thus, they are limited in the type of crops they can grow, (especially with respect to crops' water requirements) and generally their agriculture production incurs greater risks of crop failure. Rice production has been the most affected by the drought, as rice is a high-water requirement crop; important riceland areas have become unfit for agricultural production because of salt intrusion and/or insufficient

flooding. Because bottomlands are scarce, the extent to which the Mandingized Diolas can fulfill their objective of food supply through rice production is limited and varies from year to year depending on rainfalls. Therefore, it is through millet and sorghum production that farmers will have to satisfy most of the households' food requirements, granted these crops receive at least their minimum water requirements. The same climatic constraints apply to groundnut production, which, given the abundance of uplands, gives the Mandingized Diolas the ability to fulfill most of their cash requirements.

2. Considering the extent to which groundnut proceeds are affected by government's price, credit and subsidy policies and by the performance of the transportation and marketing systems, households' cash gains from groundnut production are variable.

3. Socio-cultural norms are such that females are responsible for the households' rice supply and males are responsible for the households' millet and sorghum supply. However, as in the case of the Diolas, Mandingized Diola women have usufructory rights only on lowlying riceland. Therefore, the extent to which they can meet their cash requirements through agricultural activities is very limited. Furthermore, besides the fact that in addition to their agricultural tasks household duties keep them close to home and leave them little free time, religious beliefs restricts female mobility. Meanwhile, reliable cash earning opportunities outside agriculure are scarce in rural areas.

4. Mandingized Diola households have also been experiencing cereal deficits, although to a smaller extent than the Diolas. However, similarly to the Diolas, the acquisition of imported rice to complete the

food supply is costly and unreliable due to marketing and transportation bottlenecks.

To summarize, although the Mandingized Diolas have the ability to achieve large scale farm production and thus have higher incomes and be able to fulfill their objectives, they are faced with greater risks of crop failures because of their greater vulnerability to uncertain climatic conditions and to uncertain government policies. However, they have the option of diversifying their production to spread risks.

Since households' first priority is to assure adequate family food supplies, and given that they are better off relying primarily on their own food production, male farmers will be very devoted to their millet and sorghum crops, especially in years of low rainfall when rice production is lower, even at the expense of groundnut production. Female farmers will always be devoted to rice production, since it is their only means of meeting their food supply obligations and their greatest opportunity of economic independence. While male farmers will be motivated to assure that they can meet the majority of their cash needs with groundnut production, female farmers will be motivated to seek other sources of cash-earning activities, close by and not tied to land ownership.

3.3 Conclusion

After having derived the households' opportunity sets, the next step is to predict households' labor allocation strategies based on these opportunity sets.

CHAPTER 4

LABOR ALLOCATION STRATEGIES PREDICTED BEHAVIOR VERSUS OBSERVED BEHAVIOR

4.1 Introduction

The focus of this study is small farm households' labor allocation strategies, that is the strategies of labor allocation that these households adopt in the pursuit of their main objectives. We are focusing on the resource labor because in West Africa and Senegal in particular, labor is one of the most crucial of farmers' resources, as large-scale mechanization seldom exists on these small African farms.

The basic hypothesis underlying this paper is that farm households' internal and external circumstances justify the labor allocation strategies they adopt, the strategies which enable them to meet their objectives. In Chapter 3 we made the assumption that these farming households had similar basic objectives. After the last chapter, we have a better idea of what the circumstances of the average Diola and Mandingized Diola households are. Great differences and some similarities exist between the two groups. Pursuing similar basic goals and having different circumstances, we would also expect some differences in the labor allocation strategies of these two types of farm households. The purpose of this chapter is (a) to hypothesize about the strategies of labor allocation that each of these two types of households would be more likely to follow, given their particular circumstances (b) to check the accuracy of our hypotheses with these households' observed behavior of labor allocation as documented by the ISRA Research Team in Djibelor, and (c) to discuss eventual divergences between hypotheses and facts.

Four aspects of labor allocation strategies have been selected as the basis of comparison between hypothesized and observed behaviors: (a) the relative importance of farm versus nonfarm activities, (b) the crop mix (relative importance of food crops versus cash crops), (c) the methods of cultivation and techniques of production, and (d) the sexual division of agricultural tasks.

4.2 Farm/Nonfarm Activities

Considering these households' opportunity sets and goals, what would be an optimal labor allocation between farm and nonfarm activities? In farm activities, we include food cropping and cashcropping only. This means that livestock related activities are left out, due to a lack of sufficient information on this topic, even though we suspect that relatively important income may be derived from such activities (e.g., selling poultry, eggs, pigs or goats). In nonfarm activities, we distinguish between those activities carried out on or about the farm and those activities requiring seasonal or permanent outmigration.

4.2.1. Predicted Behavior

The Diolas and the Mandingized Diolas are primarily farmers and it is primarily through farming that they will strive to reach their basic objectives. Moreover, earning cash income is the primary purpose of nonfarm activities.

4.2.1.1. The Diolas

How well can the Diolas fulfill their objectives through farming alone? Since we have argued that the Diolas would try to meet their objectives through farming activities, it seems that this is the first question which should be addressed.

The Diolas' main crops are rice and groundnuts. By producing abundant quantities of these two crops the Diolas could have sufficient food supplies, necessary cash and in-kind and/or cash savings. However, due to serious limitations on their productive capacity, that is not the case. First, if we refer to

the Diolas' opportunity set (Chapter 3), one of the major constraints seems to be that production depends heavily on rainfall. The rains are seasonal and to live by farming alone, farmers would have to be able to produce enough for the full year during the single rainy season. However, this is only one of the production constraints resulting from local rainfall patterns. Not only does it rain for a relatively short time, but rainfall has been decreasing in amounts and has had a less regular distribution in recent years. This has tremendous consequences for the Diolas main crop--rice. The Diolas' rice production is indeed doubly affected. There is a loss of arable riceland due to the salinization of the more exposed paddies and rice yields are also affected by insufficient rains.

Second, loss of riceland and lower yields would not have been as much of a problem if farmers had adjusted by increasing areas under cultivation or by intensifying production through the use of chemical fertilizers and improved seeds. However, increasing areas under cultivation is difficult because of a low per capita land availability. Furthermore, because of the bottlenecks that impede farmers' access to chemical fertilizers and improved seeds (see Chapters 2 and 3), intensifying production through these methods does not appear to be a realistic solution in the short-term.

Given that rice is the main traditional food crop of the Diolas, the above limitations on rice production seem to indicate that the Diolas would not be able to fulfill their objective of adequate family food supplies through home production alone. However, farmers still have one option left to meet this objective through farming; that is groundnut production, the leading cash crop, which could allow them to complete family food supplies by purchasing additional food.

Unfortunately, the same restrictions on the Diolas' agriculture--time available, labor resources available, and access to modern inputs -- also affect their groundnut production. In addition, the groundnut crop has to compete with

the rice crop for the available labor resources, and uplands (where groundnuts are grown) are scarce, making land availability an even bigger constraint. Thus, the supply of cash through farming will be relatively low for the Diolas while, on the other hand, the demand of cash is constantly growing (see chapters 2 and 3).

Hence, the Diolas' productive resources seem to restrict their productive capacity. Consequently, it is unlikely that the Diolas can reach their food and cash goals, let alone their savings goals, through farming alone. Diola farming households must to some extent involve themselves in nonfarming activities in order to survive. The primary purpose of farmers' involvement in nonfarm activities is to earn a cash income. The question which arises now is what will determine farmers' ability to earn a cash income through nonfarm activities?

