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CHEMONICS INTERNATIONAL INC.

GUINEA NATURAL RESOURCES MANAGEMENT PROJECT
FINAL REPORT
AGROFORESTRY/FORESTRY COMPONENT

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ACRONYMS

AF/FOR	Agroforestry/Forestry
AFNETA	Alley Farming Network for Africa
CBNRM	Community-Based Natural Resources Management
CED	Community Enterprise Development
DNFF	Direction Nationale des Forêts et de Faune
ENATEF	*Ecole Nationale des Techniciens des Eaux et Forêts*
FG	Guinean franc *(Francs Guinéens)*
GOG	Government of Guinea
IITA	International Institute of Tropical Agriculture
IVMC	Inter-Village Management Committee
LTC	Land Tenure Center
M&E	Monitoring and Evaluation
MAEF	*Ministère d'Agriculture, Elevage et Forêts*
NFM	Natural Forest Management
NRM	Natural Resources Management
PRA	Participatory Rapid Appraisal
SOW	Scope of Work
STTA	Short-Term Technical Assistance
TA	Technical Assistance

EXECUTIVE SUMMARY

Introduction

The Guinea Natural Resources Management project operated in three watersheds in Fouta Djallon, the middle region of Guinea. Field activities in the three watersheds began in January of 1993 and will continue until September 1997. The project contract states that the project's goal is "increased sustainable agricultural and value-added production by men and women for domestic and export markets," while its purpose is "to improve the management of natural resources in three target watersheds in the Fouta Djallon highlands for profitable and sustainable agricultural production." Natural resources management (NRM) and community enterprise development (CED) comprised the project's two major components. The two principal activities under the NRM component were agroforestry/forestry (AF/FOR) and agricultural production/soil and water conservation. The four supporting components were training, applied research, monitoring and evaluation (M&E), and policy analysis.

The project was implemented in collaboration with the Guinean Forest and Wildlife Directorate (*Direction Nationale des Forêts et de Faune* or DNFF), which is within the Guinean Agricultural Ministry (*Ministère d'Agriculture, Elevage et Forêts* or MAEF). A team of five Guineans (a director plus a counterpart for each of the four technical assistants) ensured the daily execution of project activities in the three watersheds. On each team were three technicians who were DNFF employees and two who were contractors.

Agroforestry/Forestry Component

The goal of the AF/FOR component was to introduce and/or improve agroforestry and forestry techniques to manage natural resources better and support agricultural production. These techniques were demonstrated to interested villagers and communities. The desired result was the non-subsidized, spontaneous adoption of new agroforestry practices, aided by farmer-to-farmer visits.

Setting and Key Considerations

Several major factors must be considered when evaluating the project's AF/FOR component. First, agroforestry and forestry are not priorities for the target populations of the three watersheds, even though these components were included in the project design. Second, the problems that agroforestry and forestry try to remedy are long-term. Third, one of the project's six outputs is "increased adoption of NRM techniques," but given the long-term nature of agroforestry and forestry, the question of when these techniques will be adopted remains unanswered. A final consideration is the difference between on-farm and on-station conditions.

Overview of Interventions and Activities

The project's AF/FOR interventions were of two types. Primary interventions were widely implemented in the three watersheds, and because they appear to be the most promising, they will be continued by villagers after the project. Secondary interventions were those not implemented on a wide-scale or those that were problematic. Primary interventions included private nurseries, live fencing, reforested and protected forest zones, contour hedgerows, and co-

management of the Nialama Forest Reserve. Secondary interventions included wildfire control, multipurpose shrub blocks, the experimental nursery, and the development of village management committees.

Private Nurseries

This section presents the recommendations. The primary and secondary interventions, information on background, goals, methods, constraints, and results appear in the body of the report.

Lessons

- Villagers can quickly become proficient at most nursery techniques.
- Because nurseries are not a full-time activity for villagers, optimum seedling quality will not be attained.

Recommendations

- Nurserymen should be encouraged to make at least 50 percent of the nursery sacks required for 1997 production from local materials.
- Watershed agroforesters and enterprise technicians should assist private nurserymen in promoting their enterprises, especially in taking orders for plants from interested villagers. Similarly, the project's policy of requiring collaborators to pay for a percentage of their seedlings should be continued in 1997 (an increase in payment of 25 to 50 percent of seedlings should be considered); this system should be refined so that all collaborators are known by February or March, thus enabling nurserymen to collect money for the seedlings during the first quarter of 1997.
- The feasibility of small, community-based nurseries using bare root production methods for the needs of one or two villages should be tested.
- Tests should continue regarding the possibility of producing a wide range of species in bare root beds. Similarly, techniques for lifting seedlings out of these beds with small balls should be tested.

Live Fences

Lessons

- Of all agroforestry techniques, watershed villagers are most interested in live fencing.
- The local population and some Guinean foresters do not appreciate the local species, despite their established, traditional uses.

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Recommendations

- At demonstration sites where significant growth has occurred, objectives concerning the types of products grown should be defined and management (pruning, lopping) should commence. Quantities of biomass (green and woody) or other products produced should be measured and recorded on a per meter (of live fence) basis. These sites should also be used for numerous farmer-to-farmer visits.

- Tests should continue for propagating Gliricidia by direct seeding (seeds should be collected as late in the dry season as possible (early to mid-April) and should be sown no later than mid-May).

- The establishment of live fences using cuttings and direct seeding should be emphasized as these methods are more appropriate and sustainable at the village level.

- The use of *Acacia mangium*, Gliricidia, Gmelina, and Moringa should be promoted as live fence species on a large-scale.

- The appreciation and promotion of native species should be a theme in the project's environmental education program and should be included in all future environmental education programs throughout the country.

Reforestation and Protected Forest Zones

Lessons

- At least one of three factors is necessary for establishing a successful community reforestation plot: a strong village structure capable of organizing and motivating people, an area where domestic animal pressure is minimal, or an area where wildfire is rare.

- Early burning (by the end of December at latest) around reforestation plots or protected zones is necessary; if this is not done, there is a good chance that the plot or zone will burn.

Recommendations

- Intensive discussions and negotiations with the management committees in each village having a reforestation plot or protected zone should occur; precise responsibilities and organizational methods need to be defined for each village so that maintenance and protection tasks are accomplished.

- Watershed agroforesters should organize field training sessions on pruning methods for saplings in plots or zones, with villagers responsible for maintenance.

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Recommendations (continued)

- To have a long-term, beneficial effect on spring flow, reforestation plots or protected zones should be established on a significant area (at least 2 ha) at a considerable distance above the spring.
- If trees require planting next to springs for symbolic or other reasons, the species selected should be of short stature and/or have a deciduous habit (e.g., Gmelina).
- The establishment of protected forest zones should be emphasized rather than producing and planting numerous seedlings for reforestation; this method is more appropriate and sustainable at the village level.

Contour Hedgerows

Lessons

- Contour hedgerows in conjunction with rock lines can increase the cropping cycle in an exterior field, as exemplified in the original Diaforé site.
- Flemingia is a fast-growing, resistant species well-suited to this intervention; it can produce green manure quickly.

Recommendations

- The testing of Gliricidia through direct seeding should continue. Seeds should be collected as late as possible in the dry season and sown as early as possible in the wet season. Technicians should monitor closely the sites where it is sown.
- Once established, *Flemingia* is a superior hedgerow species; therefore, efforts should continue to find a suitable method for its establishment. Direct seeding tests should continue (seeds require treatment before sowing). Trials involving small bare root nurseries near the outplanting sites should be attempted.
- For areas such as Dissa where fallow regeneration is rapid, hedgerows should be established the first year after a field is cleared.
- Direct seeding of Pigeon Pea along contours should be promoted on a large scale. Its capacity for facilitating soil conservation, reinforcing rock lines, and producing edible seeds should be stressed, not its ability to provide green manure.

Co-Management of the Nialama Forest Reserve

Lesson

- Forced, rapid evictions of farmers from state forest land will cause conflicts between the local people and government authorities, especially DNFF.

Recommendations

- Project personnel should work to finalize (including negotiating with the IVMC), submit, and get approval of the management plan.
- Work should continue to develop and negotiate a contract between the DNFF and the IVMC, even before approval of the management plan.
- Studies should be undertaken to analyze the feasibility of co-management initiatives for the state forest reserves near the Dissa (Souti-Yanfou) and Diaforé (Bakoun) watersheds.
- The project should seek continued short-term technical assistance to ensure that the co-management initiative continues. Specifically, short-term technical assistance is needed to help implement the management plan, especially assigning village responsibility, demarcating agricultural and protected zones (including GPS work), and selecting trees to be harvested.
- The revisions of the forest map, including village responsibility zones once these are finalized, requested of the *Bureau Technique* at DNFF/Conakry by the project need to be monitored and pursued by the Koundou director and the project's regional and national coordinators.
- When illegal farming occurs in state forests, forced evictions should be avoided; instead, a long-term process of negotiation should begin to convince farmers to farm legally through contracts with DNFF, or agree to stop farming altogether.
- The DNFF should consider replicating the Nialama co-management model in at least one state forest reserve in each of the other three geographic zones of the country.

Fire Control

Lesson

- Wildfire is an immense, complex problem that is not easily solved or remedied. Many players are involved, some of them unknown.

Recommendations

- Partial burning should be tested in the Nialama Forest Reserve; early burning should occur along all the roads that transect the forest, along the entire border of the reserve, and on laterite zones (*bowés*) and grassy areas within its interior; the remainder of the forest should be spared from fire.

- Project technicians should work with CGs to reinforce their capacity and organization with respect to early burning. To the extent possible, clear responsibilities regarding who will do the work should be delineated; collaboration should also continue with the local *cantonnements* to help them organize their early burning campaigns and become more flexible in their approaches to burning.

- The DNFF should consider designing and implementing a nationwide awareness campaign regarding the effects of wildfire and its prevention. If the design is satisfactory, a donor could be found to help with funding.

Multipurpose Shrub Blocks

Lessons

- A sustained and intense extension campaign, with vigilant follow-up is needed for the introduction of any innovative technique within the framework of a rural development project.

Recommendations

- Project personnel should organize farmer-to-farmer visits to the best sites in each watershed. Pruning demonstrations should take place during these visits and an emphasis should be put on the use of the blocks for mulch and green manure, not fodder.

- If farmers are interested in installing more shrub block demonstrations, project personnel should formulate an appropriate, sustainable strategy for establishing new blocks, such as direct seeding for Flemingia and Gliricidia and cuttings for Gliricidia.

Experimental Nursery

Lesson

- Given current attitudes in Guinean society, it is extremely difficult to dismiss or fire an employee.

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Recommendations

- Clearly written, agreed-upon job descriptions should be prepared for all project personnel; if individuals are unable or unwilling to adhere to these descriptions, they should be dismissed and replaced.

- The DNFF should consider establishing similar experimental nurseries in each of its four geographic regions to develop and promote production methods for native species. Seed banks and arboretums of native species could also be established in association with these nurseries. Again, it would probably not be difficult to interest donors in this activity, especially if biodiversity is stressed.

Village Land Management Committees

Lessons

- The establishment of new community structures is a long and complex undertaking that requires sociological expertise and commitment of significant project resources.

- For each activity specified in a project design, consensus must be reached regarding who is responsible for developing and implementing the activity; if consensus is not reached, minimal achievement will occur.

Recommendations

- The Dissa watershed team should vigorously pursue development of the village land management initiative in the four pilot watersheds. Above all, NRM-related activities identified in the action plans should be carried out to the fullest extent possible.

- Project designers should ensure that, for all project activities, at least one person among the personnel recruited have the appropriate technical expertise.

Training

For the most part, the agroforestry technical assistant trained his counterparts informally or on the job during watershed visits. Participants in the training in turn trained villagers informally during site visits within the watersheds. Formal trainings associated with the project's AF/FOR component are summarized in Exhibit V-1.

Additional Recommendations Relevant to Project Setting

To assess the project accurately, donor representatives and other outside evaluators must understand the project's larger constraints.

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Lesson

- Written job descriptions are necessary for the steady operation of a project, for evaluating performance (accountability), and to avoid conflicts resulting from differing interpretations of who is to do what.

Recommendations

- The existence of written, agreed-upon job descriptions for all positions should be a prerequisite for project start-up.
- Alternate funding mechanisms to PL-480 should be identified for field-level work for projects that are supposed to show field-level results; this is especially true for NRM projects that have activities linked to certain seasons and are thus time-sensitive.
- The DNFF should consider using an open application process for positions on rural development projects. This would ensure that the personnel chosen would be ready to serve in project settings. Similarly, for contractual positions, applicants should be carefully screened for their willingness and ability to work in isolated rural settings.
- DNFF should consider staffing at least half of the key positions of projects with an AF/FOR component with trained foresters.

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SECTION I
PROJECT OVERVIEW

The Guinea Natural Resources Management project operated in three watersheds in the middle Guinea region known as the Fouta Djallon. Field activities in the three watersheds began in January 1993 and will continue until September 1997[1]. The project contract states that the goal of the project is "increased sustainable agricultural and value-added production by men and women for domestic and export markets," while its purpose is "to improve the management of natural resources in three target watersheds in the Fouta Djallon highlands for profitable and sustainable agricultural production." Natural resources management (NRM) and community enterprise development (CED) comprised the project's two major components.

Agroforestry/forestry (AF/FOR) was one of two principal activities under the NRM component. The other was agricultural production/soil and water conservation. Supporting components included training, applied research, monitoring and evaluation (M&E), and policy analysis.

The technical assistance team was based in the project's administrative headquarters in Labé.[2] The three watersheds—Diaforé, Dissa, and Koundou—are located in the following directions from Labé: Diaforé is 120 km to the northeast, a 4 to 5 hour drive; Dissa is 265 km to the south, a 4.5 hour drive; and Koundou is 120 km to the north-northwest, a 3 hour drive. Additional information on the three watersheds, including climatological data, is found in Annex A. The project was implemented in collaboration with the Guinean Forest and Wildlife Directorate (*Direction Nationale des Forêts et de Faune* or DNFF), in the Guinean Agricultural Ministry (*Ministère d'Agriculture, Elevage et Forêts* or MAEF). A team of five Guineans (a director plus a counterpart for each of the four TAs) ensured the daily execution of project activities in the three watersheds. Each team had three technicians who were DNFF employees. The remaining two technicians were contractors.

[1] This is the official end of the project's first phase, although the primary contractor, Chemonics International, is due to end its technical assistance in December 1996.

[2] This multidisciplinary team is comprised of a chief of party, a soil and water expert/agronomist, an agroforester/forester, a women-in-development expert, and an enterprise development expert.

