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GAMBIA FORESTRY PROJECT  
635-0205

Evaluation Report #1

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# GAMBIA FORESTRY PROJECT

## Table of Contents

	<u>PAGE</u>
I. RECOMMENDATIONS	1
A. Project Recommendations	1
B. Recommendations for Studies	2
C. Future Forestry Projects	3
II. Project Implementation Weaknesses	4
III. INTRODUCTION	5
IV. PROJECT EVALUATION: Project 635-0205	6
A. Evaluation Criteria	6
B. Progress of the Forestry Project to Date	7
C. Plantations	8
1. Establishment	8
a. Site selection/site clearing	8
b. Planting/planting supervision and planting	10
c. Fire	11
2. Plantation species	11
D. Woodlots	12
E. Training	12
F. Mangrove Feasibility	13
G. Sawmill	13
H. Woodstoves	14
V. FOREST DEPARTMENT ELEMENT - PROJECT MANAGEMENT AND ADMINISTRATION	14

## I. RECOMMENDATIONS

### A. Project Recommendations

In an effort to most efficiently utilize the resources remaining in The Gambia Forestry Project, to best meet the project's goals as originally set in the P.P. and Project Agreement, the evaluator makes the following recommendations:

1. The remaining training should be oriented towards:
  - a. 1 B.S., trained in general forestry, with a minor in Public administration or business management.
  - b. 1 M.S., scheduled for month No. 46 in Implementation Time Frame, to be revised to 1 diploma level technician trained, with remaining financing allocated to short-term specialized training.
  - c. Remaining short term specialized training (18 mos) be provided in:
    - (1) Extension for technician level; in-country.
    - (2) Fire suppression techniques; U.S., Australia, or in-country.
2. Professional staff should be given in-service training, preferably in-country, to increase their managerial capabilities.
3. Diploma level staff should be given in-service training in program planning and administrative procedures to make them aware of management needs.
4. The technical assistance for training in those areas recommended by the USDA sawmill specialist (on such topics as log breakdown decisions, product mix/log size and quality balance, production scheduling, and drying and inventory procedures) should be included following installation of the new sawmill equipment.
5. The mix of sawmill equipment recommended by USDA sawmill specialist J. M. Higgs should be purchased in accordance with his recommendations and as quickly as possible. The additional improvements, specifically the drying shed and S.T. training, will not only improve the efficiency of the utilization unit, but also produce a more marketable and more valuable product. The overall increase in project cost for recommendations 4 and 5 will be approximately \$199,149 (Attachment No. 1).
6. Links to the Soil and Water Management Unit, the Mixed Farming Project, the Rural Development Project and the FRG forestry project should be strengthened. Specifically, the coordinating meetings already begun should become more regularized. Also of extreme importance is obtaining assurances from the SWMU and the FRG (GTZ) Inventory project, for assistance in identifying suitable sites for future plantation establishment.

7. The plantation establishment schedule should be modified as detailed in Attachment No. 2.
8. The cross-cut saws planned for distribution to the villages where woodlots are to be established should be eliminated. Saws are presently available in country and are used by pit sawyers in rural areas. It is not necessary to distribute additional saws free of charge to determine their acceptance.
9. The present scheduling of establishing two woodlots per year is considered appropriate for the remainder of the project for the following reasons: (1) Reafforestation from nurseries and at a village level is a new activity for the Forestry Department; (2) The fuel situation has created difficulties in contracting the villages and acquainting them with the need and benefits of establishing woodlots; and (3) Despite the fact several villages will have Peace Corps assisting in this educating process, they require supervision and assistance.

Some mechanism for the monitoring of this pilot effort is necessary to provide baseline information on which to develop any future expansion. Possible options are discussed in evaluatio text, Section III.D.

10. Assistance to any follow-up of the Mangrove Feasibility Study should be provided as appropriate. This fuel source, if it can be salvaged economically can provide valuable time.
11. After installation of equipment and revised production rates have been determined, the technical assistance scheduled to develop plantation management plans should be requested to develop management plans to provide, on a sustained yield, an optional mix of forest products and propose recommendations for a more suitable mix of species.
12. Additional equipment and training is necessary for the protection of the timber plantations from forest fires. This may be supplied through the upcoming UNSO proposal and any fire suppression planning should be done in conjunction with UNSO personnel. If UNSO assistance in fire protection for the plantations is not forthcoming, additional modification of the forestry project will be necessary to develop protection plans and purchase fire fighting equipment.

#### B. Recommended Studies:

1. Wood consumption study: The project has requested BUCEN to prepare an analytical study which will hopefully be funded as a subproject or obligation of the Energy Initiatives for Africa project. This survey has previously been recommended in the sector analysis prepared by a CILSS/Club du Sahel team (Forests

and Forestry in the Sahel - The Gambia, a Case Study 1981 Vol.5.P.50), and in the original P.P. (page 48). This study is considered a necessary complement to the ongoing forest inventory to provide adequate information for long range, land use allocation decisions, and for developing future personnel requirements.

