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GUINEA NATURAL RESOURCES MANAGEMENT ASSESSMENT

Martha Gaudreau, Team Leader, DAI

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Karen LeAnn McKay, DAI  
Barton Sensenig, E/DI

March 5, 1990

Natural Resources Management Support Project  
(AID Project No. 698-0467)

Contract No. AFR-0467-C-00-8054-00



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## EXECUTIVE SUMMARY

In the midst of a rapidly escalating level of project activity and international attention, the Republic of Guinea is working to balance the needs for natural resources conservation and economic development in the Fouta Djallon highlands. After a long period of economic and social disruption during the First Republic, development and natural resources management are moving ahead in Guinea.

The Fouta Djallon highlands is an area of particular interest to the Government of Guinea, donors and the international community. As the source of several major West African rivers, the management of this region's natural resources is particularly critical. Several recent initiatives address natural resources management nationally and regionally: the Environmental Action Plan, the Tropical Forestry Action Plan and the Integrated Management of the Fouta Djallon Watershed project. Coordination of ongoing and proposed activities is a major government concern.

This report is intended to complement these national and regional level programs by offering a look at local level activities. The objectives of this report are to identify and document natural resources management activities that are of interest from the farmer's point of view and from the point of view of environmentally sustainable development. Although our time was limited and most projects are still too new to judge success or failure, the team identified a range of promising initiatives carried out by government, donor and NGO projects, and by farmers themselves.

The most promising interventions built upon traditional techniques and/or addressed farmers' immediate concerns of increasing agricultural productivity and income. Interventions that focused exclusively on project objectives and experimentation have made some technical contributions, but remain untried in terms of farmer acceptability and sustainability.

Traditional techniques that offer opportunities for improvement include agricultural production in the homegardens or tapades, living fences, and gardening and tree nurseries in the bottomlands. Project introduced activities that seemed particularly promising included the formation of production groups (primarily gardening groups), improved metal cookstoves, extension techniques using model farmers and farmer to farmer visits, protected water sources and improved pasture and livestock related interventions.

It should be emphasized that this report identifies and documents promising interventions that the team was able to observe. A more indepth analysis, including financial analysis, and proposed improvements to the identified interventions is found in the NRM Action Program.

The complexity of the region and its people pose exciting opportunities and considerable constraints for natural resources management. This report should be viewed as an informational first step towards further investigation of ongoing activities and ways to build upon and improve them. A balance not only between conservation and development, but between technical and socio-economic solutions to problems will be critical.

## ACKNOWLEDGEMENTS

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We wish to thank our colleagues who accompanied us on our visit to the Fouta Djallon:

Mr. Ibrahima Kegneko Diallo, Direction des Forets et Chasse

Mr. Alhassane Balde, Centre de Recherche Agronomique de Bareng

Their knowledge, insight, guidance and humor contributed greatly to our work and to this report.

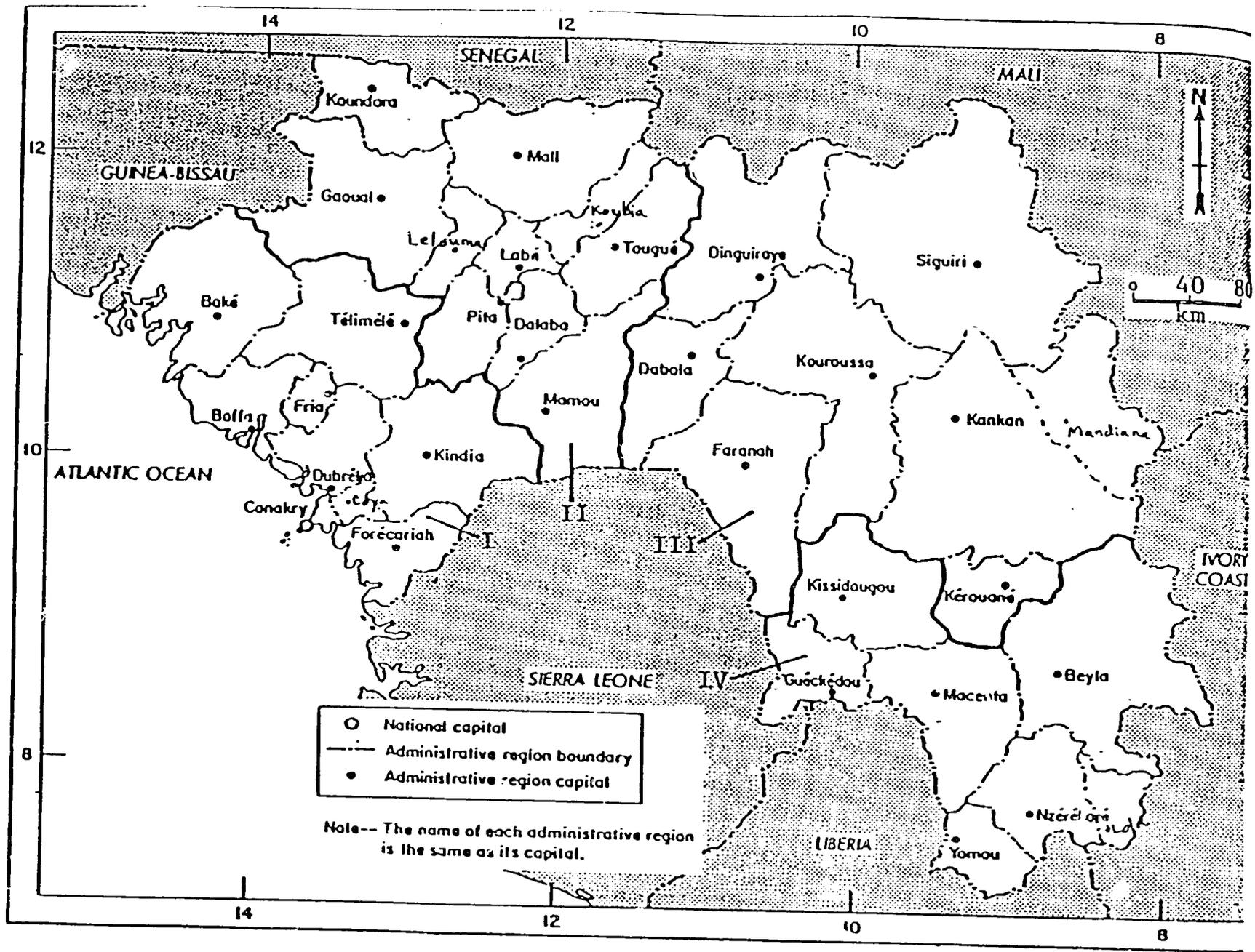
Any errors in fact or interpretation are the fault of the team. this report presents the opinions of the authors, not necessarily the views or policy of USAID or the Government of Guinea.

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## GLOSSARY

BRP	Bassin Representatif Pilot
BRT	Bassin Representatif Temoin
CECI	Centre Canadien d'Etudes et de Cooperation Internationale
CEPAM	Centre pilote d'action maraichere de Dalaba
EAP	Environmental Action Plan
EEC	European Economic Community
ESSOR	Echange Sud Sud-Ouest en Milieu Rural
FAC	French Fund for Aid and Cooperation
FAO	United Nations Food and Agriculture Organization
FENU	Fonds European de Nations Unis
IMFDW	Integrated Management of the Fouta Djallon Watershed
MARA	Ministry of Agriculture and Animal Resources
NGO	Non-governmental organization
OAU	Organization of African Unity
PDA	Projet Developpement Agricole
PDR	Projet de Developpement Rurale
SNAPE	Service Nationale d'Amenagement des Points d'Eaux
TFAP	Tropical Forestry Action Plan
UGVD	Union Guinean des Volontaires pour la Developpement
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
VED	Volontaires European de Developpement

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○ National capital  
 - - - Administrative region boundary  
 ● Administrative region capital

Note-- The name of each administrative region is the same as its capital.

- I Lower Guinea
- II Middle Guinea
- III Upper Guinea
- IV Forest Region

REPUBLIC OF GUINEA

Source: Adapted from Varady, 1983

## 1. INTRODUCTION TO THIS REPORT

Environmental degradation and the loss of primary productivity it brings has become a global concern, particularly for countries in which the majority of the population is rural and directly dependent upon the natural resource base. The Republic of Guinea, as one such country working to deal with these problems, has taken significant steps to address the environmental problems and natural resources issues facing its people.

In 1983, following extensive international discussions and meetings with the Organization of African Unity, the United Nations and neighboring countries, the Government of Guinea embarked upon a comprehensive program to manage the important watersheds of the Fouta Djallon highlands; the source of several major West African rivers. The IMFDW Project (Integrated Management of the Fouta Djallon Watershed), which will be described further below, is a major effort to both protect and develop this densely populated area.

Guinea has also completed the initial studies and plans for a Tropical Forest Action Plan (TFAP) which outlines major areas for forestry development and protection activities. Finally, in the last two years, the Government of Guinea has been working to develop an Environmental Action Plan (EAP) that will help to integrate environmental concerns and opportunities into development activities. Given the lack of infrastructure, communications and information available, Guinea's decisive actions to come to terms with the long-term needs of the country's rural population are impressive.

In the United States, concern over the global environment and its link to development has touched many aspects of U.S. foreign relations, including foreign assistance through the U.S. Agency for International Development (A.I.D.). The Natural Resources Management Support Project for Africa (NRMS), financed by the Africa Bureau of U.S.A.I.D., is an outgrowth of this concern.

The NRMS project hopes to assist both U.S.A.I.D. missions and African governments to identify and analyze successful or promising activities that are already being carried out by small farmers and have the potential to serve as models for donors and governments. This micro-level approach will complement Guinea's national level efforts through the TFAP, the EAP and the integrated watershed management project. Interventions which start with village priorities and practices and build toward long-term natural resources management offer the best hope for sustained success through collaboration between villagers and government.

This natural resources management (NRM) assessment then is both a reflection and an expression of the interests and priorities of two countries: the Republic of Guinea and the United States of America. As such it was a joint effort with the commitment of time, resources and personnel from both U.S. A.I.D. (through the Africa Bureau's NRMS Project) and the Government of Guinea through the Ministry of Agriculture and Animal Resources (MARA) and in particular the Department of Forestry and Hunting.

The assessment team was a multi-disciplinary team composed of a forest economist, a sociologist, an agronomist, a social forester, a watershed management specialist, a forester, an agricultural researcher and an extension/rural development specialist. The assessment was carried out in January and February, in the middle of the dry season. This limited our opportunities to see the main agricultural systems of the home gardens and grain fields in production.

This assessment was limited to the Fouta Djallon region of Guinea for several reasons. The Government of Guinea places a high priority on this area because of its dense population and important watershed value. There are many activities beginning in the area. U.S.A.I.D., following Government of Guinea priorities, also plans to focus its natural resources management activities in the Fouta. Although every effort was made to spend as much time as possible in the field, time limitations necessitated restricting our field observations to the Prefectures of Lelouma, Labe, Pita, Mamou, and Dalaba within the Fouta Djallon (see map).

Even within these limitations the diversity of the Fouta Djallon region and the dynamism of its people was obvious. The interventions discussed below may not be applicable for all areas within the Fouta Djallon, however, the team feels that within each intervention there are elements of interest and value to the region as a whole.

## **2. INTRODUCTION TO GUINEA AND THE FOUTA DJALLON HIGHLANDS**

### **2.1. Natural Regions of Guinea**

Guinea is divided into four regions which correspond to the major natural regions: Lower Guinea, Middle Guinea, Upper Guinea, and Forest Guinea.

Lower Guinea can be subdivided into three zones: the coast with alluvial plains and mangrove swamps where swamp rice, tubers, vegetables, and various fruits (especially mango, pineapple, oranges) are the predominant crops; the interior plain, leading gradually to the foothills of the Fouta Djallon mountain range, where fruits, vegetables and bottomland rice predominate; and the foothills with poorer soils susceptible to aluminum and iron toxicity where traditional rainfed crops (rice, maize, peanuts, and fonio) and livestock are important. The rainfall of Lower Guinea varies from 2,000 to 4,000 mm per year with a growing season of 6-7 months.