SECTION II
THE AGROFORESTRY/FORESTRY COMPONENT

A. Goals and Strategy

The goal of the AF/FOR component was to introduce and/or improve agroforestry and forestry techniques for better management of natural resources and support agricultural production. This was achieved by installing demonstrations for interested individuals and communities. Before the demonstrations were organized, extension and education efforts took place to stimulate interest in and understanding of the proposed activities.[1] These efforts usually used one or more of the following tools: visual aids (paintings and posters), slide shows, video projection, and explanatory leaflets translated into local languages.

The desired result of this component is the non-subsidized, spontaneous adoption of the AF/FOR techniques, aided by farmer visits to successful demonstrations, word of mouth, etc. Additionally, those activities contributed to four of the six project outputs specified in the contract, namely:

- Increased watershed-specific knowledge of at least three watershed communities to manage natural resources more effectively
- Increased capacity of watershed resource users to plan and manage common watershed resources, especially water sources, forests, and pastures
- Increased adoption of NRM technologies, such as soil conservation, water control, planting of trees and windbreaks, in at least three watersheds
- Approximately 30 Government of Guinea (GOG) personnel and watershed community leaders trained in NRM; improved NRM skills among GOG staff and watershed community leaders

B. Setting and Key Considerations

Several factors need to be considered when evaluating the AF/FOR component.[2] Although agroforestry and forestry were included in the project design, these goals are not priorities for the target populations of the three watersheds. The watershed villagers are poor farmers who are preoccupied with short-term needs, especially the production of food for their families and/or for sale (i.e., agriculture). Agroforestry and forestry are long-term ventures requiring the luxury of a long-term perspective, a perspective that most watershed villagers do not share.

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[1] It should be noted that the proposed activities usually addressed constraints or priorities cited by watershed villagers during initial and subsequent Participatory Rural Appraisals (PRAs); others corresponded to the mandate of the AF/FOR component as outlined in the project contract and in the Agroforestry Technical Assistance Scope of Work (SOW). For more information on initial PRA results, see Guinea NRM Project (1994a) and (1994b).

[2] This part of the discussion is not meant to be negative. Rather, it aims to explicate the field-level realities faced by the project. For additional constraints to realization of AF/FOR activities, see Section VI.

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This perspective is related to the second factor, the long-term nature of agroforestry and forestry and the problems they intend to remedy. For example, enhanced or stabilized soil fertility through the addition of green manure from contour hedgerows or live fences is not achieved in one or two years. At least four years are required before crop yields stabilize or increase. Thus, AF/FOR techniques are difficult "sell" to farmers interested in immediate returns. Likewise, many donors and evaluators look for quick results (often visually), yet AF/FOR is usually not able to show significant, rapid impacts in one, two, or even four years.

The third factor is the adoption dilemma: one of the project's six outputs is "increased adoption of NRM techniques."[3] Yet, given the long-term nature of agroforestry and forestry, when can one expect to see adoption of these techniques? Optimistically, adoption may begin four years after screening and demonstration have begun; realistically, it begins after six years. Expectations therefore need to be adjusted to conform to the latter scenario.[4] Contrary to assumptions made in the project design paper, few species and technologies had been tested in Fouta Djallon when the project began in 1992. No "off-the-shelf" methods were available to the Guinea NRM team. The screening and demonstration steps had to be combined even though this would not occur in an ideal situation.

Finally, on-farm and on-station conditions differ. Many promising results from agroforestry techniques have been demonstrated on-station, yet these same results cannot be replicated in the same timeframe under on-farm conditions because the growth of trees and shrubs is much slower on-farm. Compromising conditions in the three watersheds included poor soils, partially shaded sites, browsing animals, competition from weeds, and fire.

C. Overview of Interventions and Activities

AF/FOR interventions can be of two types. The primary interventions were widely implemented in the three watersheds. Because they are the most promising, they will be continued by watershed villagers after the project. Primary interventions include private nurseries, live fencing, reforested and protected forest zones, contour hedgerows, and co-management of the Nialama Forest Reserve. Contour hedgerows and co-management of the forest reserve are placed in this category due to their promising nature even though they were not widely implemented.

Secondary interventions are those that were problematic or not implemented on a wide-scale, including wildfire control, multipurpose shrub blocks, the experimental nursery, and village management committees. Additional miscellaneous activities and interventions are also presented.

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[3] Adoption as defined here is spontaneous, non-subsidized adoption. In the author's view, a willingness to try or a given technique in collaboration with a project does not constitute adoption.

[4] For more commentary on expectations associated with the results of agroforestry techniques, the reader is referred to the author's letter to the editor in *Agroforestry Today*, Vol. 8, No. 1, 1996.

SECTION III
PRIMARY INTERVENTIONS

A. Private Nurseries

A1. Background, Goals, and Methods

The project supported establishment of eight private nurseries in the three watersheds during its first two years of field operations. Collaboration has continued to the present. The primary goals of the nurseries were to:

- Produce tree and shrub seedlings for the project's AF/FOR demonstrations
- Produce fruit trees for the watershed populations
- Create a profitable and sustainable small enterprise

The watershed agroforesters chose interested villagers as the first step in establishing the nurseries. These individuals often possessed permanent lowland gardens that were suitable nursery sites. The nurserymen then received training in nursery and enterprise development techniques.[1] A total of 12 villagers, including one woman, were trained in making a suitable potting mixture, filling pots, treating and sowing seeds, transplanting, creating and maintaining bare root beds, pruning roots, making pots from locally available materials, and grafting. Watershed agroforesters trained villagers during visits to the nurseries, working side-by-side them, especially during the first two years. Follow-up visits during the seedling production season (January to May) occurred weekly or bi-weekly. More formal training, often outside the watersheds, occurred for selected topics such as grafting.

For the first three years, the project bought all agroforestry and forestry seedlings from the nurserymen (most seedlings were purchased for 150 FG). In 1996, collaborating farmers and villagers were asked to buy 10-15 percent of the seedlings for their demonstrations. From the start, nurserymen sold their fruit trees directly to villagers.

A2. Constraints

The project encountered numerous problems with respect to the private nurseries including the fact that working in the nurseries was not a full-time occupation for the nurserymen.[2] The nurserymen were almost always occupied with several activities at any given moment. Production often fell behind schedule and the maintenance of seedlings was often cursory. Seedling quality suffered because many did not achieve optimum growth by the time they were taken from the nurseries for outplanting. This, in turn, affected seedling survival in the AF/FOR demonstrations.

Several nursery techniques were not mastered or were ignored. Most notable was pricking seedlings out of pots where more than one had germinated and removing the pots to prune roots

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[1] See the final report of the community enterprise technical assistant for more information on the enterprise aspects of this activity.

[2] See Guinea NRM Project (1995) and (1996) for additional discussions of constraints and analyses of major and minor interventions.

to avoid rootbound plants. Some nurserymen also had trouble becoming adept at grafting techniques even after two formal trainings and repeated practice.

Other constraints related to the lack of materials. Polyethylene sacks could not be purchased in Guinea and had to be imported. Two alternatives, which the project promoted, were bare root production and making pots from local materials. Other materials lacking were grafting stock (especially for scions) and seeds of exotic species. To resolve these problems, the project helped nurserymen acquire grafted stock to be used for scions. Each nurseryman also planted a small seed orchard of exotic species to serve as a seed source. Additionally, trips were made to different sites in the Labé area to obtain seeds and scions; nurserymen are now aware of these locations. Another constraint that prevented the nurseries from becoming sustainable was the transportation of seedlings. To alleviate this problem, nurserymen were encouraged to contact truckers who make regular runs through their areas or to buy bicycles or cattle-drawn carts.

Two enterprise-related constraints also merit mention. First, most nurserymen have not promoted their plants aggressively, with the result that many watershed inhabitants do not know the origin of the plants used in their demonstrations. Second, the current market for forestry or agroforestry seedlings is very small. Although there is a small demand for *Acacia auriculiformis*, *Acacia mangium*, and *Grevillea robusta*, the market for these species is not expected to increase significantly in the near future. Perhaps in five years or so, the market for AF/FOR species will increase as farmers see the benefits of the new species; the degree of this increase, however, is uncertain.

This situation leads to the following question: If donors and governments believe that reforestation and agroforestry are important and need to be promoted, yet the market for the species used in these undertakings is small at best, shouldn't they find a way to subsidize the permanent production and distribution of these seedlings? Another alternative is to dispense with seedling production altogether and emphasize direct seeding, propagation by cuttings, and protected forest zones that rely on natural regeneration. The disadvantages of these methods are a limited range of species amenable to propagation by these techniques, lower survival, and slower growth.

A3. Results

Major achievements for the project's private nurseries are summarized in Exhibit III-1.

Exhibit III-1. Private Nursery Seedling Production

Year	AF/FOR Seedlings		Fruit Tree Seedlings	
	Quantity Produced	Gross Profit (FG)	Quantity Produced	Gross Profit (FG)
1993	10,944	1,368,000	8453	119,400
1994	31,572	3,946,500	9825 (1903 sold)	2,035,7001*
1995	22,635	3,395,250	3600 (1365 sold)	955,800**
1996	12,593	2,209,850	n/av (415 sold)	n/av
TOTAL	77,744	10,919,600	21,878	3,110,900

* Includes oil palm, coffee, and cola seedlings
** Includes sale of seedlings produced in previous years.

Other significant achievements of the private nursery intervention during the project included:

- Successful production of 9 fruit species, 15 exotic AF/FOR species, and 25 native AF/FOR species
- Establishment of small seed orchards of exotic species for each nursery (some trees and shrubs in these orchards have already begun production)
- Production and distribution to clients of an extension flyer in the local language providing instructions on planting a seedling grown in a plastic sack and a flyer explaining the potential uses and benefits of 18 AF/FOR species
- Announcements on local radio stations regarding the availability of plants in the project nurseries
- More than 250 AF/FOR seedlings sold to private individuals
- All nurserymen participated in a grafting review training in 1995; more than 300 citrus seedlings grafted as a result of these trainings
- Workshops for the nurserymen on constructing plastic sacks with local materials in each watershed
- Two 2.5-day workshops held in Dissa and Diaforé on nursery techniques for 26 para-nurserymen in 1996

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A4. Lessons Learned and Recommendations

Lessons 1, 2

- Villagers can quickly become proficient at most nursery techniques.
- Because nurseries are not a full-time activity for villagers, optimum seedling quality will not be attained.

Recommendations for 1997

- Nurserymen should be encouraged to make at least 50 percent of the nursery sacks required for 1997 production from local materials.
- Watershed agroforesters and enterprise technicians should assist private nurserymen in promoting their enterprises, especially in taking orders for plants from interested villagers. Similarly, the project's policy of requiring collaborators to pay for a percentage of their seedlings should be continued in 1997 (an increase in payment of 25 to 50 percent of seedlings should be considered); this system should be refined so that all collaborators are known by February or March, thus enabling nurserymen to collect money for the seedlings during the first quarter of 1997.

Recommendations for 1997 and Beyond

- The feasibility of small, community-based nurseries using bare root production methods for the needs of one or two villages should be tested.
- Tests should continue regarding the possibility of producing a wide range of species in bare root beds. Similarly, techniques for lifting seedlings out of these beds with small balls should be tested.

B. Live Fences

B1. Background, Goals, and Methods

Live fencing was a mainstay of the project's AF/FOR component because of problems with traditional dead wood fences. Live fences had also been planted to a limited and haphazard extent in the Koundou and Diaforé watersheds when the project began.

The goals of the intervention were to:

- Introduce a wide range of multipurpose species for use in fencing
- Diminish the time employed in annual renewal of dead wood fences (long-term)
- Diminish deforestation rates (long-term)
- Reduce termite populations in the *tapades*, the mixed crop home gardens that constitute the backbone of agricultural production in the Diaforé and Koundou watersheds

Although some live fence demonstrations were installed in 1993, the activity began in earnest in 1994. Extension meetings that explained and promoted the technique were held in all three watersheds during 1994 and 1995. Paintings, slides, and videos were used as visual aids during these meetings and extension flyers in local languages were distributed.

Subsequently, the project installed demonstrations with interested villagers. Seedlings were planted along the interior of dead wood fences at a spacing of 0.5 m. This method does not result in a live fence in the strict sense of the word but a fence with closely spaced live posts. It was thought that this modification of the traditional fence in Diaforé and Koundou would be more easily accepted than a live fence using thorny species. Nonetheless, collaborators have been encouraged to fill in between the live plants in the future, using direct seeding or cuttings.

Additionally, *Jatropha curcas*, the traditional species used in live fencing in Diaforé and Koundou, is not currently managed for any products. During the installation of demonstrations and subsequent visits, the project emphasized that the species it was promoting could be managed for several products in the future: fodder, green manure or mulch, poles and medicine or pesticides (in the case of *Azadirachta indica* or Neem).

Gliricidia sepium cuttings were also promoted in live fences beginning in 1993. Timing of planting and lengths of cuttings were not perfected until 1995, however. Additionally, direct seeding and cuttings of local species were tested and promoted with live fence collaborators in 1995 and 1996 (see Annex B). Many 1996 sites were fences around lowland gardening plots. Live fencing can facilitate production in these plots because women's gardening groups would not be forced to pay men to construct dead wood fences around their gardens.

Dead wood fencing (along with the intensive *tapade* system) is not traditionally practiced in the Dissa watershed. However, several farmers were interested in trying the technique around gardens or other plantations. Currently, some of the best growing live fences can be seen in Dissa. There are signs of spontaneous adoption of the technique, especially using local cuttings.

In 1996, collaborators were asked to pay for 10-15 percent of the seedlings used in their demonstrations. Although some have paid, many still owe money to private nurserymen for these plants.

B2. Constraints

The major constraint of live fencing is the slow growth or development of outplanted seedlings. Many factors contribute to this problem and will affect the spontaneous adoption of the method and the species promoted by the project. Although each watershed has two or three live fence sites where growth has been exceptional, most sites will need two or three more years of development before they are impressive enough to convince visiting farmers to adopt them.

Poor soils, termite attacks, and shading by crops and dead wood fences were the major factors slowing the growth of seedlings. Browsing animals were another major detriment (livestock are allowed to enter the *tapades* during the dry season). In general, collaborators were unable or unwilling to perform any maintenance tasks (e.g., weeding or extra protection) for the seedlings after outplanting. Again, all these factors indicate that expectations for growth and adoption must be adjusted to suit on-farm conditions.

To find a sustainable and appropriate propagation method for promising species, the project experimented with direct seeding and cuttings. Several species tested as cuttings appear promising, but only one species (*Moringa oleifera*), which was direct seeded, demonstrated satisfying results. This was because most of the species tested are very small at germination and are unable to compete with weeds and crops in a semi-wild, zero-maintenance, on-farm setting.