2. The Sociological study, as suggested by the design team (P.P., pages 48, Annex G, PP 1, 25-26), is still unfunded and will be necessary if the rural woodlot element is to be expanded in the future. The 10 woodlot pilot should be monitored and modified over the length of the project, not simply evaluated. Peace Corps volunteers and forest guards may be able to collect this data with periodic guidance from a sociologist/anthropologist.
3. The mangrove feasibility has been received by the GOTG, and considered satisfactory. A follow-up, pilot exploitation of the mangroves is the next logical step, and should be supported as conditions permit.
4. As scheduled, a project evaluation around month 40 should assess the feasibility of developing a second phase to the current project.
5. Upon the return of the forester trained in mensurational techniques, an indepth investigation should be initiated to determine:
  - a. production rates of *Gmelina arorea* for an entire rotation (longitudinal study).
  - b. production rates of the natural woodlands over the same period. This study may succeed results to be obtained by the FRC project, but should be conducted over the same time frame as the *Gmelina* study.

C. Future Forestry Projects:

The project paper has been developed under the assumption that this is a multi-phase effort. This 5-year project was considered a "time-slice" of a long-term commitment to forest sector assistance. This rationale is the basis of the goal "to slow and eventually reverse the accelerating depletion of the natural resource base of the Gambia."

The technical analysis explicitly recommends that a Phase II be considered part of the mid-term project evaluation. The evaluation

fully supports and recommends that this possibility be investigated to a greater extent during the evaluation scheduled for month 42 (on or about March 1983). The increasing demands for forest products and for additional agricultural land imply a prodigious task of land allocation and improved forest management, a task which must be undertaken by a fledging forest service. The objectives of the Forest Department are:

1. To reserve and maintain a national forest resource capable of minimizing soil desiccation and erosion caused by wind and water, maintaining riverbank stability, and providing an adequate supply of wood and other forest products to meet industrial needs as well as those of the rural population;
2. To promote planting by individuals of wind breaks in fields, along roads, and in compounds and woodlots to increase supplies of tree products in rural areas;
3. To develop the economic use of forest products by local industry; and
4. To instill among Gambian people an understanding of the value of trees and forests and the need for their development and rational exploitation.

To accomplish these objectives will require a sustained effort over an extended period of time. Such an effort cannot be supported solely with Gambia resources, but will require a concerted effort by both. The GOTG and other donors, including A.I.D.

This situation suggests a need for a long term, phased effort to address this complex problem of rapid deforestation with accompanying environmental (natural resource base) degradation.

However, the evaluator feels a recommendation for a Phase II for the Gambia Forestry Project is premature. The implementation of the project is still in its infancy. The major commodities are not yet in place, plantations are not firmly established, nor has a successful process of establishing Gmelina on the scale proposed in the P.P. been proven. Finally, and most important, the participants sent for long-term training have not yet returned and become familiar with their new positions and responsibilities.

## II. PROJECT IMPLEMENTATION WEAKNESSES

There are a number of assumptions made by the P.P. which have changed and which present serious potential problems for the implementation of the project:

1. The technical analysis described the administrative capabilities of the Forestry Department and indicated that the present Chief Conservator of Forests should be available for the length of the project, while the project funded participants completed their training. However, the Chief Conservator has effectively completed his contract of work, leaving the Acting Director alone to manage and direct all forestry activity for the Department. As the Acting Director requires assistance in executing his duties he will be forced to draw from a lightly manned field force, most probably the forest supervisor in charge of afforestation.
2. The first cost estimates for sawmill equipment, as detailed in the P.P., were under-estimated, while other necessary improvements were not included in the proposal.
3. The plantation establishment schedule has taxed Department capabilities, possibly contributing to the failures to date. The loss of the Chief Conservator, the probable reassignment of the person in charge of plantation establishment, and the present fuel rationing policy of the GOTB will necessitate a modification in the original establishment schedule.
4. The woodlot establishment activity is also adversely affected by the fuel situation. The personnel involved with this activity (both forestry Department guards and Peace Corps Volunteers) are not properly trained or supervised to ensure replicability of the woodlots after the termination of the project.

### III. INTRODUCTION

This is a long-term institutional development and forest sector assistance project, designed to create the capability within the Forestry Department of the Ministry of Environment and Water Resources, to undertake a forestry sector program to confront the deforestation crisis on a nation-wide basis. The project has six major components with the specific objective of improving the efficiency of wood production and utilization in the Gambia. There is no doubt of the need of such a program, and increasing emphasis has been accorded the sector in the GOTG's new five-year plan.