Middle Guinea (the Fouta Djallon highlands) is an area of lower rainfall (1300 to 2000 mm/year) and cooler climate with a growing season from 5-6 months. It varies in altitude from 600 to 1600 meters. It is divided into the northwest plains, the Fouta Djallon Mountain range, and the southern foothills. The northwest plains are characterized by rice, peanuts, sorghum and extensive livestock production. The Fouta Djallon mountain range, which has poor soils but is densely populated, is characterized by a system of intensive gardening around the homestead, extensively cultivated cereal fields (fonio, upland rice, sorghum) and limited areas of grain legumes and vegetable production on the better soils. Livestock is managed extensively and integrated with

agricultural activities through the use of manure in the homegardens. The foothill area south of the mountain range produces fruits, vegetables, fonio, tuber crops, and livestock.

Upper Guinea is primarily an area of savanna with transitional areas bordering Middle and Forest Guinea. The principal crops are rainfed rice, maize, peanuts, sorghum, cotton, cassava and fruits such as citrus. Livestock is important in this area. Along the more densely populated riverbanks and floodplains floodplain rice is also grown. Rainfall is variable particularly in the north and averages between 1300 and 2000 mm a year with a growing season of 4-5 months.

Forest Guinea is a zone of hilly terrain with some remnant rain forest and gallery forest. The eight month rainy season, with annual rainfall averaging 1900-2500 mm/year, permits multiple crops a year. Shifting cultivation is practiced with upland rice being by far the most important food crop. Perennial crops such as coffee, oil palm, cocoa, rubber and quinquina are grown in the forest.

## 2.2 History of the Fouta Djallon

Itinerant Fulbe cattle herders began moving into the Fouta Djallon in the fifteenth century. They lived in harmony with the agricultural Diallonke inhabitants until the Fulbe-led jihad of 1727-1777 in which the Diallonke and their allies were generally reduced to serfdom. The Fulbe then settled and formed a confederation in the Fouta Djallon.

A quasi-feudal social structure developed with four status levels: (1) chiefly families, (2) the Free Fulbe ("lassilibe" -- who aided in the Jihad), (3) the Fulbe of the bush ("burure" -- who avoided or hindered the Jihad), and (4) serfs ("mattyudo"). Wars and raids continued, resulting in captured serfs from many tribes. Four classes of villages evolved which reflected these social divisions: "diwal" (provincial capital), "misside" (a mosque village), "fulasso" (a Fulbe village without mosque), and "runde" (a serf village).

Fulbe were generally literate in the Arabic script (most male Fouta inhabitants today are literate in Peular, thanks to religious education), but serfs were denied education, religious status and land ownership. Serfs generally converted to Islam and accepted Fulbe values, but their access to religious rites was mediated by the Fulbe who held all religious offices. Because most of their time was spent working for their masters, serfs had little time for their own fields and were generally poorly clothed and nourished (Derman 1973:12-42).

During the colonial period (1896-1958), the French introduced major political and economic changes. Loyal "Chefs de Canton" replaced hereditary chiefs. Their new roles included collecting taxes, organizing forced labor for public works, and conscripting troops for the French Army (Crowder 1968:193).

The French ended warfare and the slave trade, but, for administrative convenience, did not outlaw serfdom. Their economic policies, however -- most importantly the demand for cash payment of taxes from noble and serf alike -- gradually undermined the institution of serfdom. The search for tax money initiated the practice of young men emigrating to seek employment, replaced barter with cash sales, monetarized payments to artisans, and gave birth to new occupations. Eventually markets were established and economic competition developed. Money made status more transferable, and serfs could purchase freedom (Derman:1973:43-56).

In 1958, Sekou Toure led Guinea to become the only African nation to opt for immediate independence rather than accept Charles de Gaulle's proposed autonomy within a Franco-African community. Infuriated, the French left immediately, ripping out telephone poles, destroying military equipment, and burning civilian archives as they went. French citizens fled, withdrawing massive amount of capital, thus helping to bring about Guinea's economic collapse.

The First Republic (1958-1983) again brought major political and economic changes. Serfdom was abolished and all citizens were considered equal. A Chinese-style socialist political and development strategy was adopted with state-run farms and weekly meetings of revolutionary units. These politics, along with factors such as human rights abuses, led millions to flee to neighboring countries. The remaining farmers could only work about one-fourth of the country's arable land.

Sekou Toure (a Malinke) arrested, tortured and executed many political opponents. In 1976 he implicitly charged the entire Fulbe population with complicity in an attempted coup and one-fourth of the country's population (mostly Fulbe) went into exile.

The Second Republic, which followed immediately upon the death of Sekou Toure in 1984, has taken steps to restore an open society and reestablished free enterprise. Bustling economic activity is evident throughout the country and especially in the Fouta Djallon; roads are being repaired, and extensive construction is underway. Reversing the disastrous decline in agricultural productivity will not be easy, but Guinea and the Fouta Djallon are now clearly on the march (Newton 1988:188-190).

### 2.3 Land use in the Fouta Djallon

As mentioned above, the Fulbe inhabitants of the Fouta Djallon were traditionally nomadic cattle herders. Although no longer nomadic in the strict sense of the word, some seasonal herding is still practiced. For both cultural and ecological reasons cattle remain a fairly important component of natural resource use in the Fouta Djallon. The breakdown of traditional livestock management techniques during the First Republic (which will be discussed below) continues to have effects on land management today.

Traditionally land is owned by men and subdivided among their sons at death. In 1958, the government claimed title to all land, but people continued to work the land as before. Under the First Republic, however, it became possible for former serfs to acquire rights to land they had traditionally farmed or to purchase land (Heermans and Williams 1988). Women gain access to land through husbands or male relatives. Former serf and female headed households are most disadvantaged by the current land tenure system. Most people do not own the land they farm (Roberts et al 1988).

The Fulbe describe their land in seven categories: "Sountoure" (women's household gardens, known as tapade in French), "ayinde" (flat or dry land), "dunkire" (stream border-lands), "dantare" (workable, but exhausted soils), "hansangare" (hillside slopes), "hollande" (compacted clay soils), and "bowe" (crusted laterite). A detailed description of each of these pedomorphological units can be found in Landeck (1989).

Tapades are fenced garden areas around the houses, enriched by manure and mulch, in which a wide variety of crops are grown, including maize, peanuts, taro, cassava, peppers and fruit trees. Tapades can be found on a variety of the above soil types with productivity a function of local soil fertility, amount of manure input and labor.

"Dunkire", productive streamside soils, are used for gardens in both the wet and dry season. They are cultivated by both men and women. Traditionally men grew bananas, but vegetables are now popular with both sexes. Wet season crops are often rice or potatoes, depending on moisture, and dry season crops usually include tomatoes, onions, cabbage and lettuce.

"Ayinde", "dantare", and "hansangare" lands are used for extensive cultivation. Land is cleared and cultivated one to three years depending on soil fertility and then left fallow for an extended period. In heavily populated areas, traditional fallows of 10-12 years have been shortened to as little as three to five years. Rice or fonio may be planted the first year, followed by fonio. Peanuts and sorghum may also be cultivated.

"Hollande" are heavy, fine textured soils traditionally used for pasture. When intensively managed, these soils have considerable potential for agricultural production. Several projects are currently engaged in managing this soil type and are discussed below.

"Bowe" is the Fulbe name for bare lateritic crust with minimal topsoil. These skeletal soils support little to no woody vegetation, however, a grass cover does appear during the rainy season. Grazing is the only agricultural activity possible on this land type.

### 3. CURRENT SITUATION IN THE FOUTA DJALLON

#### 3.1. Demographics

According to a national census taken in 1980, Guinea's population was between 5.3 and 5.4 million persons, with about one-third of these in the Fouta. With the exception of Conakry, the Fouta is thus the most densely populated region in Guinea (Varady, 1983). More recent figures (estimates) cite Guinea's 1989 overall population between 6.7 and 7.1 million. Population growth rates are estimated around 2.5 percent. It is unclear exactly how reliable these figures are and to what extent they take into account outmigration and other fluctuations in the population.

Heermans and Williams (1988) suggest that as population in the Fouta has increased the agricultural land exploited per capita has declined. They compare the 1955 study of the "dantare" soil type in which households averaged 5.6 members with tapades of 0.50 hectares and fields averaging 1.0 ha. to a 1988 survey of 37 households throughout the Fouta showing 8.7 persons per household and tapades still averaging 0.50 ha., but field size reduced to 0.50 (Sources: Boulet and Talineau 1986 and Mission Demographique de Guinee 1955).

Such field reduction is likely in the densely populated plateau areas where less arable land is available. It should be emphasized, however, that the Fouta Djallon encompasses a wide range of geographical diversity and population pressure. Such average statistics are not representative of all areas.

An equally important demographic issue is the change in the structure of the rural population as a result of rural exodus. Rural exodus from the Fouta Djallon dates back to colonial times when men left home to earn cash for French taxes. Now it is common for young men to go abroad or to urban areas in search of adventure and money. Many return for visits during the dry season when roads are passable, but leave again before the heavy work begins in the next rainy season. This customary exodus of young men (mostly 15-40 years old) was exacerbated by the flight of refugees from the Fouta Djallon during the First Republic. Although many of these are now returning, they tend to return to urban centers rather than their original villages.

The exodus seriously limits the agricultural labor force and results in the "feminization" of the rural areas. A survey of four villages in Labe found 40 - 61% of adult males absent in March, the period for clearing fields, preparing land, and repairing fences. Most go to the cities. There is also considerable seasonal migration to the peanut raising areas of Senegal.

Many men do return after years abroad, but by then they are elderly. Thus, agriculture is disproportionately in the hands of women and old men. Some of those who return from abroad bring financial resources and innovative ideas for development, but the actual strength of youthful "manpower" remains lacking. The female headed households left behind cannot generally farm fonio fields in addition to their tapades, consequently they must purchase their grain at the market. Although financial

remittances from family members help, they are often not sufficient to cover these expenses.

### 3.2 Environmental trends

Two environmental changes that have affected the lives of the Fouta inhabitants are changes in annual rainfall and the degradation of the natural resource base.

Villagers interviewed throughout the Fouta claimed that rainfall has been decreasing and is becoming more unpredictable. Others, however, were happy that last year's rains had returned to normal. Statistics for the region as a whole do indicate a downward trend in precipitation levels over the last 20 years. As methods to accurately predict long term weather patterns do not exist, decision makers must manage the resource to account for fluctuations in climate.

Available evidence indicates that degradation of the natural resources base in the Fouta Djallon is occurring at an accelerated rate. Villagers state that a lack of rainfall and declining soil fertility have reduced agricultural yields. As the recent increase in human population places increasing pressures on the natural resources base, climatological droughts, whether part of a natural cycle or man induced, can unravel the traditional regeneration systems to the point where many years are required to return the land to its previous productive status.

Early observations of erosion in the Fouta Djallon led to statements such as the region was "moving more and more rapidly toward total ruin" (Tricart, 1956). Boulet and Talineau countered that the current topography is a result of long term geological erosion and that reports of severe erosion were exaggerated. Other recent observers (Goodson, 1987; Freeman, 1987; and Heermans and Williams, 1988) claim that severe erosion does exist on a local level, however, infrastructures within the major river basins in neighboring countries are not yet at risk.

Although our group did not witness water erosion during our dry season visit, observations, review of the literature and interviews with farmers and project personnel lead us to the following conclusions:

- o The actual forest area (estimated at only 4 percent of the land area, however wooded savanna covers an even larger area) in most parts of the Fouta has not diminished as drastically as in other parts of Guinea. Instead of extensive deforestation, a more subtle land and forest degradation threatens the agricultural productivity and quality of life of the Fouta's inhabitants.

- o A decrease in hillside fallow may cause loss of soil fertility and erosion. Soil fertility is linked to the organic matter content, which in turn relates to the vegetation cover and erosion control. Loss of agricultural productivity is a symptom of erosion and loss of soil fertility. We heard widespread reports of fertility loss throughout the Fouta, however, accurate agricultural statistics are still lacking.

- o A decrease in fallow periods also leads to a depletion in the number of floral and faunal species, as many require the complex structure of a mature forest for adequate habitat.

- o Reports of clogged irrigation canals, and damaged roads and bridges are also evidence of damage from accelerated erosion.

The team agrees with previous statements that erosion is mostly local in nature. This does not mean that the problem should be trivialized, rather, those people living in the affected region will feel the consequences long before downstream water users. Measures taken to protect the upstream soil cover now will be less costly than the engineering costs of flood prevention and dam and reservoir maintenance.