B3. Results

Based on field observations across sites, paying particular attention to growth and survival, the best species for live fencing appear to be *Acacia mangium*, *Gliricidia sepium*, *Gmelina arborea*, and *Moringa oleifera*. Gliricidia and Moringa can be successfully propagated by cuttings and direct seeding, respectively. Similarly, Gmelina can be produced in bare root beds; unfortunately, the only feasible means of producing *Acacia mangium* currently available is in pots in a nursery. Other species that showed good growth at selected sites included *Leucaena leucocephala*, *Sesbania sesban*, *Azadirachta indica* (Neem), *Cassia siamea*, and *Acacia auriculiformis*, and *Spondias mombin* cuttings. Exhibit III-2 shows the major results of the live fencing intervention.

Exhibit III-2. Live Fencing Results

Year	Meters Planted	Number of Participating Families
1993	1230	8
1994	3351	47
1995	5287	72
1996	4728*	68
TOTAL	14596	n/ap**

* Includes 2533 m of cuttings.
** Many families participated for more than one year.

Other significant achievements of the live fence intervention include:

- Fourteen exotic species and nine local species tested in the demonstrations
- More than 5,500 cuttings of *Gliricidia sepium* planted in more than 75 demonstration sites in the three watersheds during the life of the project (many of these exhibited superior growth)
- Direct seeding tested at more than 60 sites; more than 3,000 meters sown in 1996 using *Moringa oleifera* and *Gliricidia sepium*
- An extension flyer in local languages and paintings developed for extension meetings on live fencing; more than 100 flyers distributed
- Extension video in local languages developed and shown in more than 20 village extension meetings with more than 1,200 people attending

- Approximately one-third (out of 2,000) of the Gliricidia cuttings planted in the Dissa watershed in 1996 harvested from cuttings planted in previous years

- Two to three impressive live fence demonstrations established in each watershed, providing excellent sites for farmer-to-farmer visits

B4. Lessons Learned and Recommendations

Lessons 3, 4

- Of all agroforestry techniques, watershed villagers are most interested in live fencing.

- The local population and some Guinean foresters do not appreciate local species despite their established, traditional uses.[3]

Recommendations for 1997

- At demonstration sites where significant growth has occurred, objectives concerning the types of products grown should be defined and management (pruning, lopping) should commence. Quantities of biomass (green and woody) or other products produced should be measured and recorded on a per meter (of live fence) basis. These sites should also be used for numerous farmer-to-farmer visits.

- Tests should continue for propagating Gliricidia by direct seeding (seeds should be collected as late in the dry season as possible (early to mid-April) and should be sown no later than mid-May).

Recommendations for 1997 and Beyond

- The establishment of live fences using cuttings and direct seeding should be emphasized as these methods are more appropriate and sustainable at the village level.

- The use of *Acacia mangium*, Gliricidia, Gmelina, and Moringa should be promoted as live fence species on a large-scale.

- The appreciation and promotion of native species should be a theme in the project's environmental education program and should be included in all future environmental education programs throughout the country.

[3] This lesson applies to all interventions where native species were used.

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C. Reforestation and Protected Forest Zones

C1. Background, Goals, and Methods

In 1993 and 1994, the project worked with numerous villages to create community reforestation plots. With a few exceptions, these plots were established adjacent to springs. They are areas that villages were willing to take out of agricultural production, areas where Guinean foresters traditionally plant trees. In 1995 and 1996, the project gradually moved away from planting trees in a small area to creating larger, protected communal forest zones (*mise en défense*). Direct seeding was also tested on a small scale in some of these plots or zones. The goals of these related interventions were to:

- Protect chosen sites, primarily from soil erosion.
- Maintain spring water quality and eventually increase spring flow.
- Provide diverse forest products to villagers.
- Keep a small percentage of village land-use zones in permanent forest cover to conserve biodiversity. The latter was the project technicians' goal and probably would not be cited as a priority by many villagers.

The idea of community reforestation plots was presented informally to villagers at various meetings and during visits by project technicians. Collaboration then began with interested villages. From 1993 on, written agreements were formulated and signed for all community forest plots or zones.[4] These agreements were between traditional landowners and villagers, often represented by a management committee, which was created with the help of the project (see Section IV). The agreements defined the terms under which the plot or zone would be used and managed, including the period it was ceded to the village. In 1993 and 1994, agreements were also drawn up and signed by the project and the committee of the village in question; these agreements outlined the activities and responsibilities of each party. For example, the project was responsible for transporting the seedlings to the site while the villagers were responsible for weeding around the seedlings and protecting the zones from fire.

In 1995 and 1996, project personnel presented the idea of establishing sizable, protected forest zones that would rely on natural regeneration. The project also proposed planting a belt of exotic species along the borders of selected zones to render its limits more visible. Many of these discussions were accompanied by a video that combined messages about fire control and the importance of forest resources; the idea of the protected forest zone was presented at the end of the video. Several villages, especially in Dissa and Diaforé, accepted the idea, and the watershed agroforesters proceeded to help them in choosing the zone and defining its limits. Often the zone was an expansion of one of the small reforestation plots previously installed with the project's help.

Two experimental plots were established on extremely difficult sites that bordered laterite zones (one in Koundou and one in Diaforé). These plots were fenced with barbed-wire and protected from fire. The villagers and the project experimented with planting native species and direct seeding in these plots. Also, several reforestation plots in Dissa were established as green belts to slow advancing fires, which often caused damage to village houses.

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[4] The Land Tenure Center (LTC) sub-project was instrumental in helping project personnel establish the procedures for drawing up these agreements.

C2. Constraints

The major problem associated with reforestation plots and protected zones was a lack of upkeep and protection. Villagers were not willing to weed around the seedlings, build a fence around the plots, or install firebreaks (early burning around the plots or zones). This lack of upkeep contradicted the agreement many villages had signed with the project, which specified their maintenance responsibilities. The result was that many plots were severely browsed by free-range, domestic animals; two to three sites in Dissa and Diaforé also burned. Additionally, the trees in many plots urgently required pruning of side branches to grow vertically; unfortunately, this did not occur. Other factors that slowed development of these plots or zones were poor, shallow soils and high termite populations.

The maintenance problem sprang from two conditions. First, the plots or zones were not a priority for villagers; they had more pressing matters on concern. Second, the responsibility for the tasks was not well-defined even though the management committees had been asked to organize them. Many villages simply said that upkeep and protection was everyone's responsibility; what this translated into was that upkeep and protection were no one's responsibility.

Project personnel advocated the creation of larger protected zones that would include permanent forest cover at a considerable distance from springs. In 1994, project personnel began to consider a technical problem associated with spring flow. After analysis, they concluded that planting a small plot of trees around a spring would not have a long-term effect on spring flow.

Protected zones were also emphasized because future seedling production and transportation seemed problematic. Protected zones that relied on natural regeneration would obviate the need for substantial numbers of seedlings. This method is more appropriate and sustainable at the village level.

Other constraints included the problem of weed competition for directly seeded species, especially those that are very small upon germination. Large-seeded native species such as *Afzelia africana* are probably the best choices. Also needed are arguments that will convince villagers of the need to maintain biodiversity or a certain percentage of forest cover. Forest degradation in the Fouta Djallon has not yet reached an alarming level and firewood shortages are unknown in the three watersheds, so arguments based on these considerations do not convince residents.

C3. Results

Despite the numerous constraints described in the previous section, good growth and development of several reforestation plots occurred, especially in the Dissa watershed where climatic conditions, especially rainfall, and fertile soils are conducive to growth. Again, observations across sites with growth and survival in mind indicated that the best species for this intervention were *Acacia auriculiformis*, *A. holosericea*, *A. mangium*, and Gmelina. Two native species that showed acceptable growth at selected sites in Dissa were *Afzelia africana* and *Ceiba pentandra*. Other species that demonstrated good growth at selected sites were *Leucaena leucocephala* and *Azadirachta indica*. A summary of the achievements of this intervention is presented in Exhibit III-3.

Exhibit III-3. Community Reforestation/Protected Forest Zone Intervention

Year	Area Planted (ha)	Number of Participating Villages
1993	3.63	19
1994	2.03	19
1995	3.2*	23
1996	2.332	18
TOTAL	11.19	n/ap**

* Includes belts of trees planted along limits of protected zones.
** Many villages participated for more than one year.

Other achievements associated with this intervention included:

- 20 native species and 10 exotic species planted in plots or zones
- 13 protected forest zones established in three watersheds
- 42 agreements negotiated and signed between traditional landowners of plots or zones and villagers
- A video on the importance of forest resources shown in several villages (see Section IV) an accompanying extension flyer in the local languages developed and distributed
- A significant build-up of organic matter (after three years of fire suppression) in the barbed-wire plot at Koundou noted and shown to villagers

C4. Lessons Learned and Recommendations

Lessons 5, 6

- At least one of three factors is necessary for establishing a successful community reforestation plot: a strong village structure capable of organizing and motivating people, an area where domestic animal pressure is minimal, or an area where wildfire is rare.
- Early burning (by the end of December at latest) around reforestation plots or protected zones is necessary; if this is not done, there is a good chance that the plot or zone will burn.

Recommendations for 1997

- Intensive discussions and negotiations with the management committees in each village having a reforestation plot or protected zone should occur; precise responsibilities and organizational methods need to be defined for each village so that maintenance and protection tasks are accomplished.
- Watershed agroforesters should organize field training sessions on pruning methods for saplings in plots or zones, with villagers responsible for maintenance.

Recommendations for 1997 and Beyond

- To have a long-term, beneficial effect on spring flow, reforestation plots or protected zones should be established on a significant area (at least 2 ha) at a considerable distance above the spring.
- If trees require planting next to springs for symbolic or other reasons, the species selected should be of short stature and/or have a deciduous habit (e.g., Gmelina).
- The establishment of protected forest zones should be emphasized rather than producing and planting numerous seedlings for reforestation; this method is more appropriate and sustainable at the village level.

D. Contour Hedgerows

D1. Background, Goals, and Methods

The project established contour hedgerows at several sites in the Diaforé watershed during 1993 and 1994. These were in association with rock lines along the contours. The goals were to:

- Conserve topsoil by diminishing erosion
- Reinforce the rock lines
- Eventually increase the cropping cycle through deposition of leafy biomass (green manure)

In 1993, the original site was established with seedlings from the watershed's private nurseries. The use of seedings was continued to a certain extent in 1994, but for the last three years, the hedgerows have been established through direct seeding. For the most part, sites were located in exterior fields (i.e., not *tapades*) as these were seen to have the potential to escape significant browsing by domestic animals.

Shrubs at the original site at Diaforé exhibited excellent growth; consequently, the site became the focal point for farmer-to-farmer visits in 1995 and 1996. A video on rock lines and contour hedgerows was also developed and projected in many villages throughout the three watersheds. In 1996, as a result of these extension efforts, demonstrations were installed on a larger scale in the Koundou and Dissa watersheds.

D2. Constraints

The primary problem associated with contour hedgerows is finding an appropriate way to establish hedgerows on a large scale. As with other interventions, producing, transporting, and planting nursery seedlings does not seem to be sustainable at the village level. The obvious answer is direct seeding, but this method has several problems. First, germination has been problematic for Gliricidia and *Flemingia macrophylla* (the latter is the best species at the original Diaforé site). Second, Flemingia seedlings are very small after germination and farmers have trouble recognizing them (to say nothing of the problems associated with weed competition).

Another problem has been browsing by domestic animals. *Leucaena leucocephala* cannot be recommended because of this problem (nor can hedgerow establishment in sloping *tapades*). Flemingia has been browsed to a lesser extent in Diaforé, but this has slowed growth at several sites. Coppicing (resprouting after lopping) ability also is problematic for Pigeon Pea (the other successful species at Diaforé) and *Sesbania sesban*. Another problem associated with Pigeon Pea is its short life span.

Problems were also encountered at the original 1994 sites in Dissa and Koundou. In both cases, errors were made in site selection. In Dissa, the site returned to fallow the year after installation and the planted shrubs were unable to compete with natural regeneration (mainly from stump sprouts). In Koundou, the site was not a true exterior field and the plants suffered from excessive browsing as they were too close to the village and the animals. It should also be noted that two fodder grass species (*Tripsacum* sp. and *Pennisetum* sp.) were tested at these sites in association with the shrubs. Results, however, were not encouraging.

As this intervention is usually installed in conjunction with rock lines, labor input should also be mentioned. Some would argue that this represents a constraint and that the practice will not be adopted until arable land is truly scarce as it is in Diaforé. The point to emphasize, however, is the additional years in the cropping cycle that the technique makes possible. This aspect represents a labor savings as farmers are not required to abandon a field after two years to clear a new one.

D3. Results

Major achievements for the contour hedgerow intervention are summarized in Exhibit III-4.

Exhibit III-4. Contour Hedgerow Intervention

Year	Number of Meters Planted or Seeded	Number of Participating Families
1993	850	1
1994	1758	5
1995	800	5
1996	8250	19
TOTAL	11658	n/ap*

* Several families participated for more than one year.

Other significant results and achievements associated with this intervention included:

- Flemingia plants at the original site were pruned three times during the project. The first pruning occurred only 1.5 years after planting.
- Farmer-to-farmer visits to the original site occurred on three occasions. Twenty farmers representing all three watersheds participated.
- A video on rock lines and contour hedgerows, including footage of Flemingia pruning was filmed and projected in eight villages in Koundou and Dissa; more than 500 villagers attended.
- In 1996, 13 families in Koundou and Dissa solicited the intervention, and demonstration areas were subsequently installed.

D4. Lessons Learned and Recommendations

Lessons 7, 8

- Contour hedgerows in conjunction with rock lines can increase the cropping cycle in an exterior field, as exemplified in the original Diaforé site.
- Flemingia is a fast-growing, resistant species well-suited to this intervention; it can produce green manure quickly.

Recommendations for 1997

- The testing of *Gliricidia* through direct seeding should continue. Seeds should be collected as late as possible in the dry season and sown as early as possible in the wet season. Technicians should monitor closely the sites where it is sown.
- Once established, *Flemingia* is a superior hedgerow species; therefore, efforts should continue to find a suitable method for its establishment. Direct seeding tests should continue (seeds require treatment before sowing). Trials involving small bare root nurseries near the outplanting sites should be attempted.

Recommendations for 1997 and Beyond

- For areas such as Dissa where fallow regeneration is rapid, hedgerows should be established the first year after a field is cleared.
- Direct seeding of Pigeon Pea along contours should be promoted on a large scale. Its capacity for facilitating soil conservation, reinforcing rock lines, and producing edible seeds should be stressed, not its ability to provide green manure.

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E. Co-Management of the Nialama Forest Reserve

E1. Background, Goals, and Methods

The Nialama Forest Reserve occupies more than 60 percent of the Koundou watershed. Beginning in 1994, the project analyzed the possibilities for rational management of the forest. This included a series of studies carried out by consultants and project personnel.[7] In 1995, the project decided to pursue the co-management option, that is, collaborative management by the state—the owner of the land—and the local population. Among other activities, an action plan was written, the boundaries re-established, and an inventory of woody species commenced. In 1996, two additional consultants arrived to help the project establish an inter-village management committee (IVMC) and devise a preliminary management plan, respectively. A series of village meetings were held during the process of creating the IVMC to discuss a number of subjects. DNFF personnel informed villagers of their use rights in the forest. Areas for lowland rice cultivation, allowed in the original *classement* documents were identified and demarcated. Broadly, the goals of co-management were to:

- Protect and conserve the forest resource
- Provide local people with a range of forest product and generate revenue from these products
- Demonstrate to the Guinean government the feasibility of this model as a means to save other state forest reserves

Project personnel are convinced that this initiative is one of the most promising and innovative the project has undertaken and that its potential impact is large.