First, farmers must have cash-earning opportunities. In chapters 2 and 3 we have seen that the Diolas' natural resources (e.g., extensive palm groves, numerous ponds) could be exploited for petty trade of palm products, fish and wood products. However, because of transportation bottlenecks, it is difficult and costly for farmers to take their products to large market centers where they could get higher prices. Therefore, farmers' earnings from these activities are often low and irregular. Yet, petty trade may constitute one of the few alternatives of cash earning available to those farmers who have obligations keeping them close to home. A great majority of farmers in this situation would be married females. Usually, jobs offered in rural areas require no highly trained skills but great physical strength, which puts women at a disadvantage. Yet, women have a great need to earn cash because their cash gains through groundnut production are generally marginal since groundnut is a male controlled crop. In rural areas cash-income generation is difficult for anyone, but the situation is even worse for women. On the other hand, there are many more job opportunities in urban areas as unskilled labor. Wages are higher in urban areas, and having a paid job

constitutes a more predictable and consistent stream of income than petty trade. The question of who could migrate to the cities, when and for how long remains. This involves two factors: mobility and timing.

We have stated that because of their daily household duties, females will tend to be less mobile than males. However, in the Diola households it seems that marital status or age (assuming that most people get married after a certain age) is more important in determining whether or not one migrates. Because Diola households are nuclear, the married men or women are more easily tied down by responsibilities to their families. Yet, it would seem that among young people, more females than males would tend to migrate to the cities. This presumption is based on the facts mentioned earlier: that groundnuts, the leading cash crop, is primarily a male crop and that job opportunities in the rural areas are more scarce for women. The bulk of nonfarm activities would primarily be done during the off season. Diola households are small and the agricultural tasks are arduous and labor-absorbing, especially when using hand tools. Considering the time constraints imposed by a short rainy season, all labor possible is required, and the opportunity cost of labor is consequently very high during the farming season.

In summary, we would predict that the Diola household will derive their income primarily from their farm activities. However, with the decreasing trend of the rains, the part of household income generated from nonfarm activities will tend to increase. The less the rains, the less arable riceland and the less Diola households will be able to fulfill their basic goals and the more vital the income generated from nonfarm activities. Nonfarm activities primarily occur during the dry season and the younger members of the households usually will be more apt to migrate to the cities.

4.2.1.2 The Mandingized Diolas

The Mandingized Diolas are generally better off than the Diolas with regard

to their ability to fulfill their obligations through farming. However, they are not as well off as the Diolas in terms of rainfall (see Chapters 2 and 3). Yet, the consequences of short, low and irregular rains during the season are not as dramatic as in the case of the Diolas due to the Mandingized Diolas' agricultural emphasis on upland crops, which have lower water requirements. The Mandingized Diolas also have the possibility to grow millet and sorghum along with groundnuts, which allows for crop diversification. Due to the low population among the Mandingized Diolas, land availibiliity is not as much of a problem as in the case of the Diolas. They could increase areas under cultivation in the uplands to compensate for the loss of arable riceland in the lowlands and could still use a fallow system to compensate for the low fertility of upland soils. One limiting factor is the time constraints inherent in a short rainy season. However, with the large size of their households and the common use of animal traction, the Mandingized Diolas could tackle these time constraints and thus would be more able than the Diolas to muster the resources to put larger areas under cultivation.

In summary, the Mandingized Diolas, with thier ability to diversify their agricultural production and with their more substantial labor and land resources, seem to be able to fulfill their basic objectives through farming to a greater extent than can the Diolas. The Mandingized Diolas are more able to adjust to changing rainfall patterns by shifting their resources from one crop to another. Nevertheless, yields have been adversely affected by the drought, and as a result the Mandingized Diolas are not self-sufficient in cereals.

As the drought conditions persist the Mandingized Diolas can no longer completely satisfy their objectives with farming alone. Hence, increasing household income has become a crucial issue. Like the Diolas, the Mandingized Diolas must become involved in nonfarm activities. Because of meager natural resources, e.g., not as many ponds or palm groves, because of their Muslim faith

(they do not collect palm wine), and because of the scarcity of job opportunities in rural areas, the Mandingized Diolas' opportunities for earning cash in the rural areas are restricted. Consequently, outmigration to the cities will be important. This is true for both females and males. Females' almost total exclusion from groundnut production gives them little chance to earn cash from farming. Males who are not heads of households do not own land and do not have control over the groundnut proceeds. Thus, some males and most females need nonfarm activities to meet their cash requirements. Due to the large size of the households, the presence of any one member in the household is less indispensable during the dry season.

Among the Mandingized Diolas, most of the households' income will come from farm activities. However, with the decrease in rainfall, the share of households' income coming from nonfarm actifities will increase. Migration will be more important among them due to greater mobility of both males and females.

4.2.2 Observed Behavior

Unfortunately data on the contribution of nonfarm activities to total household income are only available for 1984/85 (Table 4.1).

Table 4.1
Farm and Nonfarm Income for an Average Household in the Departments of Oussouye (Zone I) and Bignona (Zone IV), 1984/85
(in FCFA)

	Zone I (Diolas)	Zone IV (Mandingized Diolas)
Total income	177,300	590,800
Nonfarm income	67,900	62,400
(as a % of total income)	(38%)	(10.5%)
Monetary disposable income from farming	21,070	193,600
(as a % of total income)	(12%)	(33%)

Source: Sall et al., 3e Rapport Annuel, Campagne 1984-85, Tables 16 and 17 ISRA, Djibelor.

Note: Migration is not included in the nonfarm activities.

It is difficult to make a strong statement based on one year's data, but it appears that the Diola households rely more on nonfarm income (38%) than do the Mandingized Diolas (10.5%).

The earning of cash is the primary purpose of nonfarm activities, and the less cash realized from groundnut production, the greater the need for cash from nonfarm activities. Therefore, the disadvantage of the Diolas with respect to groundnut production appears to be verified by the amount of disposable monetary income from farming activities, assuming that groundnuts are the most important cash-yielding activity. These observed data seem to support our predictions.

Table 4.2
The Approximation of Seasonal Migration in Zones I and IV in Lower Casamance for 1984/85
(village totals)

	Zone I Loudia-Ouoloff and Boukitingo (Diolas)	Zone IV Boulandor and Medieg (Mandingized Diolas)
Total male workers	283	537
Total female workers	260	543
Male workers absent	45	130
Female workers absent	48	109
Male rate of outmigration	16%	24%
Female rate of outmigration	18%	20%
Average rate of outmigration	17%	22%

Source: Sall et al., 3e Rapport Annuel, Campagne 1984/85, Table 13, ISRA, Djibelor.

Note: In both zones, more than 50% of the population is in the 0-15 age group.

Table 4.2 gives a rough indication of the migratory outflow among the Diolas and the Mandingized Diolas. Again, only cautious conclusions can be drawn since these data are for only one season. As expected, the Mandingized Diolas tend to migrate more than the Diolas (22% versus 17%). The Mandingized Diolas have fewer opportunities of nonfarm activities in their vicinity. Diola males tend to migrate almost as much as females, while Mandingized Diolas' females migrate less than males (20% versus 24%). We noted that among both groups, more than 50% of the villages are under 15. This means that, as expected, the great majority of the migrants are not married and thus are not tied down by household responsibilities. However, in both cases, we expected female outmigration to be noticeably higher than male outmigration, as a result of men's greater involvement in groundnut production. Yet, it seems that among the Diolas, the constraints associated with groundnut production restrict men's gains from groundnuts. Moreover, these young Diola men have the added pressure of

preparing themselves to meet the requirements of their eventual wedding. Given the Diolas' emphasis on economic and residential independence of young couples and given the fact that it has become increasingly difficult to accumulate rice savings, and given the increased monetization of the economy, cash resources have become a key element in marriage requirements.