This is the first evaluation of the Gambia Forestry Project (635-0205) since the signing of the Project Agreement on August 30, 1979. As such, thirty months have transpired of the five-year project. USAID/Gambia

requested an interim evaluation of the Gambia Forestry Project in February 1982 to confirm design suitability, and to assess management inputs, and their conversion to outputs. This paper presents an evaluation of the technical aspects of the Gambia Forestry Project (635-0205). It will concentrate on the progress to date of the specific activities as defined in the project paper (P.O.) the Project Agreement, and subsequent amendments, and on issues which may be directly related to the project interventions.

Although some indication of past project implementation problems is necessary, the main approach will be to review the project in terms of the future directions which it may take in order to best meet its original objectives, given the projects available manpower, its technical capabilities, and the time remaining to accomplish the original objectives. Finally, some recommendations will be made concerning possible features of a future forestry activity which will truly obtain the objective of improving the efficiency of wood production and utilization in the Gambia.

#### IV. PROJECT EVALUATION: Project 635-0205

##### A. Evaluation Criteria

This evaluation is based on a review of available files and field visits. Information for the evaluation was sought through interviews with knowledgeable individuals (Attachment No. 3 and a review of project files. In addition, field visits were made to the plantation sites, three woodlots, the extension aids unit, and to the utilization unit (sawmill).

The objective or goal of the Forestry Project is to slow and eventually reverse the depletion of the natural resource base of The Gambia. Related to this goal is the objective to reduce the gap between consumption and production of wood in the country. The specific purpose of the project is to increase the efficiency and utilization of wood products and lay the foundation for a forestry sector program which can meet the needs of The Gambia for wood. This assumes, of course, that the country has a comparative advantage in wood production or the country can balance the obvious need for land for wood production with other sometimes competing needs for agricultural production and livestock production.

There are a few comments which should be made here about the PP and the Project Agreement which will service as a guide in evaluating the progress of the project to date. These comments are presented below:

1. The P.P. hoped to strengthen the Forestry department through training, to increase its absorptive capacity.

2. At the same time, because of the seriousness of the deforestation/land degradation problem, it was felt that certain activities must be started immediately.
3. To lay the groundwork for a more comprehensive forestry sector program, certain studies were suggested to gather necessary baseline data for planning an expanded, long range, nation-wide program.
4. Finally, the project was intended to be closely integrated with soil and water management unit and the mixed farming project as all of the project deal with natural resources, and in fact, have the same goal (i.e. halt/reverse environmental deterioration). Those areas where the projects are thought to be most effectively complement one another are:
  - a. land use planning
  - b. extension
  - c. other planning/integration of the planting with farming
  - d. advice on how best to utilize marginal lands

This plan then suggests that there will be sufficient staff to carry out a large sector program once the accumulation and analysis of baseline data is completed and recommendations are made.

#### B. Review of the Project to Date

1. The original project design concept is still sound, the purpose is attainable by the PACD, and is fully justified.
2. The implementation plan is behind schedule by 14-20 months, primarily due to difficulties in procuring the sawmill equipment, and unavoidable disasters in attaining plantation objectives.
3. Good progress has been made in the most important component of the project; training Forestry Department Staff:
  - a. 1 sawyer trained  
2 sawyers in training
  - b. 1 extension specialist scheduled for technical training beginning June 1982.
  - c. 5 technicians in training for 2-year diploma, to return in May 1982.
  - d. 1 professional level (B.S.) in training in Tanzania.

Another forester will receive his M.S. specializing in forest mensuration under the Sahel Manpower Development Project.

4. The mangrove feasibility study has been completed and presented to the GOTG and accepted as satisfactory.
5. Periodic coordination meetings, as recommended in the P.P. (p.25), have begun between A.I.D. and project technicians, and are scheduled to include other donor project technicians as well.
6. The added woodstove component is in process and has been evaluated (Attachment No. 4).

### C. Plantations

#### 1. Establishment

The project, as originally designed, included 1300 hectares of Gmelina arborea to be planted in forest parks. The annual plantings were to increase yearly, beginning with 175 ha. in year one, and expanding to 325 ha. in year five. This "plantation establishment schedule" has not been adhered to and the evaluator has proposed a modified schedule, detailed in Attachment 2.

#### a. Site Selection/Site Clearing

Status: The sites for the first plantations were identified in the project paper. These areas appear to be favorable growing sites within already established forest parks. They were fairly densely covered with vegetation before clearing. The present practice is to clear sufficient area for two-years planting to assure that this major task is completed in sufficient time to prepare for the Gmelina which is direct seeded.

The sites were originally chosen because of the proximity of the forest parks to the potential urban market in Banjul and the Nyambai sawmill. All plantations are to be established within existing forest parks to minimize displacement of rural residents.