E2. Constraints

The major constraint to the development of the co-management initiative was the differing viewpoints of the local people and DNFF. The villagers view the forest as reserve of agricultural land. DNFF, on the other hand, would like to see the forest remain a forest and be managed as such. This divergence came to a head in early 1995 when local prefecture authorities were alerted to continued illegal clearing of the forest. Perpetrators were summoned to the *sous-préfecture* and asked to leave the forest. This aggravated relations between the two sides and made villagers distrust DNFF. Consequently, the project has been trying to re-establish confidence between the two parties during the co-management initiative.

Lack of training and expertise in forest management principles and techniques constrain the development of the co-management initiative. This constraint applies to villagers and DNFF technicians. Another problem has been the old-school mindset of many DNFF officials. Initially, many decision-makers wanted to preserve the forest as an inviolate reserve, ignoring the fact that it was and had been used for agriculture. Although they were hostile to sharing management and use rights with the local population, this attitude seems to be changing. The project now seems to have the support of most DNFF decision-makers.

[7] See McLain (1994), Barry (1995), Bourque (1995), and Sow (1994) for details.

On an ecological level, fire represents the major constraint to forest development in the Nialama reserve. Late season wildfires have occurred regularly in the reserve during the past 50 years and have been the major force behind forest degradation. Project personnel have organized early burning in the zone for the past three years and many claim that this has already had a visible impact on forest recovery.

E3. Results

The most significant results of the co-management initiative occurred in 1996. This included the completion of the woody species inventory in sixty 0.5-ha plots. The inventory provided invaluable information to the natural forest management consultant—more than 70 species were found. A preliminary management plan was also completed. However, the most impressive result was the establishment and work of the IVMC and the steps leading up to its creation. Fifteen village meetings were organized by 577 villagers from more than 30 villages. Representatives for the forest assembly and the assembly itself were elected (more than 120 villagers attended). Finally, the 16-member IVMC was elected.

Other significant achievements associated with the co-management initiative included:

- The completion of assignments and reports by five consultants (the work was financed by project funds for four of these; the fifth was recruited by the LTC)
- The completion of a report on the economic products derived from the forest by the Koundou enterprise technician
- Reserve boundaries demarcated again (approximately 30 km)
- A color vegetation map of the reserve completed by DNFF/Conakry's *Bureau Technique*
- Draft action plan circulated widely for comment and then finalized
- The training of five DNFF technicians, villagers, and other project personnel in inventory techniques
- Boundaries of a two-village enclave surveyed and marked
- 25 lowland rice zones totaling approximately 25 ha were identified and demarcated
- An environmental impact assessment of the forest (led by a USAID/Abidjan expert) completed
- Agreements for reoccupation of two *tapades* in the forest (as directed by the late director of the DNFF) engineered by the project and signed by land users and prefecture authorities
- As planned, reforestation of the two *tapades* begun in 1996 (3 ha planted)

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E4. Lessons Learned and Recommendations

Lesson 9

- Forced, rapid evictions of farmers from state forest land will cause conflicts between the local people and government authorities, especially DNFF.

Recommendations for 1997

- Project personnel should work to finalize (including negotiating with the IVMC), submit, and get approval of the management plan.
- Work should continue to develop and negotiate a contract between the DNFF and the IVMC, even before approval of the management plan.
- Studies should be undertaken to analyze the feasibility of co-management initiatives for the state forest reserves near the Dissa (Souti-Yanfou) and Diaforé (Bakoun) watersheds.
- The project should seek continued short-term technical assistance to ensure that the co-management initiative continues. Specifically, short-term technical assistance is needed to help implement the management plan, especially assigning village responsibility, demarcating agricultural and protected zones (including GPS work), and selecting trees to be harvested.
- The revisions of the forest map, including village responsibility zones once these are finalized, requested of the *Bureau Technique* at DNFF/Conakry by the project need to be monitored and pursued by the Koundou director and the project's regional and national coordinators.
- When illegal farming occurs in state forests, forced evictions should be avoided; instead, a long-term process of negotiation should begin to convince farmers to farm legally through contracts with DNFF, or agree to stop farming altogether.
- The DNFF should consider replicating the Nialama co-management model in at least one state forest reserve in each of the other three geographic zones of the country.

SECTION IV
SECONDARY INTERVENTIONS AND OTHER ACTIVITIES

A. Fire Control

A1. Background, Goals, and Methods

Fire is an enormous problem in all three project watersheds. Fire is one of the major forces leading to environmental degradation, and village houses are often lost, especially in Dissa. The project thus sought to control fire, mainly through early burning and firebreaks (a zone burned around an area to be protected, not a band manually cleared of combustible materials). The goals of this activity were to:

- Protect selected zones from burning
- Diminish environmental degradation

Much of the early work on this intervention involved informal meetings with villagers to discuss the problem and organize and perform the work. Later, extension flyers and a video on this subject were developed for use during village meetings.

A2. Constraints

The local population does not understand the long-term effects of annual fires, especially late season ones, on the environment. They do not recognize that fires destroy highly important organic matter and leave soils bare, conditions that favor capping, decreased water infiltration, and erosion. This hypothesis is supported by the fact that they do not take preventive measures when using fire. Farmers rarely use firebreaks or other methods of fire control when burning debris in cleared areas late in the dry season. This neglect results in destructive wildfires.

Firebreaks were not installed around project sites, and reforestation plots burned in the Diaforé and Dissa watersheds. Again, the underlying reason seems to be that the activity (reforestation *and* fire control) is not a priority for villagers. Also, most villages lack the strong organizational structure needed to mobilize the large group of people necessary for this activity. Hopefully, the management committees will become increasingly responsible for these activities.

A3. Results

The following summarizes the major achievements of the fire control intervention:

- A local language extension flyer written and distributed during extension meetings.

- A video on the effects of wildfire, methods of mitigating these effects, and the value of forest resources was completed and screened in eight villages in Diaforé and Dissa (460 villagers attended).

- In Dissa, the project collaborated with the local DNFF *cantonnement forestier* to organize early burning throughout the watershed and hold an educational meeting with local herders.

- From 1994 on, watershed agroforesters organized early burning around project-sponsored reforestation plots and protected zones; this occurred at approximately 15 sites per year.

- In 1995 and 1996, the project helped villagers conduct early burning along major roads and in the interior of the Nialama Forest Reserve. Destructive late season fires were thus averted in most of the forest for the first time in years.

A4. Lessons Learned and Recommendations

Lesson 10

- Wildfire is an immense, complex problem that is not easily solved or remedied. Many players are involved, some of them unknown.

Recommendations for 1997

- Partial burning should be tested in the Nialama Forest Reserve; early burning should occur along all the roads that transect the forest, along the entire border of the reserve, and on laterite zones (*bowés*) and grassy areas within its interior; the remainder of the forest should be spared from fire.

- Project technicians should work with management committees to reinforce their capacity and organization with respect to early burning. To the extent possible, clear responsibilities regarding who will do the work should be delineated; collaboration should also continue with the local *cantonnements* to help them organize their early burning campaigns and become more flexible in their approaches to burning.

Recommendations for 1997 and Beyond

- The DNFF should consider designing and implementing a nationwide awareness campaign regarding the effects of wildfire and its prevention. If the design is satisfactory, a donor could be found to help with funding.

B. Multipurpose Shrub Blocks

B1. Background, Goals, and Methods

The multipurpose shrub block intervention addressed several constraints cited by villagers during original surveys, namely the loss of soil fertility in *tapades* and a lack of fodder during the late dry season for domestic animals. Also, the shrub blocks were seen as an entry point for securing the collaboration of village women in agroforestry. The goals of this intervention were to:

- Demonstrate the capacity of biomass production for several species of multipurpose shrubs

- Provide mulch and fodder for the use of village families, especially women

This intervention was introduced in the watersheds through a formal extension campaign in 1994 and 1995, which showed paintings and videos and distributed flyers. Demonstrations using nursery-produced plants were installed with interested families in the corners of unused *tapades*, with the understanding that female family members would manage the blocks and their products. The proposed technique was, in fact, an adaptation of a traditional practice by women in Diaforé and Koundou. They normally walk into the bush to collect leaves at the beginning of the rainy season. These leaves are then applied as mulch to the *tapades* especially around maize and cocoyam plants. In Dissa, where the *tapade* system is not fully developed, project personnel collaborated with owners of traction animals to provide fodder for the bulls.

B2. Constraints

The interventions involving multipurpose shrub blocks were innovative. It was difficult to convince villagers of the technique's potential, especially because they had to wait two to three years before reaping the benefits. Protecting the seedlings was also a problem. Collaborators had agreed to fence the blocks, but often this was not done and plants were browsed.[1] This problem was partly caused by the lack of communication between husbands and wives. Even though wives may have been interested in the intervention, fencing was the husband's responsibility, and they were not always willing to construct them. Also, collaboration between the project's agroforestry and women-in-development technicians was sometimes problematic.

One technical problem was that shrubs were severely stressed during the late dry season. Even the evergreen species such as Flemigia dropped some of their leaves. Thus, the anticipated use of blocks for dry season fodder is probably not feasible because lopping stressed plants increased mortality. Another constraint was that some sites with droughty soils were exposed to full sun; shrub growth on these sites was slow and mortality high. In contrast, excellent growth was seen on partially shaded sites, especially for *Calliandra calothyrsus*.

Due to these constraints and the fact that the project was asked to streamline activities in 1996, this intervention was dropped. Currently, however, several impressive demonstrations exist in the watersheds.

B3. Results

The best species (with respect to growth and survival) was Flemingia. Gliricidia and Calliandra exhibited good growth at selected sites. Performance of *Leucaena leucocephala* and *Sesbania sesban* was not encouraging. Additionally, two herbaceous green manure species were tested in Labé: *Crotalaria juncea* and *Tephrosia vogelii*. While Crotalaria appeared promising, the project could not find a niche for it in the local farming system to improve fallow. A summary of achievements for this intervention appears in Exhibit IV-1.

[1] In fact, the extensive livestock system of wandering, unherded animals constrains any activity involving tree and shrub seedlings and is one of many major flaws in the Fouta farming system.

Exhibit IV-1. Multipurpose Shrub Block Intervention

Year	Area Planted (m^2)	Number of Participating Families
1993	370	6
1994	1,173	22
1995	552	29
TOTAL	2,095	n/ap*

* Several families participated for more than one year.

Other achievements associated with this intervention included:

- Five exotic species tested in the demonstrations
- Eighty copies of a local language extension flyer produced on shrub blocks and distributed at extension meetings
- Paintings and a video developed and used at 12 extension meetings attended by 1,027 villagers
- Pruning demonstrations occurring at two well-developed sites in 1995

B4. Lessons Learned and Recommendations

Lesson 11

- A sustained and intense extension campaign, with vigilant follow-up is needed for the introduction of any innovative technique within the framework of a rural development project.

Recommendations for 1997

- Project personnel should organize farmer-to-farmer visits to the best sites in each watershed. Pruning demonstrations should take place during these visits and an emphasis should be put on the use of the blocks for mulch and green manure, not fodder.
- If farmers are interested in installing more shrub block demonstrations, project personnel should formulate an appropriate, sustainable strategy for establishing new blocks, such as direct seeding for Flemingia and Gliricidia and cuttings for Gliricidia.

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C. Experimental Nursery

C1. Background, Goals, and Methods

In July 1993, two Guinean graduates from Senegal's *Ecole Nationale des Techniciens des Eaux et Forêts* (ENATEF) were sent to the project by the director of the DNFF. The agroforestry technical assistant was asked by the chief of party and the regional coordinator if he could employ them in the AF/FOR program. It was decided that they could establish an experimental nursery for production of native species in Labé and that they could make occasional visits to the watersheds to collect seeds and note the flowering and fruiting cycles of native trees and shrubs. The goals of the experimental nursery were to:

- Test various methods of favoring germination of native species
- Establish flowering and fruiting cycles for selected native species
- Establish nursery production methods for native species and promote these species and their production methods

The agroforestry technical assistant oversaw the work of the two nurserymen, helped them begin germination trials, and organized visits to the watersheds for seed collection and field observations. However, overseeing the nurserymen was a secondary activity because he was often occupied with other activities in the three watersheds. One nurseryman was proficient in grafting techniques and participated in trainings on this subject. Improved citrus rootstock was also grown in the nursery to use as training or demonstration stock.

C2. Constraints

The primary factor constraining this activity was the nurserymen's lack of an acceptable work ethic. They had to be repeatedly asked to do a task before the task was done. They were unwilling to do physical labor. They were also unable to work together. One nurseryman would begin doing something one way only to have it changed by a second. These problems led to the suspension of this activity in 1995.

C3. Results

A previous report under this project catalogued the major results of the experimental nursery (Sow et al., 1995). Annex D contains the results of the flowering and fruiting observation exercise performed by watershed agroforesters and the agroforestry technical assistant.

The results of the experimental nursery are summarized below.

- Methods for germinating seeds of 16 native species were tested during 1994 and 1995; methods yielding a more than 50 percent germination rate were found for 12 of these species.

- An insecticide using local materials (garlic, tobacco, etc.) was tested and found to be effective; subsequently, a brief explanatory flyer was written and distributed to the project watershed teams.

- Approximately 1,600 seedlings produced in the nursery were donated to the DNFF division for the Labé prefecture; these were subsequently planted with various communities in the prefecture.

C4. Lessons Learned and Recommendations

Lesson 12

- Given current attitudes in Guinean society, it is extremely difficult to dismiss or fire an employee.

Recommendations

- Clearly written, agreed-upon job descriptions should be prepared for all project personnel; if individuals are unable or unwilling to adhere to these descriptions, they should be dismissed and replaced.

- The DNFF should consider establishing similar experimental nurseries in each of its four geographic regions to develop and promote production methods for native species. Seed banks and arboretums of native species could also be established in association with these nurseries. Again, it would probably not be difficult to interest donors in this activity, especially if biodiversity is stressed.