#### 4. PROJECTS AND ACTIVITIES IN THE FOUTA DJALLON REGION

As was mentioned in the introduction there has been international attention focused on the Fouta Djallon region for several decades. Much of this attention began in the 1950s when the Organization of African Unity became concerned with the importance of the Fouta Djallon highlands as the watershed for the three major West African rivers. Below is a brief introduction to the major natural resources management projects in the region. These projects will be explored in further detail in Section 5.

##### Integrated Management of the Fouta Djallon Watershed

In 1988, the Government of Guinea instituted the Integrated Management of the Fouta Djallon Watershed Project (IMFDW) following a preliminary three-year phase (1984-1987) of extensive studies. Twelve pairs of watersheds (Bassins Representatifs Pilots - BRP, Bassins Representatifs Temoins - BRT) were chosen throughout the Fouta Djallon highlands and proposed to donors for funding. The basic objective of the project is to carry out adaptive research and extension that will discover techniques to both protect these watersheds and to improve their productivity. At the moment there are three watersheds that are funded and actively managed: BRP Pita, Guetoia (FAO), BRP Mamou, Bale and BRP Mamou, Bafing (FAC). Several others are in the process of being funded.

##### Bassin Reprerentatif Pilot (BRP) Pita

The central plateau in the Pita Prefecture is characterized by high population, intensive land use, and a preponderance of the impoverished "dantare" soil type. This area is generally less wooded than other areas in the Fouta.

The activities in Guetoia have been in operation longer than other natural resources projects in the region. It is now a geographically focused version of activities that formerly covered a larger area. Up until 1989 the project's main thrust was research - species trials, erosion control and plantation techniques, etc. There was very little emphasis on farmer participation. In the last year, due at least in part to a new

approach on the part of FAO in general, the project has started to reorient itself to a more participatory approach.

#### Bassin Representatif Pilot (BRP) Mamou

There are two watersheds, Bafing Source and Bale, in the BRP Mamou project. The Bafing Source is characterized by dense population and is physically representative of the southeastern Fouta. Overgrazing and population pressures are major causes of land degradation. Bale, on the other hand, with a lower population density, is more representative of the transition between the Fouta Djallon and Upper Guinea. Uncontrolled fires are a major problem in this area. (Chapellier, personal communication, 1990).

The two watersheds managed out of Mamou and financed by FAC have had a somewhat different approach than that of BRP Pita with the same major objectives. These projects have taken a more integrated and participatory approach to watershed protection and development.

#### Rural Development Project - Labe

The integrated rural development project based in Labe (Projet de Developpement Rural, PDR), financed by UNDP and implemented by FAO covers four prefectures: Mamou, Labe, Pita and Dalaba. It is the largest project in the region. This project covers a wide variety of small interventions, including agriculture, credit, extension, women's programs, small enterprise and others. In essence it is a big project composed of small projects.

#### Non-governmental Organizations (NGOS)

There are a small number of NGOs operating in Guinea and in the Fouta Djallon. The team was able to contact Echange Sud Sud Ouest en Milieu Rural (ESSOR), a French NGO, Volontaires Europeens de Developpement (VED), a loose coalition of European volunteers, Centre Canadien d'Etudes et de Cooperation Internationale (CECI), a Canadian NGO and the Union Guinean des Volontaires pour le Developpement (UGVD). All four were involved in natural resources work from living fences to gardening. Most were only in their second year of operation.

NGOs activities often started with institutional and organizational issues such as organizing farmers into farming groups to give them access to credit and inputs (see Section 5.7). These types of activities addressed farmers needs for quick returns and helped to establish the NGO in the community. Most NGOs had not yet moved beyond these activities although many had plans to begin other natural resources activities soon.

## Centre pilote d'action maraichere de Dalaba - Projet CEPAM

This project is financed by FAO/UNDP to enhance vegetable production in a valley fed by a dam constructed with Saudi Arabian and German financing. It organized farmers into a group and gave technical assistance in vegetable production. A truck assured transport to the Conakry market. The project is expanding to include testing of new imported fruit varieties under a Belgian regional project.

## Projet d'actions de production et de promotion des organisations paysannes sur le versant Sud-Est du Fouta Djallon--UNDP/FENU

This project took over three plains that had been improved either by Service Nationale d'Aménagement des Points d'Eaux (SNAPE) or Genie Rural. The infrastructure that had been built included check dams and distribution canals. Since the users had never been implicated in the SNAPE actions, the land was never exploited to its potential.

The SE versant project took over the Soumbalako plain (Marnou), the Douka plain (Tougue) and the Ditinn plain in Dalaba. Rice, vegetables and maize are the principal crops that are being promoted. The project has a credit action, an extension function, and an engineering component.

## **5. PROMISING AREAS OF INTERVENTION**

### **5.1. Tapades**

Tapades, "sountoure", are traditional home gardens of the Fouta Djallon that are generally enclosed by a fence. It is the man's responsibility to provide his wife with a garden area before their marriage and in polygamous families, each wife has her own garden area that she cultivates with her children. While gardening in the tapade is predominantly a woman's activity, fence construction and maintenance and fruit tree management is the man's responsibility.

When the tapade is first established, the soil fertility is very low and cassava is the first crop cultivated. Over time, soil fertility is built up through the addition of animal manure (cow, sheep, goats, chicken), household wastes, ashes, and leaves brought in from the forests.

Once established, the tapade is an intensive mixed cropping system cultivated annually with a variety of crops (maize, beans, taro, peanuts, small hot peppers, menace, tomatoes, gumbo, eggplants) grown in association (intercropped). There are fruit trees such as mangoes, oranges, papayas, and avocados as well as cola trees under the control of the men. Leafy vegetables similar to spinach and lemon grass are grown near the house. There are also isolated coffee and cotton plants for family use. The tapade is a major source of family food and its variety of annual and perennial crops permits continuous harvest into the dry season.

While the system of tapades is generally found throughout the Fouta Djallon, the choice of crops and management systems and the condition and productivity of tapades varies from one location to another. In some areas the tapades we visited seemed very productive and well managed whereas in other areas both men and women expressed concern over declining productivity due to lack of manure and declining soil fertility, plant diseases, termites and livestock damage. The team did not have the time to conduct an analysis of all the factors affecting tapade management and productivity.

In the village of Korbé (Lelouma prefecture), ruminants (both large and small) were essentially banned from the village tapades except if tethered. In each tapade chicken coops were built off the ground with a space below for catching the wastes. The women mixed the chicken manure with household ashes and distributed them throughout the tapade. Cow manure could be seen scattered throughout the tapades indicating that women were collecting it during the dry season. There seemed to be a deep layer of organic matter (leaves, stalks, household refuse, manure) ready to turn under when the women start preparing the land for next season.

In Kebaly (Dalaba prefecture), on the other hand, the depth of organic matter scattered over the tapades visited seemed less than at other areas visited. One farmer who was participating in the improved tapade program of the FAO-Labe project noted that maize yields in his wife's garden increased significantly when he constructed a barbed wire fence to keep the animals out. The wooden fences around the tapades did not seem as durable throughout this village as in others that were visited and animal damage was a problem.

#### 5.1.1 Soil fertility and mulching

Most of the tapades visited in the Fouta (prefectures of Dalaba, Mamou, Pita, Labe, Lelouma) were on flat areas or on slightly sloping land. Soil degradation (decreasing fertility) more than soil erosion was a major problem facing the women farmers. There are several traditional methods for maintaining soil fertility, however, some of these are breaking down due to rural exodus, changing practices and population pressures.

Throughout the prefectures visited, within the tapades and in some cases just outside the enclosures, small stables raised above the ground were constructed to facilitate the collection of small ruminant manure. Night parks, staking animals within the tapades, limited stabling and herding are all methods of assuring easily obtainable manure for the tapades. Isolated corrals at the edge of the tapades for keeping the cattle confined during the evening facilitated collection of manure, but these were not common. This issue will be explored further in section 5.4.

In the Pita area, some women lamented the fact that manure is becoming more difficult to collect and their tapades are less fertile than before. In addition to manure, mulching with leaves had been commonly practiced. Women would cut branches in the forest, bring them back and scatter the leaves throughout the tapade. The wood would

be used for some other purpose. Now leaf collection is limited since it is forbidden to cut branches from some of the local trees that were previously used.

Mulching with straw from the cereal crops and leaves from some trees and shrubs is still done. In Bantignel (Pita prefecture), one tapade had large piles of mulch around the base of the fruit trees and around yam mounds. In Compaya (Labe prefecture), the president of the women's group had large quantities of mulch in the part of the tapade which had been intercropped to maize and beans.

According to the Council of Elders in Sonke (Pita prefecture), young farm families are less willing to go out to collect manure in order to maintain the fertility of the tapades. There also seems to be less manure available, a situation that could be further exacerbated as more bottomland is brought into intensive production and competes with the tapades for manure.

Several times women farmers were asked about the relative importance of manure for the tapades versus manure for the bottomlands and they generally considered the tapades to be more important. One woman from Bantignel (Pita prefecture) solved the problem by staking her cows in the tapade to collect manure. On the way to her vegetable garden, she would collect manure in the open pastures to be used in the bottomlands. Since many riverbanks are just being opened up, the competition for organic matter may not yet be felt by women.

### 5.1.2 Compost

While composting is not traditionally practiced, holes are dug and filled with household waste for planting bananas, yam, and some fruit trees.

The PDR-Labe project is incorporating compost into its new, improved tapade program. Compost pits were being dug in Kebaly (Dalaba prefecture) but were not yet in production. Compost pits are being encouraged by the BRP-Pita project but these are associated with the bottomland vegetable production and with the fonio fields. Both compost pits and piles are being constructed. At the Bareng Station, research is being conducted to determine the relative effectiveness of above ground and below ground covered compost production.

The UNDP-FENU project in the Dalaba Prefecture is advising two pit compost production so that the compost can be turned after several months to speed up decomposition. A farmer from Ditinn who recently emptied his compost pits for use in potato production is very pleased with the results. He was able to plant his field earlier than his neighbors because he was not obliged to look for manure. His plants are looking healthy and he anticipates an early harvest, giving him a slight advantage in marketing.

Staff from the Projet Developpement Agricole project in Timbi Madina (VED) mentioned that they use composting to reduce the fruit fly populations attacking the orange trees. They gather the fallen fruit and add it to the compost piles. The heat

within the pile kills the flies. Besides the obvious benefits for soil fertility, this technique could be explored as an effective treatment for this important fruit pest.

### 5.1.3 Alley cropping

Alley cropping research is being conducted in a bottomland area of Telire (Labe prefecture) by a research team from Gembloux, Belgium. The legume species being tried are Calliandra calothyrsus, Flemingia congesta, Cajanus cajan, Leucaena leucocephala and Acacia auriculiformis. In the alleys, forage species such as Panicum sp. and Pennisetum sp., vegetable crops such as tomatoes and onions, and green manure crops such as Crotalaria sp. are grown.

In Sallia (Pita prefecture), a farmer has agreed to try alley cropping using flemingia to improve the depleted soil of the tapade extension. Between the rows of flemingia, canavalia is being grown and turned under. The flemingia has been cut twice and its leaves added to the soil. The farmer said he will give the experiment three years to see if soil fertility improves.

With dry season forage a problem, alley cropping on a small scale within the tapade may be a way to increase soil fertility and provide dry season forage. Species such as cajanus (pois d'angole), flemingia, and calliandra grow well in parts of the Fouta and can be used effectively in alley cropping as multipurpose plants.

Because it involves trees and crops, any decisions about alley cropping in the tapades should involve both men and women.

### 5.1.4 Crop varieties

Within the tapades, women have two or three varieties of each crop. For example, a woman near Lelouma has three varieties of maize: a late white variety used for couscous, an early red variety used for regular consumption and an improved yellow variety. She has two varieties of taro and three varieties of menace in her tapade.

The National Seed Project collected local varieties of rice, peanuts, and cassava from each of the four natural regions in Guinea. In Middle Guinea, sixty four varieties of rice were collected, thirty of maize, twenty of peanuts, and twenty-one of menace. A certain number of each crop were kept for future evaluation since it is felt that many local varieties have degenerated and need to be reconstituted.

The Director of Agriculture, Lelouma prefecture, has collected germplasm from each of the major crops grown in the prefecture--rice, fonio, sorghum, peanuts. He has given seed samples to the Bareng Research Station and wants to start an evaluation program to identify the most appropriate varieties for use under different agroecological conditions. He said that farmers are continually asking for early varieties since the rainfall over the past years has become increasingly unpredictable.