The plantations are behind schedule and substantial effort would have to be made to achieve planting objectives. Only 585 ha. of the scheduled 675 ha. have been cleared for planting and virtually the entire area will have to be replanted. Approximately 77 percent of planned clearing and fencing for the plantation areas has been completed to date. The remaining area has not been cleared or fenced, apparently due to some misunderstanding.

Issue: The sites were chosen rather arbitrarily, due to a lack of such base line information as soil analysis and vegetation inventories. The sites were generally densely vegetated, although most of the valuable species had been cut previously. The plantation sites were cleared two years in advance. This practice is not recommended and has been criticized by other foresters in the country.

Overall, the evaluator feels that the original plantation schedule was not too ambitious, though these goals have severely taxed the capability of the GOTG.

Recommendation: A less ambitious plantation schedule (Attachment A) has been proposed because:

- (1) Other donor projects demand a sizeable percentage of forestry department personnel.
- (2) Participants in training are selected from within the department wherever possible, creating additional personnel shortages.
- (3) There is only one forest supervisor available to direct all afforestation activities, including plantations, woodlots and national tree planting day activities.
- (4) Fuel rationing precludes adequate expansion, not to mention supervision of present plantation activities.
- (5) Despite the planned return of the diploma-level technicians, the newly trained individuals will require additional guidance during their first year.

The modification for the following two years will permit existing personnel and newly returned technicians to develop a smoothly flowing system of harvesting existing natural woodlands in preparation for plantation establishment and permit a greater percentage of the felled wood to be utilized. The modification will also "buy time" for the developing capability of the Forestry Department (assisted by the FRG/GTZ) to identify plantation sites in a more analytical manner, so the most suitable sites will be selected for reforestation in the future.

The project has already contacted and received assurances that the German (GTZ) funded project will assist in future site selections (per their project mandate). However, it is uncertain whether this project will be sufficiently advanced to

be able to provide the necessary information for the remaining project time. The SWMU (635-0202) has also agreed to assist in doing soils analyses. If adequate assistance is not forthcoming from these two projects, the evaluator recommends that project management request assistance from the Forestry Support Program, under the aegis of the Forest Resources Management Project (936-5519) and/or the "Soils Management Support Services Project, PASA AG/DSB-1129-5-79. The empirical information regarding the site selection is essential to plantation success. It will also prevent the premature harvest of existing woodlands. Once selected, only a sufficient area for one years planting should be cleared each dry season. There is little use in clearing land for two successive year in one year. There is a loss of incremental growth, and weedy growth will have to be cleared again and burned before the actual planting.

b. Planting Supervision and Planting

Status: There is a guard at each forest park where plantation work is in progress, to oversee the day-to-day operations. The clearing, planting, and weeding is done through "petty contracts" (Attachment 5). The contracting rates are based on the Gambian minimum wage of D4.50/day. Overall responsibility for plantation reforestation work resides with one senior supervisor. The plantations have suffered two successive failures placing this component two growing seasons behind. The first years planting was lost to drought, while the second year planting was lost to fire.

Issue: The forest supervisor in charge of reforestation is also responsible for all woodlot establishment and coordination of national tree planting activities. This mix of responsibilities for activities country wide has adversely affected plantation establishment. In addition, the rationing of fuel by the GOTG has severely hampered the supervisor's execution of his duties.

Recommendation: The senior forest supervisor should have assistance in overseeing the reforestation activities. One assistant should be given responsibility for the woodlots and the national tree planting activities, with another assistant to monitor and assist with the harvesting and establishment of the plantations.

Some mechanism must be found to assure mobility for the supervisors. Perhaps motor cycles, with their minimal fuel needs,

can be supplied to maximize fuel use.

c. Fire

Status: Wildfire has been identified as one of the primary causal agents in the change of the vegetation structure in the country. This problem was the focus of a recent study funded by UNSO. Fire suppression was also one of the recommended projects sited in the recent published "Energy Survey and Water Plan for The Gambia", by O.R.G.A.T.E.C. A major awareness campaign is being waged by the government in an effort to educate people to the damaging effects of wildfire by radio and in addresses made by prominent government officials.

Issue: The guards at the plantations do not have any means of rapidly spreading an alarm about wildfire.

The fire breaks around the forest park and around the 25 ha. units are totally inadequate if the Forest Department does not have the ability of combating wildfire.

Recommendation: If other assistance is not forthcoming, provision will have to be made to supply transportation to the forest guards and to supply equipment and training for fire suppression to area chiefs (crews to be recruited from nearby villages).

2. Plantation Species

Status: The GOTG has an established capability in reproducing Gmelina in the Western Division of The Gambia. It was on this basis that the plantation component was predicated. It was anticipated that as the project progressed results would be available from the species adaption trials funded by the FRG. However, these trials have not yielded any results as yet.