D. Village Land Management Committees

D1. Background, Goals, and Methods

As mentioned in Section III, the project helped selected villages establish village land management committees. The original intent of these committees was to organize the management of the community-based interventions, especially maintenance and upkeep, which were installed by the project. It was also hoped they would provide communication between project technicians and the larger population. A more ambitious, long-term goal was to organize the management of natural resources on all lands used by the village. To summarize, the goals of the management committees were to:

- Organize management of project-installed, community-based interventions
- Help project personnel promote selected interventions
- Organize management of village land

To establish the management committees, project technicians visited the villages in question (those with community-based interventions), explained the idea of the committee and its need, and asked villagers to elect a committee with male and female representatives. Committee size varied, but on average, they were made up of three men and two women. Responsibility for the support and development of the committees was initially given to the watershed directors.

However, the scant work that was done with the committees was performed by the watershed agroforesters since they needed to work with a community structure to accomplish their work in reforestation plots, protected zones, and fire control. In the second half of 1996, significant progress was made in management committee development and village land management in the Dissa watershed. This was due to the arrival of a short-term technical assistant specializing in community-based NRM who was responsible for analyzing the committees and beginning work in village land management.

D2. Constraints

The management committees were new institutions, and their development would have been enhanced by having personnel available with expertise in sociology.[2] Additionally, project personnel did not agree on which members of the watershed teams should be responsible for working with and supporting the committees. Most, if not all, committee members needed training in NRM concepts and village land management. In some cases, elected members were not dynamic, influential members of the community. It seemed doubtful that these committees would have much potential even with sufficient support work and training.

D3. Results

The results of this intervention are summarized in Exhibit IV-2.

Exhibit IV-2. Management Committee Development

Year	Number of Committees Formed	Male Members	Female Members
1993	21	70	52
1994	6	17	13
1995	4	7	8
TOTAL	31	94	73

Other achievements of this intervention were:

- In 1994, two study tours were organized to visit regional projects where village land management initiatives had been developed. Fourteen villagers, primarily committee members from the three watersheds, participated.
- A SOW was developed and approved for a community-based NRM (CBNRM) consultant responsible for analysis of village land management development and support of management committees.

[2] Although two watershed enterprise development technicians had studied sociology, they lacked field experience. It was decided that they should instead concentrate on enterprise development activities.

- The CBNRM consultant organized 13 village meetings in the Dissa watershed, which focused on analyzing the committees' performance.
- Four pilot villages were chosen for village land management initiatives.
- A series of meetings were held with selected villages leading up to the establishment of a village land action plan.
- A study tour was organized to a *Haut Niger* project watershed where significant strides in village land management had been achieved. Representatives from the four pilot villages from Dissa participated.

D4. Lessons Learned and Recommendations

Lessons 13, 14

- The establishment of new community structures is a long and complex undertaking that requires sociological expertise and commitment of significant project resources.
- For each activity specified in a project design, consensus must be reached regarding who is responsible for developing and implementing the activity; if consensus is not reached, minimal achievement will occur.

Recommendations for 1997

- The Dissa watershed team should vigorously pursue development of the village land management initiative in the four pilot watersheds. Above all, NRM-related activities identified in the action plans should be carried out to the fullest extent possible.

Recommendations for 1997 and Beyond

- Project designers should ensure that, for all project activities, at least one person among the personnel recruited have the appropriate technical expertise.

E. Miscellaneous Activities

E1. Canal Stabilization Plantings

In 1993, the project helped the Dow Kouratongo village in the Diaforé watershed improve a canal to divert runoff water from surrounding hills (flooding had previously been a problem in the village). To help stabilize the canal banks, the project and the villagers planted more than 530 seedlings, cuttings, and some seeds along a 0.5 km stretch of canal. Unfortunately, the site was extremely difficult (seasonally inundated with rocky, thin soil). The mortality rate was high and plant growth slow.

Recommendation

- Species selected for planting in difficult sites (semi-laterite, seasonally inundated, etc.) must be carefully chosen; native species already growing in the area are often the best choice.

E2. Responsible Logging

During the original participatory rapid appraisals (PRAs) in Dissa, project personnel learned that a chainsaw operator was cutting trees in the watershed. The project reasoned that the logger would continue to cut whether he collaborated with the project or not, but if he were willing to collaborate, his logging practices could become more sustainable, and he could contribute to the local communities through reforestation. The project offered to help him secure a loan to purchase his own chainsaw (he was renting at the time) in return for signing and respecting an agreement with the project and the villages where he intended to cut. Additionally, the project provided the logger a 2-day training in logging techniques and laws at the Kindia prefecture in the DNFF division.

The success of this activity has been mixed. While the logger established his own private reforestation plot (buying seedlings each year from private nurserymen) and repaid the loan on time, he did not always provide seedlings to the villages where he cut the trees, as specified in the agreement. Furthermore, he did not inform the Dissa agroforester where he was planning to cut (the agreement stipulated that proposed cuts were to be approved by the project). In one case, he cut a large tree in a project-sponsored protected zone next to a spring.

Recommendation

- Project-sponsored agreements should be carefully written and monitored, including specific clauses regarding sanctions to be taken if any party does not honor the agreement. If an agreement is not being respected, these sanctions must be enforced.

E3. Alley Farming

The project contract specified that applied research should be carried out through collaboration with the local agricultural research station in Bareng near Timbi Madina. One researcher there had already installed alley farming trials on-station and was part of the Alley Farming Network for Africa (AFNETA) sponsored by the International Institute for Tropical Agriculture (IITA). This appeared to be a good venue for collaboration with the project, given that no other researchers or research projects were devoted to agroforestry or forestry and that no national forest research organization existed in Guinea.

In 1994, two alley farming trials were installed in Diaforé and Koundou watersheds. Five species were planted for a total of 455 meters of hedgerows. The design of the trial was flawed, however. Even though the AFNETA design for biomass production was maintained, crop production measures were not envisioned. Some project personnel were doubtful that people in the watersheds would adopt the practice, but they believed that some principles of alley farming, such as lopping for green manure or mulch in live fences, could be demonstrated and used as agroforestry interventions.

Growth at the two sites was good to excellent, especially for *Acacia auriculiformis*, Flemingia, and Pigeon Pea. Unfortunately, the research ran into several problems. First, PL-480 funds for much of 1994 were lacking, which effectively curtailed follow-up of the trials. In 1995, in an effort to streamline research activities and simplify logistics, only Koundou was chosen to continue as an applied research site. However, due to a site choice error (the plot was established in the Nialama Forest Reserve before its limits were known), crop production was not possible and the researcher discontinued his efforts. Nonetheless, pruning demonstrations for villagers, given by watershed agroforesters, occurred in the plots. In Diaforé, 15 farmers from 6 villages participated; however, the demonstration was delayed and lopping occurred in the middle of the dry season which led to the death of most saplings.

Recommendations for 1997

- The plot in Koundou should be used for two farmer-to-farmer visits with lopping demonstrations (all saplings cut at a height of 1 to 1.5 m) occurring in early June. A follow-up visit in late September or early October should occur with the same group to observe the mulch deposited and the coppicing ability of the trees and shrubs. If adequate coppice biomass has developed, a second lopping should occur.

Recommendations for 1997 and Beyond

- Although further tests are needed, based on the experience in Diaforé (and elsewhere), it seems that lopping of multipurpose trees and shrubs should be avoided during the mid to late dry season.

E4. Streambank Plantings

In all watersheds, riparian or gallery forests occupy a unique niche in the landscape and are rich in biodiversity. These forests also buffer flood waters and stabilize stream banks. To conserve and rehabilitate these forests, streambanks were reforested in the Diaforé watershed in 1994 and 1995. As an added incentive for collaborators, fruit trees were planted with forestry species (five exotic and four native species were used). During the two years, 2,452 seedlings were planted. Five families participated in 1994, and 8 in 1995.

Although scattered plants showed good growth, this intervention was unsuccessful. Collaborating farmers had agreed to protect the seedlings from roaming, browsing livestock, but in the end they did not.

One farmer innovatively established a banana grove among the planted seedlings.

Recommendation

- If protection of seedlings is a prerequisite for intervention success, careful choice of collaborators and sites must occur. Planting should only occur at sites where fencing has already been installed or where it is reasonable to assume the collaborator will protect the seedlings.

E5. Bamboo Blocks

Bamboo is a multipurpose woody plant readily appreciated by many villagers in the three watersheds. Blocks of a large, exotic variety (project technicians call it Chinese bamboo, possibly *Bambusa vulgaris*) were planted with interested farmers in 1994. The goals of the intervention were to:

- Provide local construction materials for villagers
- Protect selected areas, primarily streambanks

In 1994, 600 cuttings were planted with interested farmers in three watersheds. In 1995, the activity was limited to Diaforé, where 395 cuttings were planted.

This intervention has potential for adoption in Diaforé and Koundou if some constraints can be overcome. Farmers are very interested in bamboo and acknowledge its potential uses. In Dissa, interest is not high because many villagers are unwilling to plant bamboo because they believe that bamboo clumps harbor snakes.

The cuttings sprouted well. Burying the cutting horizontally at a shallow depth (5 to 10 cm) provided better results than planting the cutting on a slant with the top half exposed, which caused many cuttings to rot.

Sources for cuttings are a great distance from the villages. People in Koundou and Diaforé transported cuttings all the way from Dissa in 1994 and 1995. For those in Koundou, a potential source in Kouramangui has been identified, while for Diaforé, Labé seems to be closest.

Recommendation

- If farmer interest continues to be high, the Diaforé and Koundou agroforesters should organize trips with farmers from each watersheds to the closest bamboo cutting source.

E6. Protection of Biodiversity

Although protection of biodiversity is not specified in the goal, purpose, or outputs of the project contract, this is an important component of NRM and is addressed directly by several USAID projects throughout the world. Project personnel therefore decided to refer to this subject in project reports.

Several AF/FOR activities should contribute to biodiversity conservation. Most obvious is co-management of the 10,000 hectare Nialama Forest Reserve. If sustainable management of the reserve is realized, natural, woody vegetation should recover in many areas of the forest, thus providing habitat for rare or endangered wildlife, such as chimpanzees and leopards, and viable niches for scarce native flora. Protection or rehabilitation of riparian forests, if successful, would also help maintain a unique ecosystem rich in biodiversity. Furthermore, project efforts in native tree and shrub production have made a positive contribution to biodiversity maintenance. For example, results of the experimental nursery's germination trials were made available to other projects, DNFF divisions in the Fouta, and project-supported private nurserymen. Project work on recording flowering and fruiting cycles of native trees should also be beneficial to maintaining

biodiversity. Finally, the agroforestry technical assistant compiled a field manual on native tree and shrub species that was copied and distributed to the watershed agroforesters to enhance their knowledge and appreciation of native flora.

The major constraint to biodiversity protection is convincing watershed villagers of its importance. Unfortunately, valid arguments have not been found. Even though westerners may recognize the intrinsic value of protecting biodiversity, direct economic benefits and indirect ecological benefits are not easily demonstrated to villagers. In some cases, biodiversity may have a negative value. Villagers in the Dissa watershed, for example, were happy with the fact that fewer wild animals live in their zone than before because damage to their crops has decreased. Additionally, in many areas, such as Diaforé, riparian forest conservation is in direct conflict with lowland, income-generating gardening. A final constraint is the fact that most villagers and many Guinean foresters are not interested in planting or producing native tree and shrub species, even though this would positively affect biodiversity conservation.[3]

Recommendation

- If biodiversity protection is important to the GOG, decision makers at DNFF and other ministries need to develop an extension strategy that convinces the rural population. This is especially important to protect the rapidly dwindling riparian forests.

E7. Improved Charcoal Production

In the Dissa watershed, charcoal production has economic benefits but has degraded the environment. In 1996, project personnel decided to help watershed villagers bring this activity under control. Villagers were encouraged to organize themselves into production groups and train group representatives in improved charcoal production techniques. The identified technique is the Cassamance kiln, which has demonstrated yields superior to traditional charcoal making techniques in other African countries.

After informal discussions with villagers led by the Dissa agroforester in collaboration with the Sougueta *cantonnement*, eight charcoal-producing groups were formed. In March, representatives from the groups, along with the *cantonnement* director, attended a 2-week, hands-on training in building and using the Cassamance kiln at the Guinean ENATEF in Mamou. After the training, meetings occurred in several villages with charcoal group and management committee members about the training and future production plans. Several committees declared that charcoal production by outsiders would be forbidden on their village land; similarly, the *cantonnement* asserted that charcoal production for the eight groups would be the sole production authorized within the watershed.

The project then formalized plans with the groups. It was decided that they would build traditional kilns to generate money to contribute to the purchase of Cassamance kiln materials (the project would pay the remainder). Also, each group agreed to buy and plant 100 forestry seedlings from the private nurserymen. Subsequently, 700 seedlings were bought and planted,

[3] The production and planting of native species rather than exotics have other advantages. Space does not allow for a discussion of these factors.

mainly in protected forest zones. It is too early to identify constraints or judge the intervention's success or feasibility.

Recommendations for 1997

- Improved charcoal production using Cassamance kilns should be pursued in the Dissa watershed; measurements of conversion ratios and labor investments should be recorded. Likewise, calculations regarding wood consumption by the producer groups and consequent reforestation requirements should be finalized.

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SECTION V
TRAINING

A. On-the-job Training

For the most part, the agroforestry technical assistant trained his counterparts informally or provided on-the-job training during watershed visits. Participants in the training then trained villagers informally during site visits to the watersheds. The magnitude and importance of this kind of training is difficult to describe and quantify. Nevertheless, the following paragraphs assess its importance.

Above all, the agroforestry technical assistant helped his counterparts develop their planning and organizational skills. This included working closely with them on nursery production, extension campaigns, site selection, and other seasonal work. The technical assistant made a concerted effort to consider the activities included in the annual work plans *before* it was time to implement them.

The watershed agroforesters already possessed certain technical skills and knowledge at the beginning of the project. The agroforestry technical assistant helped them hone skills, while providing and reinforcing new knowledge. Again, much of this was done informally during site visits within the watersheds. The important skills and knowledge transferred included production techniques for several exotic, nitrogen-fixing shrubs; pruning and lopping techniques for numerous species, depending on their intended use; evaluation using sustainability criteria; and extension methods.

The importance of extension was reinforced by the project's participatory approach. Technicians worked side-by-side with their counterparts, learning how to listen to villagers and conduct extension meetings at this level. Sustainability was another major area of knowledge transfer as watershed agroforesters had not considered this before the project. Again, skills and information were transferred to villagers during site visits, informal discussions, and extension meetings (much of this occurred in the absence of the agroforestry technical assistant as he was in each watershed only three to four days per month on average).

B. Formal Training

Exhibit V-1 summarizes the formal training given under the project's AF/FOR component.