With regenerated local varieties available to farmers, and if soil fertility is maintained, there could be increases in production with limited input.

In the Dalaba and Mamou prefectures, with the increased market for passion fruits, these could be introduced into the tapade to grow along the fences using the fence as staking material. CEPAM has introduced passion flower into one tapade in Ditinn and so far the results are promising.

### 5.1.5 Fertilizers

Farmers who are associated with rural development projects have access to fertilizer, although this has not yet extended to tapades as projects have not yet focused on tapades. Limited fertilizer application in conjunction with manure or compost might be cost effective. Mineral fertilizer trials with maize in the tapades have been initiated by the R/D section of PDR-Labe, but it is too early to determine an extension recommendation.

Mineral fertilizers are more effective in the presence of organic matter because organic matter binds aluminum and increases the cation exchange capacity of soil. For this reason, mineral fertilizers would never replace manure or compost additions but would be complementary. Since the tapade provides a significant amount of rural families' nutritional needs as well as a potential source of money to buy additional food stuffs and market goods, increasing the productivity of the tapades is an important activity for rural development projects.

## 5.2. Bottomlands

The bottomlands (bas fonds) adjacent to small streams and rivers have been used traditionally for dry season vegetable production and pasture. Many of the river banks are narrow and inappropriate for exploitation, therefore not everyone has access to this type of land. In some areas where water is controlled, rainy season crops such as rice, beans, and maize are grown in rotation with the dry season vegetables. With increased use of the bottomlands for agriculture there are conflicts over animal damage and fields must be fenced. Many bottomlands are cultivated right to the stream or river edge. There is often no buffer strip left along the river to prevent streambank erosion. While it is easier to get water when the land is cleared to the river's edge, there can be significant erosion when water begins to rise with the seasonal rains.

Many of the rural development projects have been encouraging bottomland production in the hope that intensification of bottomlands will relieve pressure from the more fragile hillsides. While this theory has proved overly simplistic, bottomland production gives the immediate positive results necessary to gain the confidence of the rural population.

Women are particularly interested in bottomland vegetable production because they perceive it as a way to increase their family income and improve the nutritional status of their families. Women's access to land is through their husbands or through a

male relative. With the high rate of outmigration by young men, women can have access to bottomlands through farmers groups initiated by development organizations and projects.

A large, women's vegetable production group initiated by the Guinean NGO, UGVD, in Compaya (Labe prefecture) works on both communal land and on individual parcels. On the communal garden, the women are growing lettuce, tomatoes, onions, leeks, garlic, potatoes, eggplants, and beans. In several of the bands lettuce was intercropped for seed production. The group, which has grown from 13 original members to 37 with more women asking for entrance, is led by a dynamic retired nurse.

Just outside of Bantignel center there is another area where a group of 11 farmers (nine women and two men) were grouped around a basin/bund system that had been constructed behind a small dam. There were 120 plots of approximately 30 m<sup>2</sup> each being cultivated. One woman had eight individual parcels--two of tomatoes, one of cabbage, one of potatoes, one of lettuce, and three of onions. The local onions are direct seeded while the imported variety are transplanted from a nursery parcel. Ashes are used as an insecticide to protect the onions from crickets. The lettuce is protected from the sun after transplanting by small leafy branches that are placed very precisely on the west side of each plant.

#### 5.2.1 Soil management

Two major types of soil management are practiced on the bottomlands--long raised beds that vary in height and length, and basins surrounded by bunds and ditches for irrigation.

In the Guetoya watershed (Pita prefecture), both types of systems were observed. In one case a farmer had cleared land that had been fallow for approximately seven years. He was growing tomatoes, onions, cabbage, lettuce, gumbo, and beans and potatoes on raised beds and advising several women farmers who were borrowing land from him.

Another farmer, growing vegetables alongside the river at the entrance to Bantignel (Pita prefecture), had help from the BRP-Pita project to change from raised beds to the basin and ditch system. He also was in the process of making compost. The project had sold him a hand pump on credit and installed a cement reservoir but he preferred to pump water directly into the basins. He said there was too much water loss due to infiltration and uneven land when he used the irrigation canals. He was very satisfied with his production and felt that the new system is far superior to the old.

#### 5.2.2 Gardening groups

Gardening groups are an important and growing activity associated with donor and NGO projects and with some independent farmer initiatives. These groups will be discussed in depth in section 5.7.

### 5.2.3 Fertilizer

Vegetable production requires inputs of both organic and chemical fertilizers. Farmers have access to chemical fertilizer through various development projects. All farmers who are involved in the bottomland vegetable production are using manure for both direct application and the production of compost. Many of the soil fertility strategies for the tapades would also be appropriate for the bottomlands (compost, fertilizer use, etc). As vegetable production increases in the bottomlands, there may be competition for manure for tapades and vegetable gardens.

### 5.2.4 Crop diversity, seeds and marketing

The same crops (tomatoes, cabbage, onions, lettuce etc) are being grown from Mamou to Lelouma. Where vegetable crops are grown throughout the year, market potential can be taken into account when making out field plans. It appears that dry season production may at some point reach a point of saturation. Since vegetable crops are often difficult to transport, areas closest to the cities of Dalaba, Mamou, Pita, and Labe have a comparative advantage. Less accessible areas such as Lelouma prefecture may have marketing problems in the future.

Because the bottomlands tend to be more fertile, there is a possibility of diversifying crop production. Green peppers, radishes, and cauliflowers could be grown for the urban market in Dalaba and Mamou prefectures. One group is growing green beans, beets, and watermelons.

Potato production is becoming increasingly important in the bottomlands and is generally quite profitable. The local variety is very small and not very productive. The PDR-Labe has brought in new varieties that are being tested in the Bareng station and on some farmer fields.

Due to a rebuilt processing facility, passion fruit is now a potentially high value crop with an assured market and should be considered, particularly in Dalaba and Mamou. There may be a significant enough market that even the more distant prefectures can profit. Spices for food and essential oils may be possible crops for the Labe region.

Seeds are available through the projects but can also be found in the markets. With increased interest in vegetable production, farmer level seed multiplication should be considered. This would be appropriate for tomatoes, peppers, lettuce, and potatoes. Crops that are photoperiod sensitive such as cabbage and carrots would not be possible.

## 5.3 Exterior Fields

Fields outside the tapades and bottomlands, referred to here as exterior fields, are of three major types: upland slopes of "hansangere" and "dantare" soil types; central plateau plains (Timbi Madina and Sagara plains); and the gently sloping plains of the south east Fouta.

The team was unable to investigate the full potential or constraints of the upland fields because most agricultural activity during the dry season is concentrated in the bottomlands and plains.

### 5.3.1 Upland fields - management aspects

The upland fields are used predominantly for the production of cereals and grain legumes such as peanuts. These fields are considered to be men's fields, but women and children help with the sowing, weeding, and harvesting.

In the more mountainous parts of the prefectures visited, particularly where there are greater reserves of forest, shifting cultivation is practiced with a fallow period of 7-9 years. These are often on the more rocky "hansangere" type soils.

Traditionally, land is cleared and the brush is piled up and burned. Stumps are left intact which provides a source of secondary regrowth while the intact root system holds the soil on the more sloping land.

The first year after the land is cleared, upland rice is cultivated on the more fertile slopes. Isolated plants of sorghum may be intercropped and part of the field may be planted to peanuts. In areas of variable fertility, rice is grown near rocks and in depressions which accumulate soil and water. Fonio is sown in the less fertile parts of the field. The second year of production on this type of field is usually fonio after which the field is abandoned. In areas of Mamou and Lelouma, whole villages organize to cut the forest in blocks so that the landscape is a mosaic of different aged fallows.

The R/D section of PDR-Labe, in association with the Bareng research station, is conducting on-farm research with varieties and fertilizers on upland rice. While farmers have several varieties of upland rice, the early maturing varieties are most appreciated.

### 5.3.2 Upland fields - soil characteristics

The central plateau upland "dantare" soils are not as rich as the "hansangere" soils. Over the years, they have become even more impoverished. Fonio is the principal cereal grain even the first year after fallow. A farmer in Kollangui remembered when upland rice grew on this type of soil but it has been many years since the farmers were obliged to abandon upland rice. In some cases the land is abandoned to fallow after just one cropping season.

The secondary growth on the "dantare" soils is prairie grass which does not build up the soil as quickly as forest vegetation. Even fallows of 3-5 years have little shrub growth. "Dantare" soils tend to be compact and water infiltration is low. Fields on this type of soil tend to be larger and animal traction is used widely for the first and second plowing.

Both "hansangere" and "dantare" soils have competing claims from a natural resource management perspective. They are selected often for forestry projects and for improved pasture activities. It is on the "dantare" soils where the BRP Pita project has planted wooded bands. These will be described in more detail under soil conservation.

Because of the soil conditions, subsoiling by tractor has been done by the BRP-Pita project to install improved pasture between the wooded bands. Not all farmers have access to the project equipment and it is unclear whether animal traction can be used for subsoiling.

Soil amendments in the form of lime and chemical fertilizers are being used to establish the improved pasture species and for cereal production in the interbands. Fertilizer research on fonio production indicating a positive response to phosphorus applications. Because of the low fertility status of the "dantare" soils, it has been suggested that the projects view chemical inputs and subsoiling as a basic infrastructure investment to be done one time for all farmers.

### 5.3.3 Central Plateau Plains

Throughout the Fouta, there are wide expanses of plains within the central plateau. These have been developed for irrigated agriculture and, in many cases, mechanized agriculture during the years of the First Republic. For example, the Sagara Plain was part of state farms system with large-scale production of rice, soybeans, potatoes, and fonio. Parts of the Timbi Madina Plain at Bareng were developed for tobacco production. For the most part these attempts at large scale agriculture have failed and been abandoned. The infrastructure remains behind and has degraded to some extent.

Rural development projects, NGOs, government, and private initiatives, have been active in reclaiming these areas. They have been organizing farmers, providing inputs, and giving technical assistance to bring these plains into rational production.

The soils tend to be infertile and unresponsive to fertilizer without the application of organic matter. However, once both are applied and properly managed, they can be quite productive. Many of these areas are producing cereals and some vegetables during the rainy season and then dry season vegetables. The extent and type of cereal production is a function of water control. Irrigated rice is introduced wherever there is sufficient water.

PDR-Labe in conjunction with UGVD and the Bareng research station has established seeding and fertility experiments at Sagara. As a result of these trials, farmers plan to plant more hectareage to transplanted rice next year.

#### 5.3.4 Southeast Plains

In the SE plains water management is a problem. There is such rapid runoff from the nearby hills that much of the land is flooded during the rainy season. The PDR-Labe project is working with farmers of Kebaly to build check dams so that rice can be produced during the rainy season. Along the edges of the developed land, farmers have planted teak and gmelina trees to delimit the area.

A major canal system was constructed by EEC that is being used higher on the plains near Ditinn for vegetable and rice production. Farmers groups have been organized by the UNDP-FENU project. This project is interesting because the credit group has determined the cost of production for different speculations and is advising farmers on marketing.

These plains could be major beneficiaries of up-slope interventions such as reforestation and soil conservation. Such activities would protect the investments made in water control infrastructure and reduce the problems of maintenance.

#### 5.4 Livestock and Pasture

The Fulbe are traditionally herders and have great attachment to their animals. Sedentary Fulbe, such as those in the Fouta Djallon, retain some of this historical attachment, as can be seen in the "toupal" which is the dosing of the animals with traditional mineral supplement made of certain soils, salt, leaves, and bark. This is as much tradition and ceremony as it is mineral supplement.

Cattle are used as a savings system. They are difficult to cash in for small needs and therefore, can be used to hold capital for large expenses. This capital can be retrieved when needed by sale but is not available for the loans, gifts, and small expenditures that constantly plague the head of extended households. Sheep and goats are used as smaller denomination exchange units. They are consumed more often as meat by the family. Chickens and other fowl are the pocket change of the exchange system. Marketing of animals does not appear to be a problem. There were animals for trade in all of the markets visited.

Animals serve other functions as well. Draft animals often provide the necessary labor inputs for soil preparation in the extensive grain production systems of the central plateau and southeast Fouta. One of the most important animal by-products is manure. As this is practically the only soil fertility amendment available, it is collected from all animals, both from the fields and from smaller ruminants in controlled situations. Manure is especially important for the tapades and in the bottomland vegetable culture (see sections 5.1 and 5.2).