Issue: Planting of Gmelina may be a suitable species for the Western Division. However, planting of a single species can pose a serious threat to such a forestry program. Susceptibility to any pest could devastate the plantation area, with serious ecological and economic repercussions. In addition, Gmelina is not the most suitable species for the more arid areas in other Divisions in the country.

Recommendation: The Senegalese CNRF and the CTFT have done extensive tests on a large number of species. These results should be looked at carefully to assist in choosing additional species for both the plantation and for the trials planned by the GTZ project. Results from these trials may be directly transferable to the Gambian conditions.

#### D. Woodlots

Status: Woodlots are being established at a rate of two (1 hr./lot) per year and previously established woodlots expanded with annual one ha. increments. Certain of these woodlots are established with the assistance of P.C. volunteers, but all the woodlots also benefit from the technical advice of the forest guards responsible for the villages. There were excessive losses during the last planting season. However, these were due to factors beyond the control of the Forestry Department.

Issue: The woodlots are perceived as "government woodlots" -- mini-plantations, in effect--making spontaneous acceptance and expansion doubtful.

Recommendation: The present scheduling of establishing two woodlots per year is considered appropriate for the remainder of the project in view of the following:

- Reafforestation from nurseries and at a village level is a new activity for the Forestry Department.
- The fuel situation has created difficulties in contacting the villages and acquainting them with the need and benefits of establishing woodlots.
- Despite the fact several villages will have Peace Corps assisting in this educating process, they require supervision and assistance.

Monitoring of this pilot effort is necessary, to provide base line information on which to develop any future expansion. To understand the underlying constraints to replicability, the evaluator feels an intensive investigation of how this vital part of any large reforestation effort may be accomplished is necessary. This will necessitate further study or monitoring, as recommended in the original P.P., but never funded.

#### E. Training

Status: As stated previously, good progress has been made in training Forest Department Staff. Because of the training funded by the Sahel Manpower Development Project (625-0936), the project is effectively "ahead of schedule" in this component of the Forestry Project. The Forestry Project will have trained sizeable cadre of expertise, once the long term participants have returned.

Issue: Given that one forester has been trained to the M.S. level under the auspices of another project, it is felt that the money allocated in the project for graduate training would be more affectively utilized by providing specific short term training for existing personnel.

Recommendation: Additional training is needed by sawmill personnel on such topics as log breakdown decisions; product mixes, considering log size and quality; drying scheduling; and wood utilization.

Short term training for forest guards and Peace Corps volunteers in nursery establishment, technical training in relation to woodlot establishment, and extension theory and practice would be beneficial.

Training workshops should be given in country to acquaint Forest Department personnel with fire suppression techniques and supervision. Additional advanced training might be obtained through U.S.F.S. at their training center in the U.S., coupled with actual fire fighting experience.

The remaining B.S. level training should be in general forestry, with a minor emphasis in Public Administration or business management.

#### F. Mangrove Feasibility

Status: The Mangrove Feasibility Study was produced by Checchi and Company, and made available on September 11, 1981. The study investigated the alternatives for harvesting, processing and marketing mangroves in The Gambia, and proposed a plan of action for a salvaging operation for the primary purpose of supplying firewood to the Banjul area.

The study was completed within the scheduled time frame and accepted as suitable by the GOTG.

Issue: The GOTG has been unable to convene a follow-up meeting with all the necessary offices present. As such, there has been no endorsement or recommendation for further action by the government.

Recommendation: A follow-up, pilot harvesting of the mangroves is the next logical step, and should be supported by the mission as conditions permit.

#### G. Sawmill

Status: The project originally planned for installation and operation of the new sawmill equipment by the 28th month and has necessitated visits by two separate short-term consultants. The project is now attempting to prepare the specifications for RFP's.

Issue: The expansion of the unit is overdue, and the equipment is an essential component of the project. Although no estimate for this type of equipment can be made with any certitude for more than 30 days, it appears that the original cost estimate was underestimated by over 100 percent. The magnitude of the error severely jeopardizes the attainment of the project's overall goal should the equipment not be purchased. The different costing estimates for the sawmill are also due to the fact that certain additional sawmill improvements were overlooked in the original P.P. proposal.

In addition, both sawmill specialists indicate that the large-log processing machinery installed in 1959 is in need of an overhaul, tune-up and re-alignment.

Recommendations: The evaluator concurs with the recommendations made by Mr. Higgs of the USFS, State and Private Forests Western Division. The mix of sawmill equipment should be purchased in accordance with his recommendations, and as quickly as possible. The recommended improvements will not only improve the efficiency of the utilization unit, but also produce a more marketable, and more valuable produce.

#### H. Woodstoves

Status: A woodstove component was added to the project after the initial signing of the project agreement. This small pilot effort concentrated on the training of both urban and rural inhabitants in the construction and utilization of "improved" woodstoves. The pilot was instituted with the assistance of one Peace Corps volunteer and concentrated on dissemination of already proven stoves rather than testing and modification of stove models. An evaluation report, prepared by the CILSS woodstove coordinator is attached (Attachment 4).