Exhibit V-1. Formal Training under the AF/FOR Component

Year	Topic	Participants	Trainers	Location/Duration
1993	Agroforestry for development	3 watershed agroforesters	ICRAF	Nairobi, Kenya; 1 month
1994	Grafting	7 private nurserymen, Dissa agroforester, experimental nurseryman	GCP/Bel project staff (FAO project)	Dalaba, Guinea; 1 week
1994	Logging techniques and laws	1 logger (from Dissa)	DNFF Kindia prefecture	Kindia, Guinea; 5 days

Year	Topic	Participants	Trainers	Location/Duration
1995	Grafting review	3 Koundou private nurserymen	Experimental nurseryman	Koundou; 5 days
1995	Grafting review	11 private nurserymen (from Diaforé and Dissa)	Dissa agroforester	Labé, Guinea; 5 days
1995	Boundary marking and orienting	Koundou agroforester, 4 DNFF Lelouma prefecture foresters	Agroforestry technical assistant	Koundou; 3 days
1995	Forest inventory methods	5 DNFF Conakry and Lelouma foresters, 3 Peace Corps volunteers, Koundou agroforester, 2 Faranah University students	Mr. Thierno Daouda Diallo (PROGERFOR, N'Zérekoré)	Koundou; 2 weeks
1996	Improved charcoal production	7 villagers, *cantonnement* director (from Dissa)	ENATEF staff	Mamou, Guinea; 2 weeks
1996	Nursery techniques	18 villagers, 7 local NGO members	Diaforé and Dissa agroforesters	Diaforé, 5 days; Dissa; 5 days
1996	Land use planning at the village level	3 watershed agroforesters	MARFIM	Abidjan, Côte d'Ivoire; 4 weeks
1996	Nursery sack production using local materials	13 private nurserymen	Agroforestry technical assistant	1 day in each watershed
1996	Evaluation of AF/FOR component	3 watershed agroforesters	Agroforestry technical assistant	3 watersheds; 2 weeks

C. Capabilities of Watershed Agroforesters and Watershed Teams

The watershed agroforesters are proficient in basic agroforestry and community forestry. They are now capable of leading extension meetings, farmer-to-farmer visits, and field level training in nursery production, live fencing, reforestation plots, and protected zones, contour hedgerows, and multipurpose shrub blocks. Each agroforester has a different level of confidence and effectiveness as a trainer. Currently, the Dissa agroforester is best, followed by Diaforé and Koundou, respectively. Additionally, the Dissa agroforester is capable of leading trainings in basic grafting techniques, and the Diaforé agroforester could lead trainings in identification and nursery production for native tree and shrub species. Furthermore, the Koundou watershed team could train two watershed teams in the basics of co-management for state forest reserves, while the Dissa team could train the two teams in the basics of participatory planning for village lands.

SECTION VI
ADDITIONAL RECOMMENDATIONS

This section describes the larger constraints under which the project worked. Donor representatives and other outside evaluators must fully understand these before they can assess the project accurately. These remarks are not meant in a negative spirit but to aid in evaluating the project. Decision-makers will hopefully benefit from these lessons and recommendations as they plan future projects.

First, the logistics of the project were extremely difficult and taxing. The technical assistance team members visited each of the three watersheds every month and spent the fourth week in Labé trying to coordinate, plan, and organize the project's myriad activities. A good deal of time was spent on bad roads and contact with individual counterparts was often limited to three or four days a month. Consequently, the Guinean watershed teams had to execute the majority of the project's activities without technical assistance. The technical assistance team could not constantly oversee project interventions in the three watersheds. In addition, the work ethic and length of work day differed between Americans and Guineans. Many Guinean team members were not used to working an intense 40-hour week, nor were they able to.

A second major problem was that the Guinean watershed teams lacked written, agreed-upon job descriptions. In contrast, each technical assistance team member had a specific terms of reference for which they were accountable. Written, agreed-upon job descriptions should have been drafted and finalized during the project design and negotiation phase. In any case, this problem resulted in too much freedom to interpret what the watershed team members were supposed to be doing. More important, this meant there was no way to hold team members accountable for actions taken or not taken. The technical assistance team quickly recognized the problems linked to not having job descriptions, and in the first half of 1993 submitted draft descriptions for each watershed team member to DNFF. These descriptions were to be discussed among the appropriate project personnel, revised, and accepted, but this was never done.

Lesson

- Written job descriptions are necessary for the steady operation of a project, for performance evaluation and accountability, and avoiding conflicts about who is supposed to be doing what.

Recommendation

- The existence of written, agreed-upon job descriptions for all positions should be a prerequisite for project start-up.

A third major problem that negatively affected all facets of the project was the lack of counterpart funds, commonly referred to as PL-480 funds. In the project design, these funds were designated to support all field-level activities. Unfortunately, the money was not available. During the 48 months when the agroforestry technical assistant was present, PL-480 funds were unavailable for an estimated 16 months (and probably more). This resulted in incomplete work and interventions that were planned but not begun due to their seasonal nature. Additionally, the

morale of the watershed teams was often very low as part or all of their salaries came from PL-480 funds. In short, it was difficult to motivate people and to get work done when PL-480 funding was unavailable.

Recommendation 44

- Funding other than PL-480 should be identified for field-level work, especially when a project is to show field-level results. This is especially true for NRM projects, which often involve time-sensitive activities.

The final problem the Guinea NRM project encountered was linked to the isolated, rural locations of the project watersheds. Educated Guineans prefer urban or large town settings; the NRM project's watershed teams were no exception. Many were clearly unwilling or unable to work in the rural villages that made up the project's watersheds. Certain watershed team members had frequent and/or prolonged absences from the watersheds. Not all technicians were unhappy in the watershed settings; some of them thrived in this context. The challenge for the future is to involve only the latter in rural development projects.

Recommendation 45

- The DNFF should consider using an open application process for positions on rural development projects. This would ensure that the personnel chosen could serve in this type of project setting. Similarly, for contractual positions, careful screening of applicants should occur regarding their willingness and proven ability to work in isolated, rural settings.

Another smaller problem also deserves mention. Of the six watershed directors and agroforesters with whom the agroforestry technical assistant worked, only the Diaforé agroforester had any training. From time to time, this resulted in a lack of understanding of, and sympathy for, the AF/FOR component, especially among the directors.

Recommendation 46

- In the future, the DNFF should consider staffing at least half of the key positions on projects with an AF/FOR component with trained foresters.

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ANNEX A
INFORMATION ON PROJECT WATERSHEDS

Characteristic	Diaforé	Dissa	Koundou
Latitude	11°27-11°39 N	10°13-10°20 N	11°39-11°52 N
Longitude	11°23-11°34 W	12°25-12°30 W	12°32-12°47 W
Average annual rainfall	1230 mm	1855 mm	1415 mm
Temperature:			
Annual average	24.5°C	26.6°C	26.5°C
Hottest month	34.8°C (Apr. - avg. max.)	35.0°C (Mar. - avg. max.)	39.2°C (Apr.- avg. max.)
Coldest month	16.3°C (Jan. - avg. min.)	19.1°C (Jan. - avg min.)	16.4°C (Jan. - avg. min.)
Altitude	720-830 m	50-350 m	190-560 m
Soils sampled:			
Acid (pH ≤ 5.0)	51%	7%	29%
Very acid (pH ≤ 4.5)	21%	0	0
Mild P deficiency	13%	7%	14%
Serious P deficiency	8%	29%	29%
Severe P deficiency	41%	7%	21%
Size (km^2)	65	100	107
Population	2000	2200	3900
Ethnic groups	Peul	Peul (84%) Susu (16%)	Peul (90%) Sarakollé (10%)

ANNEX B
TREE AND SHRUB SPECIES PERFORMANCE IN PROJECT WATERSHEDS

Diaforé

Species Produced in Nurseries

Key: for Germination or Survival, G=Good, M=Moderate, and P=Poor; for Growth, R=Rapid, M=Moderate, and S=Slow

Species	Germination	Growth in Nursery	Growth after Planting	Observations/ Recommendations
Acacia ataxacantha	M	M	S	Seeds attacked by insects; plants in pots cannot withstand rough handling in transport and outplanting
A. auriculiformis	G	R	M	Attacked by termites; only moderate development (growth) on poor sites
A. holosericea	G	R	M	Can withstand very poor sites, even semi-laterite; withstands dry season (drought); attacked by termites
A. mangium	G	R	R	Adapted to a wide variety of conditions; to be promoted at all sites; attacked by termites
Afzelia africana	G	R	M	Uprooted by baboons at a young age; bare root production; withstands dry season (drought); withstands termites
Albizia adianthifolia	M	M	S	Browsed by animals; slow development in live fences; appreciated by villagers (spared during clearing); withstands termites; used as fodder
Anacardium occidentale	G	R	M	If tap root is cut, development is slow or plant dies; not attacked by insects; propagation by direct seeding works well; pots need to be moved in nursery; should not be left in nursery for more than one year
Annona muricata	G	M	M	First flowers at age of three or four years; appreciated by local population; good sales in Tougué
Azadirachta indica	G	M (in pots) R (bare root)	M	Bare root production; prefers silty and deep soils; browsed by animals; withstands termites
Bombax costatum	G	M	M	Does not withstand difficult sites or droughty soils; good growth on silty soils

Species	Germination	Growth in Nursery	Growth after Planting	Observations/ Recommendations
Calliandra calothyrsus	M	M	R	Rapid growth if microclimate is favorable (rich soils); prefers some shade; leaves eaten by animals and used for mulch
Carapa procera	G	R	M	Browsed by animals; not appreciated by the population; suited for planting along streambanks
Cassia siamea	G	R	R	Not appreciated by villagers (lateral roots invasive); impoverishes soil (according to villagers); to be avoided in live fencing; leaves eaten by animals
C. sieberiana	P	S	S	To be left in nursery for one year (at least); adequate method for seed treatment unknown; young plants do not withstand dry season; cannot withstand waterlogged sites
Citrus volkameriana	G	R	R	Good rootstock; after grafting, scions develop quickly; propagation possible through root suckers
Citrange	G	M	?	Inferior rootstock compared to *C. volkameriana*
Coffee (robusta)	G	M	?	To be planted in riparian forests or along streambanks; appreciated by villagers; browsed by animals
Cola nitida	M	S	S	Should be left in nursery for at least one year before transplanting; attacked by mole crickets in dry season; prefers shade
Combretum micranthum	M	S	S	Cannot withstand waterlogged sites; young plants do not withstand fire
Daniellia oliveri	G	M	S	To be left for one year in nursery; young plants do not withstand fire
Erythrina senegalensis	M	M	M	Seeds attacked by insects; slow germination with hot water treatment but fast with scarification; slow growth in live fences; used as traditional medicine by villagers
Erythrophleum suaveolens	M	M	S	Best development on deep soils; to be promoted where animal pressure is strong; withstands termites
Flemingia macrophylla	M	M	R	Hardy species even on difficult sites; good coppicing ability; good biomass production; quickly produces seeds; moderately browsed by animals
Gliricidia sepium	G	R	R	Good development in live fences; to be promoted

Species	Germination	Growth in Nursery	Growth after Planting	Observations/ Recommendations
Gmelina arborea	G	R	R	Bare root production; good development in live fences and reforestation plots; slower development on difficult sites; leaves eaten by animals in dry season; rapid growth along streambanks
Grevillea robusta	M	M	M	Cannot withstand difficult sites; not browsed by animals; good development on deep soils; difficult to obtain seeds
Holarrhena floribunda	M	R	M	Does not withstand droughty soils
Khaya senegalensis	G	M	S	Bare root production; appreciated by the population; browsed by animals; young plants do not withstand fire; withstands termites
Leucaena leucocephala	G	R	R	Browsed by animals; good seed production if minimum height is reached; not recommended for strongly acidic soils
Mangifera indica	G	R	M	Grafted varieties sought by local population, especially late-producing varieties
Milicia regia	M	M	M	To leave for one year in nursery; withstands planting along streambanks; does not withstand exposed sites/droughty soils; good development in riparian forests; difficult to obtain seeds
Moringa oleifera	G	R	R	To be promoted for live fencing; not attacked by termites; leaves consumed by humans and animals
Parkia biglobosa	G	S	S	Withstands termites and difficult sites; does not withstand waterlogged sites
Parkinsonia aculeata	M	S	?	Produced in nurseries for first time in 1996
Persea americana	G	R	R	Does not withstand waterlogged sites; browsed by animals; grafted variety sought by local population
Prosopis africana	P	S	S	Withstands difficult sites; withstands termites; adequate technique for seed treatment/germination unknown
Prosopis juliflora	P	S	?	Produced in nurseries for first time in 1996
Pterocarpus erinaceus	M	S	S	Withstands difficult sites; browsed by animals; withstands termites; does not withstand waterlogged sites

Species	Germination	Growth in Nursery	Growth after Planting	Observations/ Recommendations
Sesbania sesban	G	R	M	Attacked in nursery by beetles; not appreciated in live fences (short life span); does not withstand lopping; good development in lowlands; browsed by animals
Vitellaria paradoxa	M	S	S	Does not withstand waterlogged sites; withstands difficult sites

Species Tested by Direct Seeding

Species	Live Fences		Contour Hedgerows or other Interventions		Observations/ Recommendations
	Germination	Growth	Germination	Growth	
Jatropha curcas	-	-	G	M	Does not withstand waterlogged sites
Cajanus cajan	-	-	G	R	Browsed by animals; flowers attacked by beetles
Flemingia macrophylla	-	-	P	?	Plants very small after germination
Gliricidia sepium	P	?	P	?	Brown spots on cotyledons after germination; young leaves attacked by grasshoppers; young plants do not withstand competition
Moringa oleifera	G	R	-	-	Good development in live fences; to be promoted; withstands termites
Acacia auriculiformis	G	M	-	-	Does not withstand competition; plants very small after germination
A. mangium	G	M	-	-	Does not withstand competition; plants very small after germination
Anacardium occidentale	G	M	-	-	Promote in live fences

Species Tested as Cuttings

Species	Survival (Resprouting)	Growth	Observations/ Recommendations
Lantana camara	P	S	To be planted just after cutting; invasive species (not appreciated)
Erythrina senegalensis	M	M	Attacked by termites; better resprouting with larger diameter cuttings
Bombax costatum	G	M	Not appreciated by villagers (abundant lateral roots)
Markhamia tomentosa	P	M	Appreciated by villagers (not competitive with crops); resprouts even from small diameter cuttings
Gliricidia sepium	G	R	Attacked by termites; to be promoted in live fences; leaves eaten by animals; quickly furnishes other cuttings; appreciated by villagers
Tibbe (*Ficus* sp.)	G	R	Appreciated by villagers; good fodder source during hungry period; bark used as rope
Spondias mombin	G	R	Attracts caterpillars, according to villagers

Dissa

Species Produced in Nurseries

Key: for Germination or Survival, G=Good, M=Moderate, and P=Poor; for Growth, R=Rapid, M=Moderate, and S=Slow

Species	Germi-nation	Growth in Nursery	Growth After Planting	Observations/ Recommendations
Acacia auriculiformis	G	R	M	Not overly attacked by termites; requires pruning; splits due to wind if has multiple trunks; requested by villagers
A. holosericea	G	R	M	Not appreciated by villagers/nurserymen because of small stature; withstands termites and dry season (drought)
A. mangium	G	M	R	High demand by villagers; produces ample foliage; requires pruning very soon after planting; withstands termites; faster growth next to springs