The taxation policies of the First Republic affected some of the traditional Fulbe animal husbandry practices. During this time cattle were taxed at 10 percent. This in effect destroyed the traditional night parks, because people were unwilling to gather

their animals. People are still reluctant to say how many head they own and cattle are generally scattered and difficult to count. This reluctance to group animals makes the gathering of manure more difficult.

The animals have a relatively low level of health. Parasites are reported to be universal in the herds and increase susceptibility to other diseases. The Ndama cattle have a trypanosome resistance which allows their use in tsetse fly areas but they are rather poor milk producers and the carcass is also inefficient for meat production when compared with other breeds. If the cattle are under stress from poor feed or other pathogens their resistance to trypanosomiasis decreases.

The animals suffer from the same hungry season that the human population undergoes. This occurs just before the rains start when the succulence of the annual grasses is lowest and most of the standing annual biomass is oxidized and has a low nutrient level. Non-ruminants cannot survive on this dried vegetation. Trees and shrubs often provide leaves of higher nutritional value than grasses during this period of the - and are used as a supplemental feed, especially for milk cows.

#### 5.4.1 Animal health: Veterinary extension and education

Some activity is apparent in the organization of groups of herders or livestock owners which allows efficient extension of basic veterinary services and education by group. In the office of the livestock extension agent at Popodara, schedules for vaccination programs were displayed, mineral supplement was in evidence and the agent was actually so busy dealing with several groups that a detailed interview was not possible. Subsequent interviews with various agents working with herders confirmed that animal health was consistently referred to by the herders as the number one livestock problem. The major poultry problem is disease, with a large percentage of the unvaccinated stock lost each year.

An increase in animal health lowers farmer risk. Healthy animals can provide a farmer with the same level of security with fewer animals. As other agricultural practices are tied to animals either for power or for soil fertility, the organization of herders is one route to reach the farmer and, in an animal oriented society, may offer major incentives for reciprocal agreements such as the reforestation of water sources in conjunction with animal water hole development.

#### 5.4.2 Animal Control Techniques

Approximately six methods of animal control were identified in the Fouta. What follows is a brief discussion of each including a description, observations, constraints and opportunities for each.

The technique of staking, tying animals to a stake to limit their area of grazing or to facilitate the collection of manure, was observed with sheep and goats in several places for utilization of forage. It was observed at Ditina with cattle for collection of manure, but with no apparent supplemental feed. This was more of a night park.

Using this technique, animals must be moved to water. There is some local rope needed and pickets occasionally need to be moved. In general, though, staking is one of the easiest techniques to implement and it allows direct control of the animals' feed and manure.

Night parks are locations where animals are bedded for the night. These were observed as staked, stabled, and fenced locations. The major objectives are to have the animals bunched for observation, supplemental feeding or treatment when necessary, and a concentration of manure.

Remembering the taxation policies of the First Republic, people are now reluctant to group their animals as they often did in the past. The concentration of animals in a night park eases early detection and treatment of disease or injury. One of the major opportunities is in the recuperation of bedding material with urine which is normally lost. This enables farmers to compost bedding, manure and additional plant material adjacent to the park.

Stabling refers to a walled or fenced structure with a roof containing animals at night or during at least part of the day. Stabling is a traditional practice for chickens and sheep. Although not traditional for cattle, stabling was being tested in one case by OMVG/Gembleaux for a milk cow.

Stabling must be constructed, and feed provided. The stabling of work animals or milk animals for supplemental feeding can result in an increase in the milk supply, as well as early season strength and stamina for the work animals. The opportunities for use of bedding material and manure that is shaded from the sun is highest with this method.

Surveillance, bunching, and driving describe control of animals by direct human action. These are the most common methods cited for controlling animals in the Fouta during the growing season. Although these are the most labor intensive method for controlling animals, if properly done there is a more efficient use of the vegetative cover, better plant regeneration, less animal concentration and the resultant over grazing.

Fencing is also a traditional animal control technique in the Fouta. The most common form of fencing observed was the fence surrounding the tapade. It was usually constructed of branches placed vertically and bound to a horizontal rail of bamboo or bundled sticks. Most fences of this type contained at least some living material. (see section 5.5). Some imported or locally constructed wire fencing was observed.

Fencing is the only way to control free ranging animals. The effect on labor demand and wood availability can be lessened by increasing the amount of living material in the fence. With the increase in remittances from workers outside the country there may be even more wire used in the future. In addition to excluding animals, as

pastures are improved there may be more fencing used for enclosing animals as grazing becomes less extensive.

Collars are a traditional method used in conjunction with fencing to keep free ranging animals from entering tapades. Each animal is fitted with a wooden collar consisting of a fork over the back of the neck with the tines tied to a horizontal stick under the neck. This prevents the animal from pushing its head through any gaps in the stick fence.

Collaring was common on goats and sheep, and was occasionally seen on cattle. It was explained that these cattle were ones that had previously broken through fences. This is an example of a very successful widespread local intervention. If in the future, stranded fence becomes more common it may prove necessary to change the direction of the blocking stick from horizontal to vertical. The traditional American cattle collar is vertical to prevent entry through three strands of barbed wire.

#### 5.4.3 Pasture Management Interventions

Improved pasture is the enrichment of existing pastures by the introduction of higher value forage plants. This technique might require subsoiling to increase water percolation rates to improve growth of existing forage plants.

Several improved pastures were observed. The species most commonly used were Stylosanthes sp., Panicum maximum, Acacia auriculiformis, Acacia holocercia. In some of the heavy soils, ripping may be needed. Plants must be protected from animals until established.

The improved pasture interventions on "dantare" have been very successful and well received. A farmer in Bantignel (Pita prefecture) will put his animals into the improved pasture this March to try to increase their stamina for the plowing season.

There may be more possibilities for improved pasture by relay cropping forage species into the fonio during the second weeding. A problem that would need to be resolved would be early grazing before establishment. Farmers said that cows are anxious to get into fonio fields at time of harvest and it is difficult to keep them out. Without tethering or herding the animals or even fencing off the area to prevent overgrazing, it would be difficult to protect forage plants while they are getting established.

Local forage species could also be included in the plant mix, especially woody shrubs and trees in bands. Non-forested fields and bottom lands could be enriched with nitrogen-fixing forage plants after harvest for use in dry season as pasture. This might prolong the period of cultivation before fallow from the nitrogen fixing and manuring effect. Other species used as green manure could also be tried in the species mix.

Deffered grazing refers to the protection of a grazing area to allow plant development or to reserve the area for later use after other areas no longer provide sufficient forage. This was seen in one case where pasture improvement had been carried out. The farmer was deffering use until just before rainy season.

This technique can be used to establish a system of rotational grazing which allows the plant material sufficient time between uses to recover and the new plants to become established. Another promising use for this technique is to hold an area in reserve for use by the draft animals to build up strength before the field work starts.

## 5.5 Forestry Related Interventions

Deforestation and subsequent environmental degradation in the Fouta Djallon have been the subject of international conferences, reports and projects for over four decades now. Yet, due at least in part to Guinea's unique history, promising programs and projects are just beginning to address forestry concerns in this region.

As in many countries, rural people's first concern is feeding their families. In most of the Fouta the forestry situation is not so critical that lack of wood and fuelwood is perceived as a priority problem by farmers, particularly men farmers. Women do find fuelwood collection difficult in some of the more heavily deforested areas. Government and project workers, on the other hand, view deforestation and forest degradation as a serious, pressing problem which must be addressed immediately. Reconciling these two positions has not been a top priority and consequently farmers and foresters have not worked together.

At the moment, there is little in the way of true farmer participation and adoption of forestry activities in the region. Whether this is due to the perceived lack of interest on the part of farmers or to the top-down approach used until recently by the government is hard to determine. It is probably a combination of the two.

The new participatory approach sweeping the Fouta Djallon promises to reverse the sometimes negative situation that has arisen. Activities that are on the edges of traditional forestry (improved woodstoves) and that build on traditional practices (such as living fences) will help build the interest and confidence of farmers to work on other forestry activities like forest protection and reforestation.

### 5.5.1 Living Fences

Living fences are a traditional practice used to enclose the home gardens or tapades. Both forest trees, such as Ficus, and fruit trees, such as mangoes and oranges are used. For the most part these trees are allowed to grow naturally without pruning or coppicing and they provide fruit, shade and household wood. This practice reduces labor requirements to repair fences constructed of dead wood, and the time and labor required to find wood for repairs, not to mention the attendant potential for deforestation. The former task is generally the men's responsibility whereas women may

help with the collection of the wood. Deadwood fences are attacked by termites and generally degrade rather quickly. They must be substantially repaired every year. The team was unable to determine why some tapades have live fences while others do not, however, the potential for improving on these traditional systems seems considerable.

Past projects have only dabbled with live fences. It is not unusual to see exotic species like *Gmelina*, *Grevillia* and *Jatropha* in live fences: a sure sign of outside intervention. There are a number of organizations, from small NGOs to large projects and government services just now beginning to work on improving the traditional practice of living fences. The species of choice for most of these projects has been *Gmelina arborea*.

We saw a good start on a live fence by one of the nurserymen with whom the USAID sponsored Community Forestry Project worked. Planted in 1984 the fence was composed primarily of *Gmelina arborea* with some eucalyptus and *Cassia siamea*. The *Gmelina* seemed to be doing fairly well, although its growth could not be considered outstanding. The trees had never been coppiced, but the farmer said he was thinking about doing that this year.

This farmer was quite enthusiastic about his live fence because he said it was sturdy and took less time to repair than a dead fence. This was an oft-mentioned advantage of live fences by the men with whom we talked. This particular farmer said he often talked to his neighbors about the advantages of the living fence when they came to ask him about his small fruit tree nursery. His brother, who had an adjacent *bas fonds*, had also introduced a living fence that was doing quite well.

The French NGO, ESSOR, in the Timbi Madina area will be focusing on living fences this season. ESSOR made one of their initial contacts in the community through a national tree planting day demonstration at the school. They planted trees with the students during a major event which was attended by many people, including community leaders. After this, a few people came to ESSOR for assistance in establishing living fences. The man with whom we talked designated a small area of land that already had a living fence of *Lantana camara*. The project planted *Acacia mangium* within the fence. The farmer was not a typical farmer in that he was quite well off, was a member of the council of elders and seemed to have a particularly strong interest in trees. The project hopes to work with him as an informal demonstration farmer and extension agent.

Observations throughout the region revealed many examples of live fences, with both traditional and exotic species. In most cases, however, trees were simply allowed to grow without any kind of pruning, coppicing or other management. This may be a partial reflection of the traditional practices which do not seem to emphasize coppicing, however, it tends to limit the multipurpose usefulness of a live fence which can provide fodder, mulch, green manure, fuelwood and poles if managed correctly. In addition, coppicing can cut down on shade competition with adjacent crops. Projects often tend to emphasize one kind of species, an overall weakness in forestry activities, which not

only increases the risk of failure but also misses the opportunity for diverse uses, products and growing patterns from multiple species.

### 5.5.2 Village Forests

The government has often found it difficult to interest rural people in traditional forestry activities like forest protection and reforestation for protection and long-term timber production. Consequently, it is not surprising that some projects went ahead and simply hired people to plant trees without any local participation, in the hope that through demonstration people would come to value these activities. As yet, this approach cannot be cited as a success by the farmer-oriented criteria of this report.

The team did, however, see at least one example of a compromise between straight payment for tree planting and local participation and awareness of the importance and potential usefulness of forest protection and management. The BRP of Mamou (financed by the French Agency for Cooperation, FAC) has established village forests in the two watersheds it manages as part of the regional BRP project.

These village forests are generally classified forests that have been taken up by the project and are in the process of being inventoried with management plans being drawn up. With the participation of the concerned villages the project has undertaken enrichment plantings of species such as gmelina, grevillia, and acacia. These enrichment plantings help to maintain species diversity, increase forest production and provide for multiple uses. The existence of exotics indicates to villagers that the forest is managed and must be respected. The project appears to have dealt with tenure issues so the forest does belong to and is managed by the village.

Projects find it necessary to use food-for-work incentives for planting and guarding trees. This was done even when the extension worker told us the village had requested project assistance with the establishment of the village forest. Questions about the sustainability of the activity after the project ends and the effectiveness of village management remain to be answered. We were not able to talk to villagers so it was difficult to tell how much they valued these forestry activities.