Issue: The Mission would like to explore the possibilities of a more expansive effort, given the favorable evaluation. However, a recently submitted UNSO proposal may obviate further USAID involvement. The evaluator could not obtain a copy of the UNSO proposal.

Recommendation: The Mission may wish to review the UNSO proposal with the possibility of developing a closely coordinated large scale effort. However, in view of the UNSO interest, the evaluator feels that project goals can best be attained by concentrating on wood production and processing rather than expanding further effort in wood utilization conservation.

#### V. FOREST DEPARTMENT ELEMENT - PROJECT MANAGEMENT AND ADMINISTRATION

The Forest Department has one Director and one Deputy Director. However, during the evaluation tour, it was confirmed that the Chief Conservator would be taking accrued leave prior to the termination of his contract. This effectively reduces the Forest Department's senior staff capability by 50 percent. Technical assistance under the project is short term only. A close monitoring of the effects of this change will be necessary to determine how crucial a factor this loss will be in achieving project objectives.

The Forestry Department is no longer within the Ministry of Agriculture and Natural Resources, but has been moved to the Ministry of Environment and Water Resource. This change presumably has not adversely affected relations between the Forestry Department and the Extension Aids Unit. However, the village level work is done by the forestry department guards and rangers, who traditionally are considered revenue collectors and policemen. A closer relationship, rather than a separation of offices would

be more advantageous in developing a joint extension effort. Other necessary but as yet undeveloped linkages will have to be developed with the Minister of Agriculture Horticultural Unit, if fruit tree propagation is to be included within the woodlot extension activity.

All afforestation activities are the responsibility of one senior forest supervisor. There is no intermediate level between the supervisor and the guards in charge of specific planting activities. It is recommended that some separation of the plantation establishment effort and the more social forestry oriented work be undertaken to improve this situation.

In summary, it appears that the Forestry Department is fully extended and would be taxed to do more than maintain present activities. However, with the impending arrival of the M.S. trained forester and the third-country trained technicians this situation will be alleviated somewhat. The next scheduled evaluation should review project changes and assess how this first forestry effort can be built upon to provide a nationwide forestry sector assistance project.

## ATTACHMENT 1

### Nyambai Utilization Unit: Needs and Cost Analysis

The following is an attempt to compare the equipment recommended and the cost estimates made by the two sawmill specialists. In the original proposal, a specialist recommended a Bolter Saw to supplement the large break-down saw now at the mill. This consultant was unable to return to "flesh out" or itemize his proposal following project approval however.

The second specialist concurred with the recommendation for the Bolter Saw. The two estimates vary a great deal due to a more detailed description of equipment, a time difference of almost four years, and for other less clearly defined reasons. The second specialist also identified certain additional, essential areas that must be funded in order to establish an economically efficient small log break-down system and provide the maximum economic returns in investment.

This comparison illustrates an estimated difference of \$199,149 between the two recommendations. It is the evaluator's opinion that the additional components, except perhaps the main-saw edger (at an installed cost of approximately \$29,000), are necessary if the Utilization Unit is to improve both the quantity and quality of its product.

In sum, the evaluator feels the recommended improvements and training detailed in the revised proposal should be installed, and the P.P. and ProAg should be modified to accommodate the increased cost.

ORIGINAL PROPOSAL

<u>ITEM</u>	<u>QUANTITY</u>	<u>PRICE</u>
1. Bolter Saw (complete unit with power)	1	2,500
2. EDGER	1	3,500
3. Big Stick Loader and and Wood Rack	1	5,500
4. Lumber Planer	1	10,000
5. Saw Filing Equipment and Supplies	-	10,000
6. Materials for Salter Saw Shed	-	8,000
7. Supplies for Existing Sawmill for Alignment	-	5,500
8. Welder Package	1	(recommended but not costed)
9. Sawdust Collection System powered from Bolter Saw	1	(Included in original draft layout; not costed)
SUBTOTAL		67,500
Shipping (25% of above)	-	16,875
Purchasing Agent Fees (8% of above)	-	5,400
SUBTOTAL		89,775
10. Shed and Concrete Slab (including 10% inflation additional and 8% contingency)	185 Sq.Mi	22,000
11. Technical Services: Installation of Sawmill Equipment	-	30,000
SUBTOTAL		141,775
Contingencies 10%		14,178
<u>GRAND TOTAL</u>		<u>155,953</u>