Among the Mandingized Diolas, it seems that religious prohibitions rather than household duties may restrict the mobility of the young women. Another possible explanation is that females may have been less in need of nonfarm income in 1984/85, because with the higher rainfall of that year, they had a better rice production.

4.3 Crop Mix: Food Crops/Cash Crops

Assuming food crops are grown primarily for home consumption and cash crops for sale, how should the Diolas and the Mandingized Diolas allocate their labor between these activities to fulfill their objectives best given their opportunity sets?

4.3.1 Predicted Behavior

4.3.1.1 Diolas

A households' food-cropping activities will be far more important than its cash-cropping activities for several reasons. First, since millet and sorghum cultivation is not possible because of climatic constraints, rice cultivation remains the Diolas' only choice as to traditional cereals. Given that riceland constitutes the bulk of their land resources and that rice is primarily grown for subsistence, rice production would be households' most important agricultural activity. Considering (a) the range of utilities and obligations associated with rice in Diola society, (b) the Diolas' greater vulnerability to the effects of a crop failure because of the limited degree to which they can diversify their food, and (c) the constraints they face with respect to buying food, it is in the household's interest

to produce its own food. The scarcity of uplands restricts the Diolas' potential for cash cropping, since groundnuts are an upland crop. Riceland no longer provides any advantage due to drought conditions. Rice is vulnerable and yields are low. Therefore, there is a need for the Diolas to find alternatives to supplement their rice production, and it would appear that the direction is toward upland crops, which have lower water requirements. Groundnut production could be intensified through seed improvement and the use of chemical fertilizers. With the socio-economic constraints the Diolas have in obtaining these inputs, this does not appear to be an attractive alternative. Another alternative would be to orient themselves toward new, non-traditional food crops, with lower water requirements, more adapted to their changing natural conditions.[1] In any case, considering the households' restricted labor supply, they cannot produce much, especially when using traditional methods of cultivation which are very labor intensive and time consuming and when serious time constraints exist because rains are seasonal. Under these conditions, choices as to which crops to emphasize have to be made. Given the socio-cultural and socio-economic constraints mentioned above, there is a strong incentive for households to emphasize food cropping activities.

4.3.1.2 Mandingized Diolas

Even though they have the resources to produce groundnuts on a relatively large scale, food cropping will always be a key activity of these households. Not only does the poor performance of the food marketing system strongly induce households to rely primarily on their own food production to assure an adequate

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[1]Two themes of the ISRA project are crop diversification and the use of residual moisture . The project is trying to introduce a second crop after the rice is harvested to take full advantage of the residual moisture in the soil. ISRA has looked primarily at sweet potatoes. There would not be a major labor constraint for the second crop as the work would be done after the rice harvest

family food supply, but because groundnuts are a male crop, women's agricultural activities will be mostly food cropping. The Mandingized Diolas have the potential to produce large quantities of all crops due to their large family labor supply and land availability. However, they do have serious time constraints due to the seasonality of rainfall, which restricts this potential. As a result, some choices still have to be made between producing more food crops or more groundnuts.

Since the variability of rainfall increases during drought, lowland rice production fluctuates even more than in the Diola case since the Mandingized Diolas receive less rain even under normal conditions. Therefore, they cannot rely on rice yields to plan for millet and sorghum production. A safe strategy would be to try to maintain constant land allocation to millet and sorghum production, independently of rainfall. Thus, when rice production is high it would be a bonus and when low, the consequence would not be as serious. By keeping constant their cropping of millet and sorghum, they can keep a more uniform level of groundnut activity. Given their comparative advantage in groundnut production and the higher price for the product, they can derive more benefit from the production of groundnuts than for millet and sorghum. However, the Mandingized Diolas' first option is to satisfy their food requirements and then satisfy cash needs, and with all of the uncertainties on subsidies, credit and marketing constraints, groundnuts have become less profitable. This, along with decreasing rains, could shift farmers toward food cropping.

To summarize for both groups, households' food cropping activities will be greater than their cash cropping activities when arable riceland increases, when reliability of the food marketing system decreases, when possibilities of food diversification are restricted and when the family size is small.

4.3.2 Observed Behavior

Although Table 4.3 includes the data for only two years, it does show the relative importance of foodcrops and groundnuts in a typical Diola and Mandingized Diola production system and how it varies with rainfall and total area under cultivation. For both groups the land allocation to food crops increases with increased rainfall and allocation to groundnuts decreases. The Diola labor allocation to food production is more than double their labor for groundnut production in 1983/84, a period when more land was allocated to groundnuts than to food production. With increased rainfall the Mandingized Diolas have reversed the emphasis of their labor allocation from groundnuts to food production. In 1984/85, labor input to food crops was one and a half times greater than labor input for groundnuts even though equal amounts of land were allocated to both types of crops. However, the Mandingized Diolas' labor allocation to groundnuts did not vary with the increased rainfall, while the labor allocation to millet and sorghum, lowland rice and other upland food crops approximately doubled. There is the same phenomenon of labor intensification on each of the Diolas' crops although at a lesser extent. It is interesting to note that among the Diolas, who are the "rice specialists" in the region, upland food crops and not lowland rice show the greatest increase in labor input per hectare (1660 versus 275 hrs/ha). This appears to support the prediction that the Diolas give more emphasis to upland food production. Anmong the Mandingized Diolas, lowland rice production displays the greatest increase in labor input per hectare. However, the higher rains may have also increased weeding requirements substantially.

With increased rainfalls, millet and sorghum show the greatest increase in land allocation (40%). This does not support our hypothesis of constant land allocation to millet and sorghum to balance out the fluctuations of rice production. This suggests that rice production and upland production are carried out as two independent activities and thus the production decisions of the upland

crops are not subject to the expected yields of lowland rice. Furthermore, the use of animal traction and the collective nature of upland production may have made it possible to expand areas under cultivation quickly, despite the great time pressures inherent in the rainfall pattern. Moreover, it is also possible that some of the increase in reported area may reflect the fact that the survey team may have failed to measure some fields in 1983/84 that were not harvested because of crop failure (drought).

4.4 Methods of Cultivation

4.4.1 Predicted Behavior

4.4.1.1 The Diolas

4.4.1.1.1 Agricultural Emphasis

The Diolas' agricultural emphasis will be on lowland rice cultivation. The Diolas have most of their land resources in the lowlands and rice is the only traditional food crop which can be grown. Given the multiple functions attached to rice in the Diola society and given the bottlenecks associated with the food marketing system, it is preferable for one to rely primarily on one's own food production. With the decrease in rainfall more attention should be given to upland production.

4.4.1.1.2 Factor Intensity

The Diolas do not use animal traction due to religious beliefs. They have small farms, and their land holdings are poorly consolidated. In addition, they have many stumps and termite hills on their uplands, which obstruct the use of mechanized equipment. Morever, it would be difficult for the Diolas to generate the financial resources that would be necessary to mechanize their agricultural production since rice is both their main crop and a subsistence crop. Consequently, the capital would be mostly comprised of hand tools and human power.