### 5.5.3 Reforestation/Protection of springs

Several projects (BRP Mamou, BRP Pita and PDR Labe) are involved in reforestation for the protection of improved (protected) springs. These interventions are discussed in Section 5.8. The plantings that we saw seemed to be doing very well. Species composition differed from site to site but often consisted of Acacia spp., Grevillia robusta, Eucalyptus spp., Gmelina arborea and others.

This type of reforestation is necessary to protect the investment made in a protected spring. The activity is small scale so villagers can supply labor and maintenance. Although they may not possess all the technical knowledge to link reforestation with water quality, an education campaign, along with the benefit of pure water will certainly encourage farmers to appreciate the value of reforestation.

At the moment, villagers are still receiving food-for-work for this type of work. Some project and government staff maintain that they will not do it without this incentive although this was difficult to verify independently. Nonetheless, even with food-for-work if there is an element of education it seemed likely that the villagers would maintain the reforested areas even after the project leaves.

#### 5.5.4 Nurseries

Always a popular visitors' attraction, the team saw a number of nurseries, from large, BRP nurseries to medium size nurseries of the Direction Prefectoral des Forets et Chasses to small fruit tree nurseries in the bottomlands of individual farmers. From an innovative and biological diversity point of view the BRP of Mamou nurseries were perhaps the most interesting in their wide range of species (both indigenous and exotic) and cultivation techniques. The BRP Pita had a fairly limited range of species (primarily exotics) specific to the project's technical interests of fast growing trees.

The small farmer nurseries that we saw were primarily connected to the Projet Foret Communautaire, started with U.S. A.I.D. assistance and continued by the Government of Guinea. This project identified what could be called model farmers who were already involved in nursery production of fruit tree seedlings. The project worked with them to raise forest tree species which were used for a variety of purposes from establishing a community woodlot, to live fencing and replenishing the project's stock of seedlings.

The problem faced by all of the above nurseries is that farmers are not interested enough in forest tree species to buy them. There is a good market for fruit and coffee trees which are sold by private and project nurseries, except the BRP Pita nurseries which give them away under certain conditions (although one farmer said she bought trees from this nursery).

There are many opportunities for extension, demonstration and encouragement of model farmers in the area of tree nurseries. Several projects do have demonstration areas of the different species in their nurseries. Until forest tree species are valued by farmers, however, these seedlings will have to be subsidized by projects both in the large nurseries and in the small private nurseries. Subsidization, in whatever form, needs to be clearly identified and consistent to avoid misunderstandings.

This type of intervention need not be expensive, but requires a long-term commitment on the part of donors to support these farmers and encourage tree planting. The USAID project referred to above experienced a variety of problems and was not extended beyond the three year pilot project. Although the government is continuing with the project they are hampered by lack of funds. Several farmers complained about the short-term nature of the project and the ambiguity surrounding compensation for their efforts in raising forest tree seedlings for the project.

### 5.5.5 Wood conservation - Improved cookstoves

Throughout the country we saw many examples of improved metal cookstoves, particularly in the towns. These cookstoves were being distributed by BRP Mamou, PDR Labe and a few NGOs and being produced and sold locally. Projects were also training metal workers to make the stoves and several were available in the Labe market. Projects often had a minor subsidy for the stoves (2,500 GF instead of 3,000 GF), but we also spoke with women who had bought their stoves at the market without a subsidy. All the women noted the quick cooking time and the decreased amount of wood required to use the stove - as much as two-thirds less wood.

We also saw a few examples of improved mud cookstoves that had been constructed by projects (PDR/Labe and BRP/Mamou). These were not as successful for a number of reasons - the most often cited being the fact that they could not be moved to where the women wanted them. In one case the stoves did not survive the rainy season. One woman gave a few additional reasons for preferring her traditional metal tripod stove. She could use larger pieces of wood so the live coals would last longer and could be easily relit. This open stove also provided light and heat.

The potential for the widespread adoption of improved metal cookstoves seems promising. At present their cost is a factor but can be dealt with through credit schemes. Certainly, in towns where wood must be bought they were in widespread use. Mud cookstoves will require improvement before they can be successfully extended.

## 5.6 Soil conservation and management

The potential for increasing sedimentation rates to disrupt activities of downstream inhabitants was the driving force for the OAU initiative to study watershed management in the Fouta Djallon. Rivers originating from eroded watersheds often dry up after the monsoons, while during the rainy season they yield a high volume, muddy runoff. When this high volume reaches a downstream reservoir, operators are required to release large volumes of water in order to avoid overflow. As less water becomes available in the dry season, reservoir levels will decrease at a greater than normal rate.

Local effects of accelerated erosion are now considered top priority. These include the loss of upland soil fertility, a probable increase in laterization processes, and damage to local infrastructure such as small dams or watering holes, irrigation canals for bottom land agriculture, roads and bridges. Such damage is already visible in the Fouta. Deterioration of local and regional roads due to erosion is everywhere apparent and represents a major constraint to development.

Interviews with farmers indicated that upland agricultural production has declined in recent years. Sheet erosion along with factors such as decreasing fallows due to increased population pressure contribute significantly to the decline in soil fertility.

### 5.6.1 Soil erosion control

Soil erosion control seen in the Fouta Djallon is generally classified into 1) vegetative, 2) mechanical or engineering, and 3) a combination of the first two. Vegetative refers to the use of various forms of vegetation to provide the soil with a protective cover. It is the most effective and desirable method in the long run. Mechanical measures are groundworks, which include terracing, contour furrowing, subsoiling, and structural measures such as check dams, gabions, earth plugs, brush fills, rock walls on contour lines, etc. Examples of combined methods include fascines with live vegetation interspersed with dead branches to prevent gully erosion.

### 5.6.2 Vegetative bands along contour lines

Vegetative bands were seen at several sites including Saraya, Bourkadje, Pide, and Kollangui in the Pita prefecture. Bands of seedlings are planted along contour lines to impede sheet erosion, help maintain soil fertility, and eventually provide wood and non-wood products. Variations included trees planted in a grid-like fashion with the lines of the grid corresponding to ownership rights (Saraya) and trees planted in bands with the interbands used for forages (Bourkadje) or crops (Kollangui). The species makeup of these bands can vary; our team saw combinations of pines, eucalyptus, acacia, and sisal. The Forest Service generally prefers fast growing exotics to slower growing local species.

Vegetative bands have been established on the "dantare" soils used most often for cereal production. Problems included termites attacking the eucalyptus and livestock rubbing against and destroying many of the young pine trees. Thinning was planned after five years, however, proper rotation age for the trees was not yet established.

Although the trees were generally planted on the contour, there was significant interband erosion in parts of the fields where the contours were not respected. While the concept of wooded strips laid out on the contour is technically sound, care must be taken to lay them out correctly or erosion will increase.

The oldest wooded strips in Follongui (Pita prefecture) which are linked to fertilizer application and compost production have permitted one farmer to put rice back in his field. He feels that over time he will be able to bring back peanuts and maize.

A major constraint for this intervention is the lack of good land for agricultural production. Farmers usually adopted a "wait and see" attitude towards vegetated bands in their fields. In general, they were not involved in the planning of the intervention or selection of the species used. They were not given much explanation about the anticipated benefits even though some of their land was taken out of production. Wood products were not yet available, nor was there any noticeable increase in grain production.

Technically, tree belts represent a good possibility to maintain soil fertility by controlling erosion and providing multiple tree products. Extension is an essential ingredient to encourage farmers to adopt and adapt vegetative bands in their fields. Technical issues of appropriate species, pruning, spacing, harvesting, competition with crops, etc. will have to be carefully examined in light of farmers priorities.

### 5.6.3 Murettes or rock walls

Murettes are low walls of small or medium sized rocks cleared from upland fields (usually *hansangere*) during hoeing or planting. Similar structures were also found around a construction (dam) site on surfaces which were totally denuded of vegetation cover.

Rock walls were initiated by the former colonial rulers in Mouorande (Mamou prefecture). In the village of Horesere, within Mourande, the team visited a farmer who has had rock walls on his upland fields since that time. He has continued to rebuild them periodically without any outside inputs when he cultivates those particular fields. His level of effort, however, may have been inadequate to derive full benefit from the walls.

The BRP/Mamou project offered him food-for-work incentives in 1988 to improve his wall maintenance. Project personnel staked out the contours on the sections to be repaired and checked the work afterwards. The farmer claimed that production in his fields was superior to other upland fields without murettes that could be seen across the valley.

A major constraint is the labor requirements versus the long-term nature of the benefits. It is hard to teach intensive management schemes in traditionally extensive systems where each field is only farmed two years out of ten (depending on the area). In addition, certain land units ("*dantare*") do not really have enough rocks to make murettes. Labor availability and slope gradient are also constraints.

This intervention could be made more useful by incorporating tree species that have value to the farmer. Trees should be planted just inside the wall and be protected for about three years.

### 5.6.4 Gabions

Gabions are large rectangular wire crates filled with stones. They are flexible and permeable. In areas with abundant rock, the major cost is the wire crates. Gabions are used to control stream flow, retard gullying and prevent loss of sediments.

Gabions were seen at several construction sites, along roadways next to bridges, at dam sites, and on "*dantare*" fields to reduce gully erosion. These gabions were constructed as public works projects with projects supplying the materials and (if needed) transport, while villagers were reimbursed with food-for-work for their labor.

A rich village elder from the Bantignel village in the Guetoya Basin, seemed extremely upset by the gully erosion in his fields. With material help from the BRP Pita project, he planned to hire temporary laborers to construct and place gabions in the gullies.

A major constraint of using this type of erosion control is the cost for the metal crates. In areas where there are no rocks or small rocks, these must also be bought. Farmers are in general reluctant to use such techniques on their own. Without project support for materials and labor, it would be difficult to extend this technique.

An alternative would be to place piles of rocks (not baled) into a gully to prevent erosion. Rocks must be large enough to resist streamflow and yet permeable enough to trap sediments. These are not as effective as gabions in case of high streamflows. On the other hand, they are more appropriate for individual villagers because materials are not a constraint. The labor involved in the construction of these piles is minimal. In cases where gullying in a farmer's field is not too advanced, rock piles may be an effective means of preventing the expansion of gullies.

#### 5.6.5 Buffer strips

Buffer strips are bands of vegetation, usually trees and shrubs, left along waterways after agricultural clearing or logging.

Residents of the Fouta Djallon have traditionally left buffers along streams, although the width seems to have diminished in recent years. For the most part, these buffer strips are respected, but in some areas fuelwood cutting has reduced their width. One area, Saraya (Pita prefecture), did not seem to protect the vegetation around the natural spring. Not surprisingly, the villagers reported decreased water flow in the dry season. The BRP Pita project has worked to improve this particular situation: the natural spring was capped and the upstream area was replanted to assure long term protection.

Buffer strips are a good example of a traditional practice that needs to be reinforced. Traditional crops such as bananas and papayas can be integrated into the buffer strips to provide rapid yields while still conserving the soil.

### 5.7 Production groups

Traditional natural resources management interventions in the Fouta Djallon involved little or no grass-roots organization or participation. Forest plantations and anti-erosion interventions were implemented either directly by government employees or by villagers hired temporarily and compensated with food-for-work. Government-villager interactions involved prohibitions more often than cooperation. Only recently have major government projects such as BRP Pita, PDR Labe and PDA Timbi Madina initiated participative approaches which respect farmers' priorities while integrating long-term natural resource management concerns. Farmer groups have been central to sustaining such participative initiatives.

The team found both project-initiated and spontaneously formed development groups functioning effectively at the grass-roots level. The following types provide empirically-based approaches for potential interventions.

- o Village Gardening Groups
- o Agricultural Entrepreneurs
- o Grain Banks
- o Fence Repairing Organizations
- o Well Maintenance Committees
- o Animal Husbandry Associations

### 5.7.1 Village gardening groups

By far the most frequently encountered groups were village gardening groups sharing land served by a common irrigation system. These groups are a success story which has been widely recognized by village farmers, agriculture graduates, and donor projects. The relatively high cash value of vegetables, the quick return on investment, the low risk in selling to local markets, and the ability to farm in the dry season all contribute to their popularity. Many agricultural development projects are beginning with gardening groups to encourage participation and demonstrate rapid economic benefits.