Species	Germi-nation	Growth in Nursery	Growth After Planting	Observations/ Recommendations
Afzelia africana	G	R	M	Bare root production; lifted seedlings resprout easily after watering; requested by villagers for protected zones, private plantations; withstands termites and the dry season (drought)
Albizia adianthifolia	M	M	M	Appreciated by villagers (spared during clearing) because of straight trunk; to be promoted as fodder source
Azadirachta indica	G	M	M	Withstands termites; not browsed by animals; used as traditional medicine; better development in nursery in bare root beds
Calliandra calothyrsus	P	S	S	Plants lost to lack of maintenance, exposed sites
Carapa procera	M	R	M	Requested by villagers because of use in traditional medicine and soap-making; best growth on humid sites
Ceiba pentandra	M	R	R	Growth comparable to rapid growth exotic species; mysterious (supernatural) species according to villagers; place of sacrifice
Citrus aurantium	G	R	?	Not grafted in nursery because of lack of training in grafting techniques at the time; not to be sold without grafting
Citrus volkameriana	G	R	R	Plants have been grafted; good growth of scions after grafting; grafted plants readily sold
Cola nitida	M	S	S	Requested by villagers; production of older trees reduced because of destruction of riparian forests
Daniellia ogea	G	M	S	Not many stems in watershed (rare); prefers humid sites; appreciated by villagers for use in carpentry
Daniellia oliveri	P	S	S	Began using as crate wood in watershed; wood used for mortars
Dialium guineense	G	R	R	Not appreciated by villagers in reforestation efforts because of slow growth; withstands termites; fruit sold in markets; method for treating seeds to induce germination unknown; wood used for pestles
Flemingia macrophylla	G	R	R	Produces large quantities of biomass; uses unknown by local population
Gliricidia sepium	M	M	S	To be promoted; appreciated by the villagers; use as fodder unknown by villagers; withstands termites

Species	Germi-nation	Growth in Nursery	Growth After Planting	Observations/ Recommendations
Grevillea robusta	M	M	S	Attacked by termites; requested by villagers because of leaves; does not withstand competition with weeds; does not seem to be suited to Dissa heat
Gmelina arborea	G	R	R	Bare root production; requested by villagers; used as timber; seeds easily obtained; good resprouting ability after lifting from bare root beds
Khaya senegalensis	G	M	M	Bare root production
Leucaena leucocephala	G	R	R	Natural regeneration observed; heavily browsed by animals; produces large quantities of seeds; best growth at humid sites; use of leaves unknown by villagers
Mangifera indica	G	R	R	Requested by villagers after grafting; grafting of volunteers practiced by nurserymen
Milicia regia	G	M	M	Attacked by gall-inducing insect larvae; rapid development of tap root; seeds difficult to obtain; requested by villagers
Moringa oleifera	G	R	R	To be promoted; leaves used in sauces; used as fence posts for toilet enclosures; seeds easily obtained
Parkia biglobosa	G	S	S	Rapid development of tap root; withstands dry season, drought, and termites; sack movement required in nursery; fruit appreciated and harvested by population
Persea americana	G	R	R	Successful grafting at Fotongbé (simple English method on young plants); requested by villagers; roots do not withstand rough handling during transport
Prosopis africana	P	S	S	Lack of technique to favor germination unknown; to be left for one to two years in the nursery; wood used for mortars and for sculpture
Pterocarpus erinaceus	P	S	S	Not appreciated by population because of slow growth; used as firewood
Pycnanthus angolensis	M	R	?	Appreciated by villagers for crate wood; rapid growth; good form (straight boles); seeds difficult to obtain; to be promoted in nurseries
Ricinodendron heudelotii	M	R	?	Appreciated by villagers for crate wood; good form; rapid growth

Species	Germi-nation	Growth in Nursery	Growth After Planting	Observations/ Recommendations
Sesbania sesban	G	M	R	Browsed by animals; attacked by beetles in nurseries; short life span; rapid production of seeds

Species Tested by Direct Seeding

Species	Live Fences		Contour Hedgerows or Other Sites		Observations/ Recommendations
	Germina-tion	Growth	Germina-tion	Growth	
Anacardium occidentale	-	-	G	M	Withstands termites and dry season (drought); not requested by villagers because of myths (supernatural associations)
Acacia auriculiformis	G	S	-	-	Does not withstand competition with weeds nor dry season; need to find appropriate method for direct seeding; to test in small bare root nurseries
A. mangium	G	S	-	-	Does not withstand competition with weeds nor dry season; need to find appropriate method for direct seeding; to test in small bare root nurseries
Flemingia macrophylla	-	-	G	R	To be promoted along rock lines; need for villagers to master recognition of young plants
Gliricidia sepium	G	R	G	R	Appreciated by the villagers; to be promoted; withstands termites and dry season; use as fodder unknown by population
Cajanus cajan	-	-	G	R	Appreciated by villagers for edible seeds
Moringa oleifera	G	R	-	-	Rapid growth after germination; withstands termites and dry season; species to be promoted; seeds easily obtained

Species Tested as Cuttings

Species	Survival (Resprouting)	Growth	Observations/ Recommendations
Gliricidia sepium	G	R	Not attacked by termites; cuttings sometimes rot; need to tamp earth around cutting after planting; bark should have whitish color if used as a cutting
Bombax costatum	G	M	Less appreciated by villagers because of thorns; sometimes attacked by termites
Spondias mombin	G	R	Not attacked by termites; traditionally used as cuttings; better known by population compared to other species; does not withstand waterlogged sites; need to dig holes before planting
Erythrina senegalensis	M	R	Appreciated by villagers because of use in traditional medicine; to be encouraged

Koundou

Species Produced in Nurseries

Key: for Germination or Survival, G=Good, M=Moderate, and P=Poor; for Growth, R=Rapid, M=Moderate, and S=Slow

Species	Germination	Growth in Nursery	Growth after Planting	Observations/ Recommendations
Acacia ataxacantha	P	S	M	Plants lost to dry season; many seeds not viable
A. auriculiformis	G	M	M	Attacked by termites after plantation; slow growth on poor soils
A. holosericea	G	R	M	Attacked by termites; withstands dry season even on semi-laterite sites
A. mangium	G	R	R	Not overly attacked by termites; to be promoted
Afzelia africana	G	R	S	Attacked by termites; browsed by animals; good growth in some live fences; continue to promote
Azadirachta indica	M	M	M	Leaves used as medicine for malaria; browsed by animals; good growth in certain live fences; continue to promote
Bombax costatum	M	M	S	Withstands droughty, semi-laterite sites

Species	Germination	Growth in Nursery	Growth after Planting	Observations/ Recommendations
Calliandra calothyrsus	G	R	R	Good growth where microclimate is favorable (partial shade); slow development or mortality on exposed sites; seed source unknown in Guinea
Cassia siamea	G	R	R	Good growth at all sites; leaves sometimes used as mulch
Cassia sieberiana	P	S	S	Lack of appropriate technique to facilitate germination; moderate survival; to be left in the nursery for one year
Carapa procera	G	R	R	Growth satisfactory at Sigon; withstands termites; leaves browsed in dry season
Ceiba pentandra	G	R	R	Withstands dry season and termites; leaves browsed
Combretum micranthum	M	S	M	Withstands semi-laterite sites; some plants attacked by termites
Flemingia macrophylla	G	R	R	Young plants browsed; earliest outplanted plants producing seeds; withstands dry season; provides mulch at N'Dantari
Gliricidia sepium	G	R	R	Requested by villagers; withstands termites; prefers fertile soils; leaves yellow on difficult sites
Gmelina arborea	G	R	R	Withstands dry season and termites; leaves used as mulch at Hamdallaye; bare root production
Grevillea robusta	M	S	M	Attacked by termites; plants lost on difficult sites; climate at Koundou too hot (?)
Holarrhena floribunda	P	S	S	Young plants browsed; attacked by termites; needs one year in nursery
Khaya senegalensis	M	M	S	Slow growth; leaves browsed; young plants cannot withstand fire; bare root production; requires one year in nursery
Leucaena leucocephala	G	R	M	Browsed by animals; leaves applied as mulch in certain cases; withstands termites
Moringa oleifera	G	R	R	Browsed by animals; quickly produces seeds; sometimes attacked by termites; can withstand difficult sites
Prosopis africana	P	S	S	Plants lost on difficult sites; requires one year in the nursery
Pterocarpus erinaceus	P	S	S	Plants lost on difficult sites; requires one year in the nursery

Species	Germination	Growth in Nursery	Growth after Planting	Observations/ Recommendations
Sesbania sesban	G	R	R	Cannot withstand dry season, especially on droughty soils; browsed by animals; attacked by beetles in nursery; short lifespan; not recommended in live fences
Tamararindus indica	G	R	R	Requested by some villagers; withstands dry season
Citrus aurantium	G	M	?	Requested by population; attacked by caterpillars in nursery; requires watering in nursery; does not thrive in shade
C. volkameriana	G	R	R	Requested by population; attacked by caterpillars in nursery; requires watering in nursery; does not thrive in shade
Citrange	G	M	?	Requested by population; attacked by caterpillars in nursery; requires watering in nursery; does not thrive in shade
Cola nitida	M	M	S	Prefers shade; attacked by insects in nursery; requested by villagers
Mangifera indica	G	R	M	Requested by villagers if grafted; prefers fertile soils
Persea americana	G	R	R	Requested by villagers; attacked by termites after plantation; likes silty soils; does not withstand droughty soils

Species Tested by Direct Seeding

Species	Live Fences		Contour Hedgerows or Other Sites		Observations/ Recommendations
	Germination	Growth	Germination	Growth	
Moringa oleifera	G	R	-	-	To promote
Acacia auriculiformis	P	S	-	-	Propagation not recommended by direct seeding
A. mangium	M	S	-	-	Propagation not recommended by direct seeding
Gliricidia sepium	G	R	P	?	Problems along rock lines; continue to test
Flemingia macrophylla	-	-	P	?	Not sure if villagers recognize young plants after germination; requires very close monitoring after germination

Species	Live Fences		Contour Hedgerows or Other Sites		Observations/ Recommendations
	Germination	Growth	Germination	Growth	
Cajanus cajan	-	-	G	R	To promote
Parkia biglobosa	-	-	P	S	Withstands dry season

Species Tested as Cuttings

Species	Survival (Resprouting)	Growth	Observations/ Recommendations
Erythrina senegalensis	M	M	Attacked by termites; leaves browsed; low resprouting observed on cuttings
Gliricidia sepium	G	R	To be encouraged; lower survival on dry sites; does not withstand humid sites; to cut and plant in May/ June
Bombax costatum	M	M	Withstands termites
Spondias mombin	G	R	Prefers silty soils; rarely attacked by termites
Urdé (*Ficus* sp.)	G	R	Browsed by animals (good fodder); evergreen; rarely attacked by termites; prefers silty soils
Nonko (*Ficus* sp.)	G	M	Browsed by animals (good fodder); evergreen; rarely attacked by termites; prefers silty soils

Appendix C: List of Scientific and Vernacular Names of Tree and Shrub Species found in Project Watersheds

Scientific Name	Pular Name[32]	Susu Name
Acacia ataxacantha	Koŋo, Bulle Koŋo	
Adansonia digitata	Ɓohe	Kiiri
Afzelia africana	Lenge	Feela
Albizia adianthifolia	Maarona'i	Wassa
Albizia glaberrima	Maarona'i	
Albizia zygia	Maarona'i	
Alchornea cordifolia	Garkasaki	Bolonta
Allophyllus africana	Kosiyara	
Anacardium occidentale	Yalage Porto	Yagale
Annona muricata	Dukumme Porto, Sopsop	Fote Mokè
Annona senegalensis	Dukumme	Suunyi
Anthocleista djalonensis	Ɓeyɗo Moyyo	Khobokhobonyi
Anthostema senagalensis	Mbura	Gèrènyi
Antiaris africana	Ake	
Anysophylla laurina	Kansi	Kantinyi
Baissea multiflora	Poore Kooduudu	Woyonyi
Bombax costatum	Luukun	Luukhui
Borassus aethiopium	Duɓɓe	Khankhè
Boswellia dalzielii	Annduke	
Bridelia ferruginea	Daafi	Tolinyi
Canthium venosum	Ndakka	
Carapa procera	Gobi	Kubi
Carissa edulis	Buudi	Fofiya
Cassia occidentalis	Seŋama	
Cassia podocarpa	Seŋenge, Celen	
Cassia siamea	Kasiya	Kasiya
Cassia sieberiana	Sinnja	Gbangba
Ceiba pentandra	Bantan	Konde
Cola cordifolia	Gumbambe	
Combretum micranthum	Kankaliba	Kankilibanyi
Combretum nigricans	Ɓooki	
Crossopteryx febrifuga	Belende	
Cussonia barteri	Bulukuntu	
Cussonia djalonensis	Bulukuntu	
Dalbergia boehmii	Fulufeele	
Daniellia oliveri	Ceewe	Wulunyi
Detarium microcarpum	Pompondogo	

[32]The alphabet used conforms to the standardized style for writing Pular and Fulfulde agreed upon by most west African countries; it should be noted, however, that this system has only been used in Guinea since, approximately, 1991.