Table 4.3
Typical Households' Land and Labor Allocation Between Food Crops and Cash Crops in the Departments of Oussouyne (Zone I) And Bignona (Zone IV) in 1983/84 and 1984/85

	Zone I (Diolas)		Zone IV (Mandingized Diolas)	
	1983/84	1984/85	1983/84	1984/85
Rainfall (mm)				
Amount	1030	1135	690	891
Land Allocation (ha)				
Total area cultivated	1.5	1.4	5.9	6.5
1. Land to Food Crops	.7	.8	2.2	3.2
(% of total area cultivated)	(46%)	(57%)	(37%)	(49%)
a. Land to Lowland Rice	.6	.7	.8	1.0
(% of total area cultivated)	(40%)	(50%)	(13%)	(15%)
b. Land to Millet and Sorghum	--	--	1.0	1.4
(% of total area cultivated)	--	--	(17%)	(21%)
c. Land to Other Upland Food Crops	.1	.1	.4	.8
(% of total area cultivated)	(6%)	(7%)	(7%)	(12%)
2. Land to Cash Crops	.8	.6	3.7	3.2
(% of total area cultivated)	(53%)	(43%)	(63%)	(49%)
a. Land to Groundnuts	.8	.6	3.7	3.2
(% of Total area cultivated)	(53%)	(43%)	(63%)	(49%)
Labor Allocation (hrs)				
Total Agr. Labor Input	1447	1880	3144	4892
1. Labor input to Food Crops	1038	1520	1016	2956
(% of total Ag. Labor)	(72%)	(81%)	(32%)	(60%)
Per hectare (hrs/ha)	1483	1900	462	924
a. Labor input to Lowland Rice	740	1056	778	2116
(% of total Ag. Labor)	(51%)	(56%)	(25%)	(43%)
Per hectare (hrs/ha)	1233	1508	972	2116
b. Labor input to Millet and Sorghum	--	--	170	400
(% of total Agr. Labor)	--	--	(5%)	(8%)
Per hectare (hrs/ha)	--	--	170	286
c. Labor input to Other Upland Crops	298	464	68	440
(% of total Ag. Labor)	(21%)	(25%)	(2%)	(9%)
Per hectare (hrs/ha)	2980	4640	170	550
2. Labor input to Cash Crops	409	360	2134	1936
(% of total Agr. Labor)	(28%)	(19%)	(68%)	(40%)
Per hectare (hrs/ha)	511	600	577	605
a. Labor input to Groundnuts	409	360	2134	1936
(% of total Agr. Labor)	(28%)	(19%)	(68%)	(40%)
Per hectare (hrs/ha)	511	600	577	605
3. % of total Agr. Labor to				
a. Upland cultivation	49%	44%	75%	57%
b. Lowland cultivation	51%	56%	25%	43%

Source: Sall et al., 3e Rapport Annuel, Campagne, 1984/85, Annex 1 and tables 1 and 5, ISRA, Djibelor.

4.4.1.1.3 Use of Modern Inputs

The use of modern inputs in Diola agriculture will be minimal. The financial constraints previously mentioned and the marketing system create delays in input delivery which make relying on modern inputs very risky.

4.4.1.1.4 Labor Utilization

The pattern of labor utilization will be closely linked to rainfall patterns. Farmers will plan their agriculture in a way that rainfall can satisfy at least the minimum water requirements in each stage of the developmental cycle. In addition, because of the Diolas' small family labor supply, they will need to rely on off-farm labor, especially for operations such as transplanting and harvesting.

4.4.1.2 The Mandingized Diolas

4.4.1.2.1 Agricultural Emphasis

The Mandingized Diolas' agricultural emphasis will be on upland cultivation. First, they have a natural comparative advantage in upland production, as the major part of their land resources are upland and they have enough labor to cultivate large areas extensively. Second, with the decreased rainfall, rice yields have become too variable to be relied upon. Third, they have the option of diversifying agriculture on the uplands and intercropping food crops and cash crops.

4.4.1.2.2 Factor Intensity

The Mandingized Diolas' techniques of production will exhibit different patterns of factor intensity in the uplands and on the lowlands. In the uplands, land holdings are relatively abundant and well consolidated. Upland soils are relatively poor, which, combined with the meager rainfall, prevents intensive agriculture. Therefore, it seems that an extensive agriculture would be better suited to their upland production. However, due to time constraints imposed by the rainfall patterns, even though their family labor is more substantial than the

Diolas', the Mandingized Diolas would need labor-saving devices to take advantage of their land resources. It appears that it is during land preparation that the labor constraint is the more binding among the Mandingized Diolas (Chopak, 1987). Therefore, it seems that it is in the farmers' interest to adopt animal traction, which is the cheapest and most common form of agricultural mechanization in Senegal. Since they have a comparative advantage in groundnut production, the opportunity to produce groundnuts on a relatively large scale, and since groundnuts historically have been the most supported crop in Senegal in terms of subsidies, credit, producer prices and other agricultural services, Mandingized Diolas are more likely than Diola to tackle the financial constraints associated with agricultural mechanization.

In the lowlands, the use of hand tools will prevail among the Mandingized Diola females since they are the rice farmers and cultural beliefs forbid women to handle animal traction. In addition, lowland holdings are small, and current animal traction equipment is not designed for use in this area. Weeds are abundant in the directly seeded lowland ricefields which will require much labor since herbicide availability is problematic. Therefore, production in the lowlands will be very labor intensive.

4.4.1.2.3 Use of Modern Inputs

The use of modern inputs will be minimal. With abundant land resources, the Mandingized Diolas can fallow their land to restore soil fertility. They also have the option of adopting extensive agriculture as opposed to intensifying agriculture through the use of modern inputs. The system of input delivery is too uncertain to be relied upon.

4.4.1.2.4 Labor Utilization

Similarly to the Diolas, labor utilization among the Mandingized Diolas will be dictated by rainfall patterns. Because rains are shorter and more variable than

in the case of the Diolas, it is even more crucial to be sure that the crop receives as much rain as possible. Therefore, even though the Mandingized Diolas have access to a larger family labor, because rainfall patterns do not allow them as much flexibility as the Diolas, they will have to rely more often on off-farm labor in order to complete each agricultural operation in the time allowed by the rainfall pattern.

4.4.2 Observed Behavior

4.4.2.1 Agricultural Emphasis

Table 4.4
Relative Importance of Lowland Versus Upland Production at Household Level in the Departments of Oussouye (Zone I) and Bignona (Zone IV), 1983/84 and 1984/85

	Zone I (Diolas)		Zone IV (Mandingized Diolas)	
	1983/84	1984/85	1984/84	1984/85
Rainfall (mm)				
Amount	1030	1135	609	891
Land Allocation (ha)				
Total area cultivated	1.5	1.4	5.9	6.5
Land to upland	.9	.7	5.1	5.5
% of total cultivated)	(60%)	(50%)	(86%)	(85%)
Land to lowland	.6	.7	.8	1.0
(% of total cultivated)	(40%)	(50%)	(14%)	(15%)
Labor Allocation (hrs)				
Total labor input	1447	1880	3150	4892
Labor input to upland	707	824	2372	2776
(% of total labor input)	(49%)	(44%)	(75%)	(57%)
Labor input to lowland	740	1056	778	2116
(% of total labor input)	(51%)	(56%)	(25%)	(43%)

Source: Sall et al.,3e Rapport Annuel, Campagne 1984/85, Annex I and Table 2, ISRA, Djibelor.