At least eight such groups were seen, which had many elements in common. One example, although recent, illustrates excellent utilization of incentives and organization and uses many techniques employed by other projects.

The PDA Timbi Madina gardening group is relatively new. This VED project was identified by a French agronomist in 1985 who returned to implement it in 1988. There are two groups one of 30 and one of 37 people, each consisting of both men and women. These groups currently work a total area of about ten hectares of irrigated plain. There is more land available to the project.

The project began with a meeting of "anyone interested" to which 200 people showed up. It was then announced that participants would have to donate about two months of free labor for public works. This reduced the group to about 40 serious candidates. These candidates dug canals, leveled plots, constructed border ridges, and brought manure to enrich the soil. The small diversion dam was improved and a laundry platform constructed to one side to keep irrigation water clean. Such initiation tests are a good technique for consolidating group membership to serious participants.

The project made available the required tools such as hoes, boots and wheel barrows, but they were to be BOUGHT by participants on credit and paid off over 1 to 4 years, with interest. Similarly, seeds and fertilizer were available, but had to be repaid with interest. For one kilogram of seed potatoes, two kilograms were to be returned after the harvest.

Soil tests had shown sterility from aluminum and iron toxicity, requiring the addition of both organic matter and chemical fertilizer in addition to water. The agronomist told farmers that potatoes would require both compost and chemical fertilizer. Few listened the first year, but those who did realized much better yields than those who used only chemical fertilizers. Thereafter, farmers were required to bring one sack of compost to obtain one kilogram of seed potatoes. Project personnel said that this was not difficult to institute after the concrete successes of farmers that had followed recommended techniques. Training on composting techniques was conducted and composting is now both improved and widespread.

As administrative demands grew, the need for a formal group structure became evident. Farmers selected a steering committee with a president, vice-president and treasurer, as well as a technical officer to monitor seed and fertilizer distribution. Irrigation management personnel were also selected, and two sub-groups were designated for morning and evening irrigation. Those who had done well with the first crop of potatoes were selected for leadership positions. In several groups visited farmers would select group leaders based on merit but complement this by the selection of village elders for honorary positions.

A treasury was established and a bank account opened. The funds repaid for the various inputs supplied by the project established a rolling fund to be used by the group for other activities. These rolling funds are a key element in building the capability and sustainability of groups. No food-for-work rations were distributed in the first year when candidates were demonstrating their commitment. In the second year, however, public works like maintaining canals or clearing new fields involved food-for-work payments. Food-for-work was never provided for a farmer's work on his own field.

Training for group leaders should be included in any project intervention. Training is needed in accounting, record keeping, and management techniques in addition to technical agriculture. This training is most effective when linked to a concrete task and scheduled to provide timely skills that will be immediately put to use.

When economic advantages are perceived, Fouta Djallon farmers seem to work together readily in groups. A wide variety of group compositions were found -- mixed sex groups, all men, all women, and groups of mixed socioeconomic status. In the latter, individuals of higher socioeconomic status usually had leadership positions -- in part due to land ownership -- but all parties seemed to cooperate well.

Similarly, a wide variety of internal organization was found. Most commonly, each participant worked his or her own plot, but some groups farmed in common. Others arranged for each individual to grow one type of vegetable and then divided and marketed their crops communally. Group organization should be developed with the participants according to local conditions and preferences.

Gardening groups also require careful economic sensitivity - especially regarding marketing. The plethora of vegetable gardens with the same crops in almost every valley raises the question of whether a glut on the market may not be imminent. Some

groups have already begun experimenting with less common vegetables or adjusted their planting cycle to produce harvests in the off season.

A final, but important point to bring up is that of land tenure. Land tenure may become a serious constraint to the development of gardening groups in Fouta Djallon. The total amount of bottomland suitable for irrigation is limited, so gardening groups cannot be opened to all. Getting clear title to such bottomland is also difficult. Where projects have been initiated on private land, it is often specified that the land and all improvements will revert back to the owner after a specified number of years. Projects initiated on government land have obtained indefinite tenure rights, but not yet legal title, from the Prefet. Farmers and project workers differed in their perceptions of this problem. In some areas, such as the PDA project in Timbi Madina, it was perceived as critical and the project is seeking legal Titles to individual parcels for participating farmers. This was not an activity based on traditional social networks. By contrast, in other areas, such as the CECI project near Lelouma, traditional social structures and hierarchies seemed to reduce the felt need for formal title.

### 5.7.2 Agricultural entrepreneurs

Two farming groups were organized by former agriculture students -- at Bafing near Mamou and Holande Tyale near Pita. These were spontaneous private enterprise initiatives without any project support.

Next to the Bafing Forest Nursery by Mamou, a group of six young graduates from the nearby Ecole Nationale d'Agriculture ENA/TOLO have recently initiated passion fruit cultivation on borrowed land. There are five men and one woman. All had completed three years of agricultural study and, finding no opportunities with the government, they banded together to initiate this private enterprise. They have a guarantee from the Passion Fruit Factory in Mamou to buy all their produce.

Currently, their interest is expanding to vegetable gardening. This would yield better money with a quicker return and could be continued year round. They are seeking to borrow money to go into the gardening business. Provision of capital for such private initiatives represents an important opportunity for mobilizing underemployed, trained technicians.

Even more interesting is the group of Holande Tyale in Sintale near Pita. It is located on a 30 hectare irrigated collective farm that had originally been improved with EEC assistance in 1982-83 and then was abandoned because it failed to attract farmers.

Three years ago, a group of 21 former agriculture students who did not pass the government's civil service examination joined together with the idea of applying for funding to put the farm back into production. This group was quickly reduced to a few serious members who decided to begin working before applying for funding in order to demonstrate their commitment.

The Prefet granted them permission to use the farm and they opened up a small area to grow cabbage. This proved very lucrative. Since then, they have been improving infrastructure by leveling fields to improve water control. Each year they have doubled or tripled the area cultivated. Now they are growing beets, onions, watermelon, cabbage, beans, and gumbo. Part of their success depends on planning so that their crops will ripen in the off-season.

These young men opened their group to nearby farmers and succeeded in getting about ten to join. Now the agriculturalists and farmers constitute one integrated group with seven former students and eight village farmers. Initially the membership fee was 7,500 GF, but, due to the group's investment in infrastructure, it is now 20,000 GF. The fee can be paid in installments. Current members are all men, some women want to join, but haven't gotten the money together. They have written a constitution and rules. An elderly farmer was elected president and the young men serve as vice-president, secretary, manager, and foreman. The farmers seem very happy with the arrangements. In June 1989 they were formally registered and authorized by the Prefet under the statutes applying to cooperatives.

The young men work their parcel in common in a capital intensive mode, paying hired labor to plow and utilizing fertilizer. The farmers, however, work individual plots. The young men taught the farmers organic farming techniques. Farmers have learned to make smaller mounds in the dry season, pound manure before spreading it, to make compost from sawdust, straw and manure and to plant in lines. Such groups contribute directly to soil improvement and water control as demonstrated by their composting and irrigation activities. Longer-term natural resource management initiatives such as orchards are already under consideration.

These groups demonstrate the possibility for agriculture graduates and village farmers to work together effectively as partners for mutual profit. This is quite different from the usual teacher-student or official-farmer interactions. It leads to mutual respect and to the concrete evaluation of practices in terms of their economic value.

Such spontaneous entrepreneurship demonstrates the resources available for development efforts. Two underutilized resources have been put to work: (1) unemployed trained manpower, and (2) unused improved land.

The large number of unemployed Guineans with agricultural training throughout the country and even residing abroad constitute a valuable human resource for such initiatives. Similarly, abandoned collective farms provide a valuable resource. These farms and similar government holdings could be provided as incentives to encourage the formation of more collaborative efforts uniting agriculture graduates and village farmers.

### 5.7.3 Grain bank

The farmer group at Ditinn, near Dalaba, also farms an improved plain. Their main activity is the production of grains -- rice, peanuts and fonio. Other activities include composting, night parks for animals and vegetable production.

Last year, with assistance from the "Amenagement des Versants Soudes de Fouta Djallon" Project, they initiated a grain bank. The project was only interested in rice, but at their own initiative, the villagers expanded the bank to include peanuts and fonio. They knew that peanuts would have the largest marginal increase in the market.

The bank intends to buy excess grain from members at ten francs above the market price and sell it back to members at ten francs below the market price. Because most of the grain is purchased at harvest time when prices are low and sold back for seed when prices are high, the bank makes a profit. Market prices generally rise about 75 FG/kilo (rice rose from 125 FG to 200 FG, peanuts 125 FG to 250 FG, and fonio 125 FG to 150 FG) over the three to four month storage period, yielding a profit of about 55 FG/kilo for the bank. Excess grain left in the bank is sold on the open market.

Officers include a president, vice-president, manager, treasurer and "stockist". There are almost no expenses for the bank. Members bring their grain already in bags and it is stored in the president's house.

Last year was the first year of operation for the grain bank. Unfortunately the rice crop failed and the bank had to purchase rice at the market. The project provided startup funds to the bank for initial grain purchases. A loan of 5 million FG was planned, but when the rice crop failed they gave only 2 million FG. By the end of the year the bank had a 95 percent payback rate.

An initial constraint is the need for startup money for initial purchases. The system is also dependent on market forces and assumes a positive margin over the storage period. This margin may become reduced over time by the activity of the bank itself and depends on external competition.

Such grain banks offer a very promising intervention where sufficient quantities of excess grain are available for storage. This implies primarily irrigated plains. The crop must be storable, thus it would not work for vegetables unless they underwent processing to make them storable.

#### 5.7.4 Korbe: a unique example of village organization

In 1962, the village of Korbe, near Leiouma undertook a radical experiment. They built one long fence around the entire village in place of individual fences around each tapade. The objective was to reduce the workload of fence repair and the material required. This experiment was undertaken by the villagers themselves without any urging or support from an external development project.

The villagers organized themselves and assigned each member his length of fence to keep repaired. A system of heavy fines was established for when a cow breaks through the fence. The management committee judges what proportion should be paid by the owner of the animal and what proportion by the person responsible for the fence.

Only one villager expressed discontent and started building his own fence within the village fence. Under social pressure to give up this project, he dawdled over it and eventually died without completing it.

Because one village fence is considerably shorter than separate fences around each tapade, it yields a significant savings in labor for the men who repair the fence. It also results in a reduction in the demand for wood for fence construction. With the planting of trees for live fence posts and the gradual replacement of wood with wire fencing, the fence could eventually become a net producer rather than consumer of wood.

This situation is atypical. It assumes that village solidarity is close enough that people want to live together within one fence. It also assumes that village leadership and coordination is strong enough to maintain the necessary cooperation for fence repairs. The fact that this innovation has been in place for many years without any other villages copying it may imply that these assumptions are not adequately met in surrounding villages. Nonetheless, innovative variations on traditional practices, particularly when they are devised by villagers, should be examined for extendable techniques.

#### 5.7.5 Animal husbandry associations

Animal Husbandry Associations ("Groupements des Eleveurs") are concerned with health, nutrition and husbandry practices of both cattle and small ruminants.

Animal Husbandry Associations are a current priority of PDR Labe and the World Bank Project, but are too new to evaluate. We encountered two and noted that the herders were especially interested in health-related activities such as vaccination and parasite control. Villager reactions to improved husbandry techniques such as night parks and the Telire (Gembloux University) experiment on stabling milk cows remain to be seen and face some of the obstacles mentioned in section 5.4.

Cattle are now allowed to graze freely in the fields throughout the dry season, while the tapades are protected with fences. Any proposals which involve more work such as supervising the cattle, cut-and-carry forage systems, or planting improved pasture will be in competition with other activities for the already scarce supply of labor. A careful study would be required to determine if the above interventions would save more labor than they would create.

### 5.8 Water Resources Management

The importance of safe water in any country's development cannot be understated. In addition to a list of normal household uses, clean water availability is the key to the success of any agricultural or infrastructure development.

### 5.8.1 Improved natural springs

The key elements of an improved spring are a capturing structure to funnel the water into the system, a filter to purify the water, a holding tank (preferably enclosed for sanitary reasons), a device to control overflow, a faucet or pipe by which the water is delivered, and a plug near the bottom of the tank for periodic draining. In addition, it is advisable to gently grade the outlet stream so that water is not stagnating close to the source. The main objective is the protection, sanitation, and assurance of quality water throughout the year.