REVISED PROPOSAL

<u>ITEM</u>	<u>QUANTITY</u>	<u>PRICE</u>
1. Bolter Saw (no power Bolter Saw Power Unit	1 1	35,000 12,000
2. EDGER (no power) EDGER Power Unit	1 1	11,000 10,000
3. EDGER for Main Sawmill Unit with Power Unit	1	29,000
4. Big Stick Loaders and Wood Rack	Comparable equipment supplied by FRG	
5. Lumber Planner Planer Power Unit	1 1	3,000 10,000
6. Saw Filing Equipment and Supplies (miscellaneous supplies)	-	4,000
7. Materials for Bolter Saw Shed (#4,5,6 in Higg's report; rolls, caster sets; support)	-	9,000
8. Supplies for Main Sawmill Alignment	-	Recommended but not costed.
9. Welder Package	1	4,000
10. Cutting Torch Package (Acctelyne)	1	2,000
11. Saw Dust Collection (Blower for Bolter only)	1	1,500
SUBTOTAL: Commodities		- 130,500
Shipping (25% of above)		32,500
Purchasing Agents Fees (8% of above)		10,440
SUTOTAL: Commodities		173,440
Inflation 10%		17,344
12. Shed and Concrete Slab for Sawmill Equipment (including inflation 10%)	185 sq.mi.	40,000
13. Additional Shed and Slab for Drying/ Storing Processed Lumber (including inflation 10%)	280 sq.mi.	28,000
SUBTOTAL		258,784
14. Technical Services for Installation	-	20,000
15. S&PF Short Term Training	-	30,000
SUBTOTAL		308,784
Contingency 15%		46,318
<u>GRAND TOTAL</u>		<u>\$ 355,102</u>

## PLANTATION ESTABLISHMENT SCHEDULE

(ha.)

	Proposed		Actual		Modified	
	Cleared	Planted/ Survived	Cleared	Planted/ Survived	Cleared	Planted/ Survived
Year 1 o	175	175	192	192/0	-	-
Year 2 o	225	225	30	220/25	-	-
Year 3 o	275	275	300	520 (scheduled)	520	520
Year 4 o	300	300	-	-	250	250
Year 5 o	325	325	-	-	250	250
TOTAL	1300	1300	522	-/25	1020	1020

## Individuals Consulted During Preparation for Evaluation:

GAMBIA	GOTG	Forestry Department staff
		<ol style="list-style-type: none"> <li>1. Robert McEwan, Chief Conservator</li> <li>2. Bye Maas Taal, Asst. Director, Forestry Dept. in WREN</li> <li>3. J. K. Sidibeh, Senior Forest Ranger in charge of Nyambai Utilization Unit</li> <li>4. Amadou Sey, Forest Supervisor, in charge of Afforestation operations</li> <li>5. Fabakeri Banja, Forest Guard, Farafenni</li> <li>6. Ousman Othman, Permanent Secty, in WREN</li> </ol>
U.S.		<ol style="list-style-type: none"> <li>1. Marilyn Hoskins, Sociologist</li> <li>2. Frank Turner, V.P., Checchi Co.</li> <li>3. Fred Hubbard, team leader for mangrove study, Checchi Co.</li> <li>4. J. M. Higgs, U.S.F.S. Sawmill specialist</li> <li>5. Joel Schlesinger, USAID project manager</li> <li>6. Thomas Moser, A.A.O.</li> <li>7. Quincy Benbow, A.D.O.</li> <li>3. Marc Medland, A.A.D.O., project manager</li> <li>9. Binta J. Sidibe, USAID training officer</li> <li>10. Glen Fulcher, Project Leader, Mixed Farming Project</li> <li>11. Christopher Stewart, P.C.V., woodstove specialist</li> <li>12. Steve Sweet, P.C.V., manneh woodlot</li> <li>13. Dan Coster, A.P.C.O., forestry and woodstoves</li> <li>14. Anthony Funicello, USAID Program</li> </ol>
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TECHNICAL EVALUATION OF WOODSTOVE PROJECTS IN THE GAMBIA  
WITH RECOMMENDATIONS FOR FUTURE PLANNING

SUBMITTED TO:

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## CONTENTS

I. OVERVIEW	1
II. RECOMMENDATIONS	3
III. TECHNICAL EVALUATION OF STOVES	6
A. Description	6
B. Durability	9
C. Thermal testing	12
IV. SOCIOLOGICAL EVALUATION OF GAMBELAN STOVES	13
V. TRAINING SESSIONS	16
A. Rural Program	16
B. Urban Program	18
C. Local stove-builders' associations	19
VI. ECONOMIC ISSUES	20
A. The use of external funding.	20
B. Can a woodstove project become financially independent?	22
C. The question of subsidies.	24
VII. ELEMENTS OF PROJECT DESIGN	25
APPENDIX A: List of stoves examined.	26
APPENDIX B: Proposed curriculum for urban training program.	27
APPENDIX C: Data and calculations for thermal test.	29

Note: There is no Page 22. It was inadvertently skipped during pagination.