Table 4.4 shows that in 1983/84, while the Diolas allocated 60% of their land to upland cultivation, they spent 51% of their time on lowland cultivation. In the following year, with a slight increase in rainfall, they increased land and labor allocation to lowland cultivation while they decreased land and labor allocation to upland cultivation. Although the results seem to confirm the Diolas' agricultural emphasis on lowland cultivation, there is still a substantial portion of their land and labor resources allocated to upland cultivation. This could mean that average rainfalls have decreased so much in recent years that farmers have been forced to increase the share of upland production in their agricultural system. For the Mandingized Diolas in 1983/84, when rainfall was very low, they focused almost entirely on upland production. In that year, 87% of the land and 75% of total labor input was allocated to upland production. However, with a substantial increase in rainfall the following year, there has been a dramatic increase in labor allocated to lowland cultivation and a sharp decrease in labor allocated to upland cultivation. Land allocation to upland and lowland production remained more or less constant. Although it is difficult to draw any firm conclusions based on only two years of observations, it appears that the Mandingized Diolas do not rely primarily on their rice production, but are ready to take advantage of the rice fields when climatic conditons allow. When this occurs, they don't need to work as hard on their upland crops, since upland food production can be completed by the rice produced, and less cash is needed to buy rice. Rice seems to be a prime staple food among the Mandingized Diolas, and they have reduced rice cultivation simply due to the insufficiency of the rains.

4.4.2.2 Factor Intensity

Table 4.5
Upland Plowing Techniques Among the Diolas and the Mandingized Diolas of the Lower Casamance: Use of Animal Traction vs. Traditional Hand Tools in 1982/83 and 1983/84
(Percentage of Uplands Plowed with)

Group	Traditional Hand Tools %		Animal Traction %	
	1982/83	1983/84	1982/83	1983/84
Diolas	100	100	0	0
Mandingized Diolas	20.5	5	79.5	70.5

Source: Sall et al., Rapport Annuel d' Activities No. 2 Campagne 1983/84, Annex 7, ISRA, Djibelor.

Note: Mandingized Diolas: 24.5% of area not plowed in 1983/84.

Table 4.5 shows that, as expected, the Diolas exclusively use hand tools in their land preparation tasks. Given the diversity of soil texture and the presence of numerous stumps and termite hills, these traditional hand tools, which come in different sizes and shapes, provide flexibility and allow farmers to take advantage of every bit of land. Also as expected, animal traction is widely used among the Mandingized Diolas.

4.4.2.3 Use of Modern Inputs

Table 4.6 shows the increase in the use of chemical fertilizers in 1984/85; this was the result of a credit program of the Integrated Project for the Agricultural Development of the Lower Casamance (PIDAC) in the northern region for seed multiplication. (Sall et al., 3^{e} Rapport Annuel, Campagne 1984/85). Otherwise, the use of chemical fertilizers is minimal.

Table 4.6
Use of Fertilizers in the Lower Casamance
Percentage of Plots Treated

Type of Plots	Organic		Chemical	
	1983/84	1984/85	1983/84	1984/85
Lowland rice plots %				
Directed seeded	7	1	.7	37
Transplanted	21	16	4	25
Upland plots %				
Rainfed rice	0	3	0	0
Maize	34	7	5	19
Millet and Sorgham	0	1	0	4
Groundnuts	.5	0	.5	1
Total %	10	4.7	1.7	22

Source: Sall et al., 3e Rapport Annuel, Campagne 1984/85, Annex 3, ISRA, Djibelor.

Use of Improved Seeds

Farmers' use of improved seeds is generally minimal, but may vary depending on the crops in question. The variety of groundnuts called "Bourkousse" is the most widely used (45% of the plots in 1982; 57% in 1983 and 67% in 1984). Some 58% of the seeds come from the farmers' own stock. As a result of PIDAC assistance, there is a high rate of utilization of improved maize seed (78%). Local varieties are predominant with respect to the other crops (Sall et al., Campagne Agicole 1982/83).

4.5 Sexual Division of Agricultural Tasks

Sexual division of agricultural tasks is viewed here as a group's strategy of meeting its basic goals through allocating certain agricultural tasks to females and certain agricultural tasks to males. The agricultural tasks we will be concerned with are those which relate to the production of major food crops and groundnuts.

4.5.1 Predicted Behavior

The goal of this section is to answer the following question: Who is going to do what and why?

4.5.1.1 The Diolas

Among the Diolas, husbands and wives are expected to contribute more or less the same amount to family food supplies. For the Diolas, due to climatic and topographical restrictions, food production means primarily lowland transplanted rice cultivation; therefore, men and women will rely on the same agricultural activities if they want to assure adequate family food supplies primarily through their own food production. The ricefields belong to the husband but the wife has extended usufructory rights on them. In addition, rice has important social meanings for both men and women in the Diola society. Therefore, we expect that husband and wife would both be involved in lowland rice production.

Because of a low relief and the presence of numerous rivers, controlling the level of water and salt in the ricefields is a prerequisite to lowland rice cultivation. In the absence of sophisticated water control devices, Diola farmers must rely on their hand tools to plow, dike and ridge. This implies that land preparation is a crucial stage of lowland rice cultivation and that it is very arduous. Therefore, physical strength becomes a key factor in lowland rice production and we expect that land preparation will be primarily carried out by men. Because Diola households are nuclear, a wife is the primary source of labor for her husband and vice-versa. This implies that a wife must rely on her husband for land preparation tasks. These land preparation tasks are very labor-intensive and time-consuming when they are done using hand tools. This implies that if the husband is the only one involved in the land preparation, and if there is only a limited amount of time to produce, a Diola household would be very limited in how much it could produce. But, the fact that the ricefields cannot be planted until

they are sufficiently flooded and desalinated, which doesn't happen until the big rains of August and September, gives farmers enough time to complete land preparation. Furthermore, Diola ricefields are small as a result of climatic and population density constraints. In addition, the fact that a household's rice holdings are usually composed of plots with different agronomic characteristics, provides additional flexibility to the time available to farmers to complete land preparation. For instance, farmers can prepare the plots which are the most affected by salt incursion first to allow them to be washed out longer.

These physical characteristics will induce men to specialize in land preparation. However, after the fields are ready to be planted they are flooded and there is only about a month of rains left. Therefore, only transplanting can occur at this stage. This implies that while men are busy preparing the land, women must start growing the rice in nurseries. There are two other main agricultural operations left at this point--transplanting and harvesting--which are both very labor-intensive tasks. Yet, because men must attend to the groundnut crop, transplanting and harvesting of the rice crop will primarily be female tasks. Groundnuts historically have been monitored by the Senegalese government on the basis of land ownership. As such, groundnut production has benefited men primarily.

Since groundnuts are an upland crop and since women do not have usufuctory rights on the uplands, it seems that women's direct gains from groundnut production would be minimal. A wife would have little incentive to work on her husband's groundnut crop. On the other hand, there are other considerations to be taken into account: a husband would need the assistance of his wife for timely operations such as sowing and weeding. He would have to make it worth her while to help him with the groundnut crop. He could give her cash and/or in-kind compensation for her labor. In years of low rainfall, when rice production does

not yield as much and would need to be supplemented, the need for cash becomes greater for men and women. Since groundnuts have lower water requirements than rice and since with lower rainfalls labor requirements in rice production may decrease as a result of less arable riceland available, women would have more time and a greater need to earn cash. Considering that groundnut production may be the only alternative for earning cash during the farming season, the importance of women's input into groundnut production would increase in years of lower rainfalls. Finally, there is the cultural emphasis that a household is expected to be economically independent, which may act as a reenforcer for husbands and wives to help each other, especially in adversity.

In conclusion, the Diola female labor input in food production would be greater than male's since a great deal of male labor is diverted to groundnut production and since tasks such as transplanting and harvesting are very labor intensive. Male labor would be greater than female labor input in groundnut production. Female labor input in groundnut production would increase during years of low rainfall. As a result it seems that overall, female labor input in agriculture would be greater than male labor input since females perform more tasks, some of which are very time-consuming. However, it should be noted that because the rains begin slowly and do not peak until August-September, it is possible for the Diola men to complete land preparation for the ricefields and the groundnut fields and for Diola women to help in the groundnut fields before transplanting is due. Transplanting occurs after the big rains have flooded the fields.