Of the many interventions visited, access to potable water seemed at the top of villagers' expressed needs. Consequently, villagers reacted very positively when discussing their responsibilities for upkeep and sanitation. In some cases, improved springs or wells were provided in exchange for village labor on public works, reforestation, or anti-erosion projects.

At Kankono village, near Oure Kabah (Mamou prefecture), the villagers had constructed a fence around an improved spring to keep out animals. The upstream area was being planted with gmelina. Villagers supplied building materials and other services, while SNAPE provided technical expertise. Food-for-work was given as incentive for the upstream reforestation.

The improved natural spring presents an excellent opportunity to combine natural resources management with rural development. The construction of an improved natural spring lends itself easily to notions of reforestation and erosion control. One way to solidify this link is by contractual agreement between the government, which provides materials and technical assistance, and the villagers who provide materials, labor, and maintenance.

### 5.8.1 Traditional and modern wells.

Traditional wells are generally shallow, made from locally available materials by villagers, are often uncovered, and can usually be found on bottomlands. Modern wells are constructed according to more strict guidelines, often with some kind of filter system to purify water seeping into the well. Casing material is often cinder blocks which provide some filtering capacity.

A village management committee is usually established to maintain each SNAPE well. The fenced area must be kept clean and rules against entering barefoot, washing within the fence and pumping water outside of scheduled hours must be obeyed. One well committee, in Konkola (Labe prefecture), was collecting 25 francs per bucket during the dry season towards pump maintenance. This necessitated a guard on duty while the pump was open to watch the cash box, but ensured funds available for spare parts and served to increase caution about water usage during the dry season.

One or two village artisans undergo three days of training in basic pump repair. One artisan at the Sous-Prefecture level is trained for a week in more extensive repairs. They are paid for their work according to a percentage of the price of the piece they replace. The popularity of pumps is indisputable. Not only did the villagers aid in construction of the pumps, but they participate actively in the maintenance and sanitation guidelines. At present, however, SNAPE is limited in its ability to provide pumps/wells to all who need them and villagers are limited in their financial and technical ability to contribute to construction and maintenance.

There are no such formal committees for the upkeep of improved springs as there is very little maintenance. Instead, maintenance is managed directly by the Council of Elders. There are no pumps with moving parts. The area is swept regularly and occasionally the runoff canal below the source needs to be dug out. Once every few years the drainage plug in the dam may need to be opened to drain the reservoir.

The Council of Elders, acting as a spring committee, could undertake reforestation initiatives around the head of the source and gradually broaden villagers' horizons from drinking water to more general water retention and control. Springs, as a continuous water source, may also present possibilities for irrigation.

## 5.9 Extension techniques

The team observed several promising extension methods to work with farmers in the area of natural resource management. In general, the recent introduction of the participatory approach should benefit extension workers by providing a useful methodology and should benefit farmers by placing emphasis on their needs and priorities.

### 5.9.1 Farmer to farmer visits

Several projects have made use of farmer to farmer visits. The BRP Mamou project has taken farmers to observe the interventions of BRP Pita. PDR Labe has organized farmer to farmer visits within its network of micro-projects.

BRP-Pita has scheduled farmer to farmer visits for the upcoming season so that farmers can visit and discuss some of the interventions being tested by the project. For example, farmers from Bantignel will be visiting the wooded strips in Timbi Touni. There will be exchange visits between farmers organized around livestock to see the improved pastures of Kollangui and Bourkadje.

This kind of dynamic exchange between farmers can be an extremely useful extension tool and seems to be appreciated by the projects in the region.

### 5.9.2 Model Farmers

Farmers who have status within the community and who are innovative are selected or present themselves for demonstrations and on-farm tests. These farmers then act as extension agents to help their neighbors with new technologies. Several of the smaller projects in particular have adopted this approach on a somewhat informal level. The Community Forestry project has encouraged innovative farmers, with whom they have established nurseries, to talk with their neighbors about tree planting. ESSOR hopes that the farmers with whom they establish living fences will serve as models for other farmers.

There is a lot of room to develop this approach in a more systematic manner. Model farmers could benefit from more support, including training. A clearer definition of farmers' roles and responsibilities and an explanation of project objectives might help to establish a long term relationship between farmer and extension worker that will survive the ups and downs of the project cycle. Several farmers who had worked with the Community Forestry Project felt that they had been left hanging when the project ended. Had they been given more support in the beginning and a better understanding of the limitations and objectives of the project they might not have felt so abandoned when the project came to a close.

### 5.9.3 Development of extension materials

Most Fulbe are literate in peular written in arabic script because of attendance at Koranic schools. The extension bulletins for farmers being prepared by BRP Pita are taking advantage of this and are being written in peular. The lesson plans and handouts prepared by PDR Labe are also being written in peular.

## 6. DISCUSSION

The long-term management of natural resources in the face of pressing human needs has never been easy and the situation in the Fouta Djallon highlands is no exception. In the midst of a rapidly escalating level of project activity, the need for cooperation and a balance between protection and development is becoming ever more critical.

The IMFDW initiative has a history rooted in concern for the environment and protection of a fragile natural resources base. It was spurred on by a sense of urgency within the international and national community. Consequently, some of the initial interventions were not done with the collaboration of the rural population but rather to them and for them. Only recently have participatory methods been introduced.

Government agencies, by virtue of their distance from the day to day demands faced by farmers and their wider perceptions of environmental cause and effect, have been occupied with the big picture, long-term consequences of continued deforestation and environmental degradation in the region. The farmer is often viewed as the agent of destruction. While there is certainly more than a degree of truth in this view, it

accomplishes little. An antagonistic relationship between farmer and government worker will do little to reverse the current trends of deforestation and environmental degradation.

Rural development projects on the other hand have been focusing on development initiatives with limited consideration for natural resources management. One reason for this has been the need to gain credibility with farmers and demonstrate rapid success. Another reason is that there has been an implicit assumption that upon intensification of agriculture on the plains and bottomlands, pressure would be taken off the more fragile hillside fields.

As has been shown time and again in other countries, neither approach is sufficient to deal with natural resource degradation and declining agricultural productivity. Most of the initiatives in the region are too recent to effectively evaluate their impact either on resource conservation or on economic development. It seemed, however, that both development workers and conservationists were beginning to have a better understanding of what each has to offer and how they can work with farmers to accomplish both conservation and development goals. There is a slowly growing realization that, while technically some of the interventions seem to be promising, their acceptability to the rural population will depend on participation of and ownership by the people.

#### Constraints to natural resources management

Labor is a major constraint for intensive management schemes. Rural exodus (discussed in section 3) has created a severe labor shortage in the Fouta Djallon. Projects often assume that labor, while perhaps not a free good, is nonetheless available for worthwhile activities. This cannot be assumed in the Fouta region. Any schemes which create additional demands for labor will need to do a serious evaluation of whether or not this labor is available, who will provide it and when and what trade-offs that person or family unit will have to make.

Infrastructure, although not directly related to natural resources management is, nevertheless, a serious constraint to economic development in the Fouta and therefore a constraint to working with farmers on any activity. Projects to increase agricultural productivity by developing the bottomlands must take into account the existence of markets and roads to market the increased production. The lack of other basic infrastructure such as clean water supply, schools, health clinics, etc. will also affect farmers prioritization of natural resources activities.

#### Food-for-work

Food-for-work can be used in positive and negative ways. On the one hand, it can be used to compensate people for activities that are important, but that they would not otherwise do because of lack of immediate gain or lack of time. On the other hand, food-for-work can create dependency and imbalances between projects that use it and those that do not.

The policy of using food for work to assure farmer collaboration and participation should be studied. It seemed that food aid was generalized and may not have been appropriate in all situations. While there are certain circumstances when food aid is appropriate, indiscriminate use can lead to dependence. A uniform policy for use including the types of situations in which its appropriate as well as the quantities to be distributed should be established.

### The participatory approach

The participative approach, so often referred to in this report and in the Fouta, will help to utilize rural people's interest and enthusiasm. By starting with farmers priorities and knowledge and working from there, this approach should put in place activities and practices that reflect farmers' concerns and in which they have a stake in continuing beyond the life of the project. While some activities may not be high priorities for farmers, by addressing their priorities and gaining their confidence, projects can move on to a combination of farmer priorities and project priorities.

Several projects have initiated activities that use the participative approach and combine farmer and project priorities. The BRP Mamou project has managed to encourage farmer acceptance of forestry interventions by working with farmers to assure that ownership and management of village forests stayed at the village level and at the same time involving farmers in enrichment plantings and protection of natural forest. The French NGO, ESSOR, began its program with a survey which revealed that villagers were primarily concerned with termite problems. Therefore, before introducing the project's priority of live fences, ESSOR organized a small termite eradication activity. They are now moving on to live fencing. The activities of PDA Timbi Madina are described in detail in section 5.7. BRP Pita has begun a participative approach that will work with village identified innovators as model farmers to experiment with new techniques.

### Non-governmental organizations

Both Guinean and expatriate NGO's have been very successful in mobilizing the rural population, particularly through their work with farmer groups. As yet, these organizations are still few enough, small enough and new enough it might be an excellent time for a regional, field-oriented workshop to exchange ideas, approaches and experiences in natural resources management. NGOs could learn from one another's experiences and exchange information on how they are working with donors and the government. Training and information needs could be identified and technical successes and failures shared.

This workshop could strengthen NGOs and NGO coordination which would also further general coordination in the region. To maintain an open and frank atmosphere, the workshop should be organized by NGOs with donor and government participation on a limited and invitation only basis.

### Private initiatives

The team observed several private agricultural initiatives of young people who have completed their education in agricultural-related fields but have found no employment in the public sector. These young farmers should be encouraged for several reasons. If they can make a living in the rural areas, this will reduce the outmigration of young people, a significant problem for agriculture in the Fouta. Because they are dynamic and have an entrepreneurial spirit, they can be models for the privatization of agriculture. In at least one case, the young agronomists have associated themselves with peasants and have been teaching improved methods of production. These same young men have plans to expand their operations to better integrate livestock and agriculture which will be an important strategy for protecting their soil resources.

Farmers who are not directly linked to a rural development or watershed project are disadvantaged since they have limited or no access to credit, inputs (fertilizers, seed) and equipment (loan or purchase). By minimal support to private initiatives such as the one mentioned above, these farmers could obtain access to credit and other inputs. Additionally, the example of farmers' groups improving their situation without the aid of projects might encourage self-reliance and help government extension workers overcome their own lack of resources.

### Cooperation and information

The Government of Guinea is understandably concerned about the proliferation of projects in the Fouta Djallon region. Coordination, cooperation and information sharing are essential to the ongoing projects in rural development and watershed management. Although there were examples of cooperation, there were also examples of projects pursuing the same ideas with little or no communication. Other projects could benefit from initiatives which have met with a certain level of success or have discovered promising technical innovations. Documentation on how each of these activities operates should be prepared and distributed to other projects.

The pilot watershed projects, for example, have amassed a certain amount of experience that needs to be shared with other projects. It is also extremely important to communicate what has been tried and failed in addition to communicating successes.

In order to evaluate and learn from previous activities, each project or action should establish a system of monitoring and evaluation. This information should be shared among the various projects. The Rural Development Project of Labe has established an information management system that will permit effective monitoring and evaluation of their interventions. Although this project has means that may be beyond those of other projects, a similar yet simpler system could be developed using this as a model. A small seminar with one or two representatives from each project could be organized to present PDR Labe's system and then discuss how it could be modified to meet the needs and constraints of other organizations. Discussions about the type of information to collect and share are often more important than less substantive concerns over methodology or technology constraints.

## Opportunities

Guinea is at a turning point in its development. The Second Republic has opened the door to new ideas and opportunities and the Guinean people are responding with enthusiasm and interest. Although life in rural areas is difficult, the innovative farmers, women cooperative members and young entrepreneurs with whom we spoke, all seemed ready and willing to consider new approaches and improve natural resources management and agricultural practices. This valuable human resource is only beginning to be fully realized and holds great promise for natural resources management initiatives.

In addition to the new political and economic wave, Guinea is fortunate in having traditional natural resources management practices upon which new projects and initiatives can build. Practices such as live fencing, intensive gardening and fruit tree production all demonstrate an understanding of the natural resources base and represent opportunities for projects.

Obstacles, both technical and socio-economic, to natural resources management remain. Nonetheless, enough has been learned now in both of these areas to begin initiatives that address both the conservation and the development of the natural resources base.

## ANNEX I

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