Scientific Name	Pular Name	Susu Name
Detarium senegalense syn. *heudelotianum*	Booto	Booto
Dialium guineense	Meeko	Mokè
Dichrostachys glomerata	Bulle Bete	Tansè
Entada africana	Mbuuda	Tèkhenyènyi
Erythrina senegalensis	Mboocolla	Tiliminyi
Erythrophleum suaveolens syn. *guineense*	Teli	Meli
Ficus polita	Tibe, Yibbe	Khorè
Gardenia triacantha	Bose	Tankhè
Hannoa undulata	Kolonso	
Harungana madagascariensis	Sumbala	
Hexalobus monopetalus	Kunje	
Holarrhena floribunda syn. *africana*	Enɗamma	Yètè
Hymenocardia acida	Pellitoro	Baranbara
Isoberlinia doka	Buube	
Jatropha curcas	Kiidi	Bakhènè
Khaya senegalensis	Kahi	Gnègènyi
Lannea acida	Cuko	
Lannea velutina	Cuko Maccuɓe	
Lawsonia inermis		
Lophira lanceolata	Malanga	Mènè
Mangifera indica	Mango	Mangoe
Markhamia tomentosa	Kaafa Waandu	Laakoe
Milicia regia syn. *Chlorophora regia*	Cimme	Simmè
Mitragyna stipulosa	Poopo	Fofoè
Moringa oleifera	Nebeday	Fote Wassa
Parinari excelsa	Kura	Suuge
Parkia biglobosa	Nete	Nèri
Pericopsis laxiflora syn. *Afrormosia laxiflora*	Kulokulo	Kholèkholè
Persea americana	Piya	Piya
Phyllanthus discoideus	Keeri	Mètè
Piliostigma thonningii	Barke	Yorokoe
Prosopis africana	Celen	Timoè
Pseudospondias microcarpa	Ndologa	Garanyi
Pterocarpus erinaceus	Bani	Kharinyi
Pycnanthus angolensis		Fukuyi
Ricinodendron heudelotii		Tonta
Schrebera arborea	Wan	
Spathodea campanulata	Coɓɓe Leɗɗe	
Spondias mombin	Cale	Lukhure
Sterculia tragacantha	Cappe Legge	Khabi

Scientific Name	Pular Name	Susu Name
Stereospermum kunthianum	Kuluteetega	
Syzygium guineense	Kaajo	Khayo
Tamarindus indica	Ja66e	Tombinyi
Terminalia albida	Boori Bilel	Woli
Terminalia glaucescens	Boori Gore	Woli
Terminalia macroptera	Boori Deye	Woli
Treculia africana	Gilinti	
Trema guineensis	Mbole Mbooce	
Uapaca togoensis	Yalage	Khore Yagale
Uvaria chamae	Boyle	Moronda
Vitellaria paradoxa syn. *Butyrospermum parkii*	Kaare	Doni Bili
Vitex cuneata	Bumme	Kukui
Xeroderris stuhlmanii	Bani Dane	
Xylopia aethiopica	Gile	Siminyi
Zanthoxylum gilletii syn. *Fagara macrophylla*	Bulle Barkelen	
Zanthoxylum zanthoxyloides syn. *Fagara zanthoxyloides*	Bulle Barkelen	

Observation Table: Phenology of Selected Species
DIAFORE

Legend: F=Fruiting, MF=Mature Fruit, FL=Flowering

(N.B. These tables are not yet definitive; they should be revised in 1997 based on field observations.)

Species	Jan.		Feb.		March		April		May		June		July		August		Sept.		Oct.		Nov.		Dec.	
	1–15	16–31	1–15	16–28	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–30	1–15	16–31
Acacia ataxacantha	MF						MF			FL		FL F												F MF
Afzelia africana	MF					MF	FL			FL F														F
Albizia adianthifolia	F					F MF		MF		FL			FL F											F
Anacardium occidentale (observed in Tougue)						F		F MF		MF														
Bombax costatum			FL	F	FL	F MF				MF														
Carapa procera			FL		FL F					F MF				MF										
Cassia siamea	F	F	MF					MF		FL	F				FL									F
Cassia sieberiana	F	F MF				MF			FL		F				FL									F
Combretum micranthum	F	F	MF			MF	FL				FL F													F
Daniellia oliveri			FL		FL F				F MF				MF											
Erythrina senegalensis			FL F	MF			FL F			MF														

Species	Jan.		Feb.		March		April		May		June		July		August		Sept.		Oct.		Nov.		Dec.	
	1–15	16–31	1–15	16–28	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–30	1–15	16–31
Erythrophleum suaveolens	F	F	MF				FL MF					FL F												F
Holarrhena floribunda	F				F MF		MF			FL		FL F												F
Khaya senegalensis	F					FL F	MF			FL F MF														F
Mangifera indica			FL	F	FL		MF		F				MF											
Moringa oleifera			FL F			FL	F MF					MF												
Milicia regia					FL		FL F			F MF		MF												
Parinari excelsa	F								FL F	MF		FL F	MF											F
Parkia biglobosa			FL			FL F				F MF			MF											
Prosopis africana	F	F	MF			MF				FL		F	FL											F
Pterocarpus erinaceus			FL F		FL		F MF				MF													
Vitellaria paradoxa			FL		FL F					F MF					MF									

Observation Table: Phenology of Selected Species
DISSA

Legend: F=Fruiting, MF=Mature Fruit, FL=Flowering

Species	Jan.		Feb.		March		April		May		June		July		August		Sept.		Oct.		Nov.		Dec.	
	1–15	16–31	1–15	16–28	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–30	1–15	16–31
Anisophyllea laurina						MF					MF													
Afzelia africana	F	MF		FL		MF				FL F														F
Azadirachta indica		FL		FL F		F MF				MF														
Carapa procera			FL			FL F				F MF			MF											
Ceiba pentandra	FL	F	FL	F MF		MF																		
Daniellia oliveri		FL		F	FL	MF	F			MF														
Dialium guineense	FL	FL F					F MF				MF												FL	FL
Erythrophleum guineense				FL				FL F							F									
Gmelina arborea		FL	F			FL F MF				MF														
Khaya senegalensis	F	F MF					FL	MF			FL												F	F
Mangifera indica	FL	F		FL		F MF							MF										FL	FL

Species	Jan.		Feb.		March		April		May		June		July		August		Sept.		Oct.		Nov.		Dec.	
	1–15	16–31	1–15	16–28	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–30	1–15	16–31
Moringa oleifera	FL F					FL F MF					MF												FL F	FL F
Milicia regia				FL		FL F	MF	F		MF														
Parkia biglobosa		FL		FL F		F MF					MF													
Prosopis africana	F	F MF			MF				FL			FL						F						F
Pterocarpus erinaceus	FL			FL F		F MF		MF																
Pycnanthus angolensis		F		F MF					MF															
Ricinodendron heudelotii			FL			FL F			MF	F			MF											

Observation Table: Phenology of Selected Species
KOUNDOU

Legend: F=Fruiting, MF=Mature Fruit, FL=Flowering

Species	Jan.		Feb.		March		April		May		June		July		August		Sept.		Oct.		Nov.		Dec.	
	1–15	16–31	1–15	16–28	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–30	1–15	16–31
Acacia ataxacantha								FL		FL														
	F									F														F
		MF			MF																			
Adansonia digitata									FL			FL												
	F				F							F												F
						MF		MF																
Afzelia africana						FL			FL															
									F															F
	MF		MF																					
Anacardium occidentale			FL			FL																		
				F			F																	
						MF				MF														
Bombax costatum	FL		FL																					FL
			F			F																		
						MF			MF															
Carapa procera			FL					FL																
						F				F														
										MF				MF										
Cassia siamea															FL							FL		
	F	F															F							F
			MF			MF																		
Cassia sieberiana						FL			FL															
	F	F						F																F
		MF			MF																			
Ceiba pentandra	FL	FL																						
			F			F																		
						MF			MF															
Combretum micranthum								FL		FL														
	F	F								F														F
			MF					MF																
Holarrhena floribunda								FL		FL														
	F		F							F														F
				MF				MF																

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Species	Jan.		Feb.		March		April		May		June		July		August		Sept.		Oct.		Nov.		Dec.	
	1–15	16–31	1–15	16–28	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–31	1–15	16–30	1–15	16–31	1–15	16–30	1–15	16–31
Khaya senegalensis	F		F	MF				FL F	MF	FL F														F
Mangifera indica	FL F		FL			MF		F					MF											FL F
Milicia regia			FL		FL F			F MF			MF													
Moringa oleifera	FL F	FL				F MF						MF									FL			FL F
Parkia biglobosa			FL		F	FL		F MF				MF												
Prosopis africana	F	F	MF			MF		FL		FL F														F
Pterocarpus erinaceus	FL	FL	F			F MF			MF															
Schrebera arborea	F			F	MF			MF			F		FL											F
Tamarindus indica	F				F	MF			MF		FL		FL F											F

ANNEX E
RANKING OF AF/FOR INTERVENTIONS

During the evaluation tour of the three watersheds, the agroforestry technical assistant asked each of his counterparts to rank the AF/FOR interventions in his watershed from most to least promising. The criteria for "promising" were that (1) the intervention showed potential of having a significant positive impact on the villagers and/or their farming system or environment, and (2) the intervention could be replicated by the villagers after the project ended (sustainability). The rankings were conceived on the spur of the moment; they would have perhaps been different if there had been time to reflect. In any case, the agroforestry technical assistant did not agree with all the rankings; his ranking follows that of his counterparts.

Diaforé

Agroforester

1. Private nurseries
2. Live fencing
3. Contour hedgerows (in association with rock lines)
4. Improved bamboo
5. Reforestation plots
6. Fire control
7. Protected forest zones
8. Streambank plantings
9. Canal stabilization plantings
10. *Cajanus cajan* in *tapades*
11. Multipurpose shrub blocks
12. Alley farming

Agroforestry Technical Assistant

1. Private nurseries
2. Live fencing
3. Contour hedgerows (in association with rock lines)
4. Protected forest zones
5. Improved bamboo
6. Reforestation plots
7. Fire control
8. Streambank plantings
9. Multipurpose shrub blocks
10. Canal stabilization plantings
11. *Cajanus cajan* in *tapades*
12. Alley farming

Dissa

Agroforester

1. Private nurseries
2. Reforestation plots
3. Live fencing
4. Green belts
5. Protected forest zones
6. Logger
7. Village land management
8. Contour hedgerows (in association with rock lines)
9. Fire control
10. Improved charcoal production
11. Multipurpose shrub blocks
12. Improved fallow
13. Improved Bamboo
14. Natural forest management

Agroforestry Technical Assistant

1. Private nurseries
2. Protected forest zones
3. Live fencing
4. Logger
5. Reforestation plots
6. Contour hedgerows (in association with rock lines)
7. Improved charcoal production
8. Green belts
9. Village lands management
10. Fire control
11. Multipurpose shrub blocks
12. Natural forest management
13. Improved bamboo
14. Improved fallow

Koundou

Agroforester

1. Co-management of the Nialama Forest Reserve
2. Private nurseries
3. Live fences
4. Fire control
5. Reforestation plots
6. Protected forest zones
7. Contour hedgerows (in association with rock lines)
8. Improved bamboo
9. Multipurpose shrub blocks

10. Melliferous plants
11. Alley farming

Agroforestry Technical Assistant

1. Co-management of the Nialama Forest Reserve
2. Private nurseries
3. Live fences
4. Protected forest zones
5. Contour hedgerows (in association with rock lines)
6. Fire control
7. Reforestation plots
8. Improved bamboo
9. Multipurpose shrub blocks
10. Melliferous plants
11. Alley farming

ANNEX F
AF/FOR ACTIVITIES FOR THIRD QUARTER 1996

During the third quarter of 1996, AF/FOR activities focused on outplanting seedlings from the private nurseries into various demonstrations. The agroforestry technical assistant and the Koundou and Dissa agroforesters also spent ample time working with and supporting two short-term technical assistants: the CBNRM expert (who was responsible for establishing the IVMC for the Nialama Forest Reserve and developing village land management in Dissa) and the natural forest management (NFM) expert, who devised a preliminary management plan for the forest. In the second half of September, the agroforestry technical assistant and the three watershed agroforesters spent two weeks on an evaluation tour of the three watersheds. They visited and discussed successful and unsuccessful intervention sites and undertook an exhaustive and detailed analysis of the AF/FOR interventions, including the species planted or tested. Specific AF/FOR activities are enumerated in Table F-1.

Exhibit F-1. AF/FOR Activities, July-September, 1996

Activity	Results (number of participants)
Village land management	1) Study visit led by CBNRM short-term technical assistants to Pita and Kissidougou to show villagers examples of village-managed lands and natural forests (three watershed technicians, including the Koundou agroforester; villagers from four pilot villages, Dissa; members of IVMC, Koundou).
Rock lines and contour planting	1) A total of 8,250 m of contour hedgerows sown in three watersheds (19 families). Most were sown in the previous quarter, but some sites in Koundou were sown in the third quarter.
Live fencing	1) A total of 4,728 m planted in three watersheds—2,533 m in cuttings and 2,195 m in plants from private nurseries (68 families). 2) 2nd half of Gliricidia cuttings transported and planted, Koundou. 3) Cuttings and direct seeding occurred at seven lowland gardening sites, Diaforé, for a total of 694 m.
Reforestation plots and protected forest zones	1) A total of 2.33 ha planted in reforestation plots, green belts, and along protected zone perimeters in three watersheds (18 villages). 2) Four agreements negotiated and signed for two protected zones in Dissa; three agreements negotiated and signed for two protected zones in Koundou.
Improved use and conservation of existing forests	**Nialama Forest Reserve** 1) Village meetings, which included discussions of forest use zones and user rights, continued. 2) An assembly made up of more than 120 representatives from more than 25 villages occurred (16-member IVMC elected at the end of the assembly). 3) Three meetings of the IVMC took place with significant participation from various project personnel, including the NFM short-term technical assistant. 4) GPS points taken along one-third of the Forest Reserve boundary by the agroforestry technical assistant in anticipation of map revisions. 5) The local *cantonnement* established a bare root nursery of four native species with project support.

Activity	Results (number of participants)
Improved use and conservation of existing forests (cont)	6) Reforestation of two *tapades* (3 ha) occurred within the forest. 7) Two walks in the Forest Reserve with IVMC members, short-term technical assistants, etc., occurred to discuss various aspects of NFM.
Miscellaneous tree planting efforts	1) 700 seedlings planted by improved charcoal production groups, Dissa. 2) Diaforé agroforester helped two families establish fruit tree orchards (250 plants total; one orchard in Koumbama, the other in Kolle).
Private nurseries	1) The project bought a total of 12,593 seedlings from the nurserymen for a gross profit of 2,209,850 FG. 2) Koundou nurseries sold 333 fruit trees. 3) Diaforé nurseries sold 281 fruit trees (97 grafted citrus, 10 ordinary sweet orange, 100 colas, 20 avocados, and 54 coffee trees). 4) Four litchi trees planted in plantations of private nurserymen (in Diaforé at Koumbama, in Koundou at Guemé, in Dissa at both nurseries).

Next Quarter. The major AF/FOR activity for the October-December quarter will be fire control. Watershed agroforesters will work with various villages to employ early burning on at-risk sites (*bowés*) as well as around reforestation plots and protected zones. In Koundou, a larger early burning campaign will focus on protecting the Nialama Forest Reserve. Efforts to finalize the management plan for the reserve and support the IVMC, especially to help it become officially recognized, will continue. Similarly, work on village land management with the four pilot villages in Dissa will continue. During December, watershed agroforesters will spend much time formulating the 1997 work plans for their watersheds.

Training. Three formal AF/FOR trainings occurred during the quarter (as always, informal training of counterparts and villagers was ongoing). These were as follows:

- Field training in natural forest management techniques led by the short-term technical assistant in NFM (six DNFF/Conakry and Lelouma foresters participated during a 2-week period)

- Formal training in NFM techniques during a seminar using the Nialama Forest Reserve as a case study (again, led by the NFM short-term technical assistant with 27 DNFF/ Conakry, Lelouma, Labé, Tougué, and Kindia foresters, with the project's watershed directors and agroforesters participating for three days)

- Training in evaluation and analysis methods for field-level interventions led by the agroforestry technical assistant (three watershed agroforesters participated for two weeks)