4.5.1.2 The Mandingized Diolas

In contrast to the Diolas, the Mandingized Diolas have three major possibilities of food production: millet, sorghum and lowland rice. However, as a result of a drier climate, most lowland rice fields are phreatic ricefields, which do

not require much water control. These ricefields do not flood enough to make transplanting possible. As a result, they have a serious weed problem. This implies that great physical strength is not as much of a requirement for land preparation of lowland rice as in the case among the Diolas, but weeding will absorb substantial labor and time. Because the rains are the strongest toward the beginning of the season, which is relatively short, there are acute time pressures with respect to completing all agricultural operations before the rains end. However, the ricefields are relatively small and are even smaller in years of lower rainfalls, when there is less arable riceland available. Consequently, even though lowland rice cultivation is labor-intensive and time-consuming, the size of the plots helps keep down total labor requirements. Because rainfall patterns do not allow for transplanting or lengthy land preparation such as ridge plowing, there is no need for a husband and wife to work as a team to produce lowland crops, for instance, if transplanting is not possible, it is not necessary to prepare nurseries and plow the land simultaneously.

In the case of these upland crops, land preparation involves heavier and more arduous tasks such as tree-felling, land-clearing, ridging and furrowing, aimed at restoring soil fertility and water retention. Upland fields are large, with groundnuts being the most important crop. A great deal of land preparation is done using animal traction. Timely weeding improves yields. This implies that men have a comparative advantage in upland crop production because of their greater physical strength and because the handling of animal traction by women is taboo. In addition, the time pressures inherent in rainfall pattern and in biological requirements of the crops and the large size of the upland fields demand a large number of workers to carry out production successfully. Therefore, while in upland cultivation several men are required, lowland rice cultivation can be carried out by women individually or in small groups. Such a sexual specialization

would be consistent with the traditional role of women in subsistence agriculture, especially rice, and with the traditional role of men as retainers of economic power within the household. However, with riceland becoming scarce, men have found a way to increase their economic power with the production of millet and sorghum, which are compatible with groundnut production.

4.5.2 Observed Behavior

Table 4.7 confirms that for both groups women work more than men in owland rice production and men work mainly in groundnut production. While Diola men participate substantially in lowland production (39% of total labor input to lowland rice in 1983/84 and in 1984/85) and women in groundnut production (40% of total labor input to groundnuts in 1983/84 and 1984/85), Mandingized Diola men participate less than 8% in lowland rice production each year and the women's participation in groundnut production is also minimal (10%).

Among the Mandingized Diolas, millet and sorghum also seem to be male crops as more than 85% of the total labor input allocated to these crops is provided by men.

How did households change their strategies of production with the increase in rainfall between 1983/84 and 1984/85? First, while rain increased by 10% in the Diola case, rain increased by more than 40% in the Mandingized case. In both cases, land allocation to food crops increased, but land allocation to groundnuts decreased only in the Diola case. Of the increase in land allocated to foodcrops, 23% is in lowland rice in the case of the Mandingized Diolas and 50% in the Diola case. Although a larger percentage of the increase in food production among the Diolas went into lowland rice production, total area devoted to rice increased more among the Mandingized Diolas (50%) than among the Diolas (28%). These figures suggest that the Mandingized Diolas may have been more successful in taking advantage of the rains. However, the Mandingized Diolas got a much

larger increase in rainfall and have a greater per capita land availability. Furthermore, their techniques of lowland preparation are not as labor- and time-consuming as the Diolas', as they are less elaborate. In both cases, total labor input to foodcrops increased substantially, while total labor input to groundnuts decreased. This seems to indicate once more that farmers draw more utility from producing their own food than from earning cash from groundnuts and buying food. Considering the marketing and transportation constraints associated with buying food, it seems like a rational decision. In the Diola case, 65% of the increase in total labor input to foodcrops is absorbed by lowland rice, with both genders increasing their labor about 1.5 times, which shows the balance between genders in lowland rice production. However, men's total labor input in lowland rice production is still less than half that of women.

In the Mandingized Diolas' case, lowland rice absorbs almost 70% of the increase in total labor input to foodcrops, while millet and sorghum absorbs about 12%. Both male and female labor increased almost threefold in lowland production and about twofold in millet and sorghum cultivation. These results show the sexual polarization of food crop production, which does not vary with increased rainfall or with increased land allocation.

In both groups, the decrease in labor input to groundnuts is minimal for both men and women. Overall, while Diola women's agricultural labor increases only slightly over men's, between the two years, the Mandingized Diolas' agricultural labor increases substantially more among women than men. Since most of the increase in female labor is absorbed by lowland rice and since the increase in land allocation to lowland was only 50%, the greater increase in female labor compared to men's may indicate increased weeding of lowland rice per unit of land. Also, the capacity of women to increase their labor input to such a great extent may suggest that women are underutilized in years of low rainfall.

Table 4.7
Labor Input by Gender for A Representative Farm Household in the Departments of Oussouye (Zone I) and Bignona (Zone IV), 1983/84 and 1984/85

	Zone I (Diolas)		Zone IV (Mandingized Diolas)	
	1983/84	1984/85	1983/84	1984/85
Rainfall (mm)				
Amount	1030	1135	609	891
1. Food Crops				
Area cultivated (ha)	.8	1.2	1.9	3.6
Total labor input (hrs)	1038	1520	1016	2956
Male labor input (hrs)	332	486	510	1485
(% of total labor input)	(32%)	(32%)	(50%)	(50%)
Female labor input (hrs)	706	1034	505	1471
(% of total labor input)	(68%)	(68%)	(50%)	(50%)
a) Lowland Rice				
Area cultivated (ha)	.7	.9	.8	1.2
Total labor input (hrs)	740	1056	778	2116
Male labor input (hrs)	289	412	58	159
(% of total labor input)	(39%)	(39%)	(7%)	(7%)
Female labor input (hrs)	451	644	720	1957
(% of total labor input)	(61%)	(61%)	(92%)	(92%)
b) Millet and Sorghum				
Area cultivated (ha)	--	--	.8	1.3
Total labor input (hrs)	--	--	170	400
Male labor input (hrs)	--	--	150	352
(% of total labor input)	--	--	(88%)	(88%)
Female labor input (hrs)	--	--	20	48
(% of total labor input)	--	--	(12%)	(12%)
2. Cash Crops				
Area cultivated (ha)	.9	.6	3.1	3.1
Total labor input (hrs)	409	360	2134	1936
Male labor input (hrs)	245	216	1915	1742
(% of total labor input)	(60%)	(60%)	(90%)	(90%)
Female labor input (hrs)	164	144	213	194
(% of total labor input)	(40%)	(40%)	(10%)	(10%)
a) Groundnuts				
Area cultivated (ha)	.9	.6	3.1	3.1
Total labor input (hrs)	409	360	2134	1936
Male labor input (hrs)	245	216	1915	1742
(% of total labor input)	(60%)	(60%)	(90%)	(90%)
Female labor input (hrs)	164	144	213	194
(% of total labor input)	(40%)	(40%)	(10%)	(10%)
3. Total Agricultural Production				
Total labor input (hrs)	1447	1880	3150	4892
Male labor input (hrs)	578	702	2426	3228
(% of total labor input)	(40%)	(40%)	(77%)	(77%)
Female labor input (hrs)	869	1178	724	1664
(% of total labor input	(60%)	(60%)	(23%)	(23%)

Source: Sall et al., 3e Rapport Annuel, Campagne 1984-85, Table 14, ISRA, Djibelor.

Table 4.8 confirms our predictions that among the Diolas men specialize in the heavy tasks of land preparation (all plowing is done by men). Men and women both participate in the production of every crop. Female participation is greater or equal to men's participation for all crops. However, it is in transplanted rice cultivation that female participation is the greatest, and it is in groundnut cultivation that male participation is the greatest.

Among the Mandingized Diolas, gender differentiation is not by tasks but by crops. Men are in charge of the upland crops, while women are in charge of the lowland rice cultivation. However, women also participate in the harvesting of millet and sorghum.

Table 4.8
Sexual Division of Agricultural Tasks for Selected Crops Among the Diolas and the Mandingized Diolas of the Lower Casamance

	Diolas	Mandingized Diolas
1. Upland Cultivation		
Groundnuts		
Plowing	M	M
Sowing	F	M
Weeding	MF	M
Harvesting	M	M
Millet and Sorghum		
Plowing	—	M
Sowing	—	M
Weeding	—	M
Harvesting	—	*M
2. Lowland Cultivation		
Transplanted Rice		
Plowing	M	F
Transplanting	F	F
Weeding	—	—
Birdscaring	*F	—
Harvesting	F	F
Directly Seeded Rice		
Plowing	—	F
Sowing	—	F
Weeding	—	F
Birdscaring	—	F
Harvesting	—	F

Source: Sall et al., Rapport Annuel d'Activites No. 2, Campagne Agricole 1983/84, Annexes 4 and 5, ISRA Djibelor.

Note: F = tasks done by females at least 75% of the time
M = tasks done by males at least 75% of the time
MF= tasks done by males and females commonly
*F= tasks done primarily by females
*M= tasks done primarily by males
—= tasks not usually done

Table 4.9
Relative Contribution of Males and Females to Agricultural Tasks at Household Level: The Diolas and the Mandingized Diolas of the Lower Casamance
(% of Total Labor Devoted to Tasks)

	Diolas		Mandingized Diolas	
Agricultural Tasks	Male	Female	Male	Female
Land preparation	63	37	61	39
Sowing/transplanting	23	77	50	50
Crop tending/weeding	41	59	77	23
Harvesting	35	65	76	24
Post-harvest	40	60	91	9
Total	40	60	70	30

Source: Sall et al., Rapport Annuel d'Activites No. 2, Campagne Agricole 1983/84, Table 8, ISRA, Djibelor.

Table 4.9 shows that except for land preparation tasks, female Diolas are more active than males in agricultural activities. The opposite is true in the case of the Mandingized Diolas, where for every agricultural task except sowing/transplanting, male labor input is greater than female labor input. This is not surprising since women are primarily responsible for only one crop.

4.6 Conclusion

The object of this chapter was to hypothesize about the behavior of Diola and Mandingized Diola households with respect to the labor allocation strategies they adopt to reach their basic objectives. The hypotheses have been formulated on the basis of the opportunity sets of these two groups of households. In order to test the hypotheses, four aspects of labor allocation strategies have been selected: the relative importance of farm versus nonfarm activities; the relative importance of food cropping versus cash cropping; the methods of cultivation and techniques of production used; and the sexual division of agricultural tasks. Table 4.10 summarizes the major findings on the behavior of labor alloction strategies of Diola and Mandingized Diola farm households.

Table 4.10
Diola and Mandingized Diola Households' Labor Allocation Strategies: Study Findings

	DIOLAS
Farm vs. Nonfarm Activities	The greater part of their total income comes from farm activities, but this decreases with lower rainfall. Nonfarm activities are carried out during the dry season. Average rate of seasonal outmigration is less than 20%. Male and female rates of outmigration are about the same. More than 50% of migrants are teenagers.
Foodcrops vs Groundnuts	Labor allocation to foodcrops greater than to groundnuts and increases with higher rainfall. Degree of intensification greater in foodcropping than in groundnut production (more labor input per unit of land). Food production is diversified very little.
Methods of Cultivation and Techniques of Production	Use traditional hand techniques. Use of modern inputs (e.g., chemical fertilizers, improved seeds, etc). is marginal. Area cultivated per household is relatively small. Land preparation operations given great importance, especially in lowlands. Extensive transplanting. Demand for off-farm labor important. Greate emphasis given to lowland cultivation. The importance of upland cultivation increases in years of lower rainfall. Relatively flat distribution of monthly labor utilization, with highest points corresponding to peaks of rainfall.
Sexual Division of Agricultural Tasks	Female labor input in food crops is greater than that of males. Male input in groundnuts is greater than that of females. Men's and women's tasks tend to be complementary and cooperative, with women specializing in weeding, transplanting and harvesting and men specializing in land preparation. Total labor input per worker relatively high, with female labor input slightly higher than males.

Table 4.10 (Continued)

	MANDINGIZED DIOLAS
Farm vs. Nonfarm Activities	The majority of total income comes from farming, but nonfarm activities tend to increase in years of lower rainfall. Nonfarm activities carried out during dry season. Average rate of seasonal outmigration less than 25%. Male rate of outmigration higher than female rate. More than 50% of migrants are teenagers.
Foodcrops vs. Groundnuts	Labor allocation to foodcrops greater than to groundnuts except in yers of low rainfall. Degree of intensification in foodcrop production greater than in groundnut production except in years of low rainfall. Diversified food production.
Methods of Cultivation and Techniques of Production	Animal traction mainly used for land preparation of the uplands. Use of hand technologies in lowland and for most other upland cultivation tasks. Use of modern inputs is minimal. Area cultivated per household is relatively large. Flat ridging and direct seeding accentuated, especially in lowland cultivation. Demand for off-farm labor relatively important. Greater emphasis given to upland cultivation; however, the imporatance of lowland upland cultivation increases when rainfall is higher. Distribution of monthly labor ultilization not as flat, with peaks corresponding to peaks in rainfall.
Sexual Division of Agricultural Tasks	Female and male labor input in food crop production are about equal. Female labor input in groundnuts is marginal. Low level of gender cooperation in agricultural production. Women tend to specialize in lowland production. Men tend to specialize in upland production. Total labor input per worker relatively high, with male labor input higher than female's.

We observe some differences but also some similarities in the behavior of the both groups (Table 4.10). Both rely primarily on farming for income, but the Diolas are less able than the Mandingized Diolas to do so. Not only do the latter have larger farms and a larger family supply of labor, they have a comparative advantage in the production of groundnuts. Considering that cash earning is the

primary purpose of nonfarm activities and considering that groundnuts are the highest cash yielding crop, the Diolas, whose groundnut production is restricted, have to depend more than the Mandingized Diolas on nonfarm earnings. However, for both groups, the need to increase nonfarm earnings increases in years of low rainfall.

For both groups, relying primarily on their own food production for family food supplies is very important. Because of numerous transportation and marketing bottlenecks, it is costly and risky to rely on the market for food supplies. Yet, in these recent drought years, farmers, especially among the Mandingized Diolas, have increased the emphasis given to groundnut production as a result of lower and less consistent rice production. However, among both groups the tendency remains to use labor resources more intensively in food production than in groundnut production.

Due to their upland dominated topography and to their drier climate, the Mandingized Diolas are more able to diversify their food production than are the Diolas. Both groups use traditional technologies, but especially the Diolas, due to socio cultural and socio economic constraints (e.g., religious prohibitions, scarce financial resources, unreliable system of input delivery, and underdeveloped research on food crops). As a result labor productivity is low.

The techniques of production for the Mandingized Diolas appears to be an adaption to the time constraints imposed by their rainfall patterns. These techniques usually constitute a less time-consuming alternative. For instance, the Mandingized Diolas do flat plowing rather than ridge plowing (which is more time consuming), direct seeding rather than transplanting. On the other hand, because time constraints inherent in rainfall patterns are not as tight in their case, the Diolas benefit from greater time flexibility. It seems through their techniques of production the Diolas have taken advantage of this time flexibility to compensate

somewhat for the fact that they have a small supply of family labor. As a result, the techniques they use may be more time-consuming than alternative techniques, but they ultimately reduce labor requirements. For instance, by transplanting rather than direct seeding, the need of weeding is reduced. Similarly, ridging (as opposed to flat plowing) discourages weed growth.

These are the main results of this study. However, these results should be seen in the context of our restricted sample of observations (only two years of available data, which are not the most representative years, considering the drought) and should be taken with caution.

In the conclusion of this study (chapter 5), we will reflect on some policy implications that this study might suggest.

CHAPTER 5

CONCLUSIONS

The main theme of this study has been that to understand farmers' priorities and needs and the labor allocation strategies movitated by these needs and priorities, it is indispensable to study farmers' opportunity sets. An opportunity set has been defined as the sum of the opportunities and constraints inherent in all the dimensions of their environment. Although Diolas and Mandingized Diolas and men and women within each ethnic group have the same basic goals, they do not have the same oportunity sets. On the average, the Diolas appear worse off than the Mandingized Diolas and the women appear worse off than the men. In the Diolas' case, several major constraints restrict agricultural productivity: scarcity of cultivable land as a result of growing population, salinization of riceland, low yields resulting from decreased rainfalls, and a difficult access to modern inputs. Because they have an agricultural system that is based on lowland rice production and therefore is not very diversified, the Diolas' agricultural system is very vulnerable, especially in years of lower rainfalls. Consequently, there is a need to diversify their agricultural production. ISRA and PIDAC have already attempted to diversify the Diolas' agriculture through the introduction of maize, cowpeas, sweet potatoes and manioc. Intensified production could be achieved through yield-increasing technologies such as the use of chemical fertilizers and higher yielding varieties, with an emphasis on drought-resistant varieties. However, in order to improve income these measures need to be accompanied with a sound agricultural credit system, competitive producer prices, especially for foodcrops and a reliable and efficient marketing system with lower transaction costs.

Another possibility is to expand the Diolas' opportunities of gaining their livelihood in rural areas, beyond farming. To accomplish this, it would be necessary to decentalize the industrial sector and improve the institutional and infrastructural setting in rural areas. If farmers cannot survive on farming alone, they will seek nonfarming activities, and if they cannot find such activities in the rural areas, they will migrate to the cities. This would cause social costs, such as the instability of rural families, loss of future leadership in villages, and other social problems typical of overcrowded urban centers.

In the Mandingized Diola case, a great deal of the constraints weighing on their agricultural production stems from their rainfall patterns which are short, low and irregular; and from the low fertility of their upland soils, which constrains the Mandingized Diolas from taking full advantage of their abundant land resources. However, independently of these constraints, the Mandingized Diolas need to mechanize their agriculture more because the areas they can presently put under cultivation with animal traction are limited by the fact that the subsequent agricultural operations are mostly done with hand technologies. This is an important consideration in the context of time constraints imposed by rainfall patterns, considering the absence of irrigation. Groundnut production, which has relatively low water requirements, is a more appropriate crop for the current situation and could provide more substantial incomes if farmers could increase their groundnut production. However, as long as farmers have to rely primarily on their own food production to secure family food supplies, they would rather intensify food production. Once more, a reliable food marketing system is a requirement.

With respect to the differential situation of men and women, it is important to realize that because groundnuts are a male-controlled crop, women gain little from its production. They do have responsibilities within the households, which

although distinct, are as important as the men's and require financial resources. When the rains were sufficient and when the economy was not as monetized, women were sufficiently well off with their rice production. That is no longer true. Women are in great need of increasing their incomes, and they need non-farm activities for that purpose. Due to their household duties, they are less mobile than men and thus less apt to migrate. Therefore, it is important to develop in the rural areas more female-oriented occupations, which would provide them with more reliable and more substantial earnings. In Lower Casamance, vegetable gardening is an example of such a move. However, for substantial profitability, it is necessary to develop good markets and good market channels for such activities. Increasing the competitiveness of foodcrops in relation to groundnuts and developing time-saving and labor-saving devices would greatly benefit women, as they are found in the most time-consuming agricultural tasks. When assessing farmers' opportunity sets, all the dimensions of the environment should be taken into account. However, among both Diolas and Mandingized Diolas it seems that a number of traditional customs may have been engendered by specific natural constraints which could not be overcome, given farmers' socio-economic means. For instance, among the Diolas, several physical characteristics of their environment may justify a sexual division of labor by tasks. Their climate only allows for the cultivation of rice, not for millet or sorghum. Given the bottlenecks of the marketing system and farmers' cash flow problems, farmers must rely heavily on the rice crop for their food supply. However, the topography is such that important land transformations are necessary prior to growing a rice crop. Since traditional hand tools are the main equipment available to farmers, these heavy preparation tasks are, in general, beyond women's physical strength. Similarly, the upland land preparation may involve the felling of large trees. Therefore, it makes sense that men specialize in land preparation. Since the rains

start slowly and do not peak until August, men have sufficient time to prepare both upland and lowland fields. By the same token, there are fewer than two months of rain left after August. This means that while the fields are being prepared, the rice crop must start being grown in nurseries, because the fields are flooded after the heavy rains of August. The flooding precludes direct seeding, and there are not enough rains left to satisfy the water requirements of an entire rice cycle. Therefore, while men are busy with the land preparation, women must start growing the rice crop in the nurseries. Similarly, while women are transplanting, men must take care of the upland crops. After the transplanting, women can help men with weeding of upland crops prior to harvesting the rice.

Among the Mandingized Diolas on the other hand, the rains peak early in the season; therefore, there is a rush to complete land preparations quickly. However, while land preparation of the upland fields is physically very demanding and is thus a man's job, in the lowlands the smaller number of rivers and the less abundant rains do not require much bunding and diking. Therefore, the preparation of the ricefields are much simpler here than among the Diolas and therefore within women's physical capabilities.

Thus, among the Diolas, women need the physical strength of men and men need women to start growing the crop in the nurseries and for transplanting while men tend the groundnut crop. Among the Mandingized Diolas, women can raise a rice crop by themselves and there is no need for either sex to go back and forth from one level of the toposequence to the other. Also, among the Mandingized Diolas there is an advantage to sexual specialization by crop, considering the shortness of the rainy season and the importance of timely weeding for all crops. Hence, in both cases, natural circumstances may justify their respective mode of sexual division of labor.

Another example is the non-use of animal traction among the Diolas. The presence of extensive stumps and termite hills, the scarcity of plateaus and the time flexibility allowed by the rainfall pattern, makes the use of animal traction impractical. Land availability is restricted and time pressures are not as serious as in the case of the Mandingized Diolas.

In most of West Africa, agricultural technology is still not very mechanized and thus must be complemented by individual physical capabilities. As a result, agricultural operations are often sex-linked, since men and women have generally different physical skills. Hence, a household's gender makeup plays as important a role as climatic conditions or land resources in determining farmers' ability to fulfill their basic goals. Similarly, the sexual division of labor is as much of a tool used by farmers to reach their objectives as is their choice of cropping pattern. Therefore, for sound recommendations to planners and policy makers concerning semi-subsistence farm households, it is as crucial to understand the dynamics of genders' contributions to agricultural activities as it is to grasp those of climate and topography.

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