I. OVERVIEW

In The Gambia, as elsewhere in West Africa, the primary source of cooking energy is fuelwood. A 1973 energy survey estimated per capita consumption of fuelwood in The Gambia at 1,006 kg per year in rural areas. Among the urban population the total was slightly less (McEwan, 1981). These estimates are nearly double the consumption rates usually cited for Upper Volta and Niger, and they are substantially higher than figures from Senegal or even Togo (see FRIDA, 1980 for a brief review of wood consumption data from sub-Saharan Africa).

In July, 1980, faced with a growing population with an increasing fuelwood appetite, the Gambian government took the unprecedented measure of banning the production of charcoal. Urban households which had previously depended on charcoal for their cooking needs now had to turn to raw wood. Because of the greater thermal efficiency in using wood directly rather than as charcoal, the national consumption of fuelwood in 1981 was expected to diminish by over 13% (McEwan, 1981). However, the inefficient burning of wood by a population accustomed to charcoal has probably overshadowed any net energy savings.

In January, 1981, following several months of planning and discussion, USAID funded two modest projects to introduce high-cost, wood-conserving cookstoves into The Gambia. One project, administered through the Rural Vocational Training Program, was directed towards people in rural villages. The other, directed by the Forestry Department, was aimed at the urban population. In both cases the basic strategy involved conducting a series of workshops to teach people how to construct, repair, and use the stoves. Summaries of the project structure, implementation, and

outcome are detailed in the following documents:

- 1) Rural Vocational Training Program / Forestry / USAID Wood-Burning Stoves Progress Report, written by Peace Corps Volunteer Christopher O'Brien, and submitted 17 November, 1981 to the USAID Mission, Banjul, by Essa B. A. Sonko. 10 pp.
- 2) The Introduction of Improved Wood-Burning Stoves to Gambian Urban Communities, written by R. J. McEwan and Saderr A. M. Geesay, Forestry Department, The Gambia, for presentation at the CILSS/Gambia Woodstove Workshop, November 16-21, 1981 at Mansakonko, The Gambia. 4 pp.

In January, 1982, an on-site inspection and evaluation of the two projects was conducted by the regional technical coordinator of woodstove projects at CILSS (Permanent Interstate Committee for Drought Control in the Sahel). Major assistance was provided by USAID and the Gambian Forestry Department. During a five-day fact-finding tour, the evaluator inspected 60 stoves in 15 towns and villages in both urban and rural areas. He interviewed 53 stove owners and 11 trainees, and discussed major issues with the project directors. On the sixth day of the evaluation, a meeting was held with representatives of USAID, the Gambian Forestry Department, and the Peace Corps to discuss preliminary recommendations. The following report and recommendations represent the final outcome of this six-day evaluation.

## II. RECOMMENDATIONS

This section presents a summary of recommendations for continued woodstove programs in The Gambia. Details can usually be found in the appropriate section on pages indicated at the end of each item. The most important recommendations are marked with an asterisk.

### Stoves

- \* 1) Considerable stove damage has apparently been caused by unnecessarily large fires. Women should be encouraged to keep their fires small. If, at the same time, the stove draft can be reduced there should be no increase in cooking time. (page 9).
- 2) In the urban stove model, the top of the entry should be arched, never flat, for greater strength. (Page 8).
- 3) In the rural stove model where cost is a factor, the steel rebar pot supports may be replaced by three stones embedded deeply in the floor and sides of the firebox. (Page 10).
- 4) Both rural and urban stoves should have internal reinforcing over the entry and within the "bridge" between the potholes. Fired clay and steel rebar have been proven effective. Specially folded corrugate may also be tried. (Page 9).
- 5) Stoves accommodating particularly large pots should stand lower than normal for greater ease in moving the pots in and out of potholes and reducing wear to the stove. (Page 10).
- 6) The stove model featuring a firebox under each pot of the two-pot stove should be discontinued, since it provides little, if any, fuel savings. (Page 12).
- 7) To reduce wear around potholes, a cement ring may be embedded around the potholes, but only if the increased cost of such a ring is acceptable. (Page 10).
- 8) To lengthen the life of corrugate chimneys, the chimney base should be protected from spattering oil by a collar of corrugate or a tin can. Alternatively, the chimney base can be made of cement or mud chimney blocks. (Page 11).
- 9) A number of problems can be solved by extending the chimney horizontally through an exterior wall of the kitchen, either at the stove level or higher. (Page 11).
- \* 10) The rural stove model should be modified to substantially reduce its draft. (Page 12).

- 11) In the urban stove when only the first pothole is in use, a pot of water should be placed in the second pothole to serve as a damper. Otherwise, the draft will be much too strong. (Page 12).
- \* 12) In areas where rice field clay is not easily accessible, efforts should be intensified to find and adapt suitable local substitutes for building the stove block. (Pages 16, 19, 24).
- 13) For the time being, the Forestry Department should continue to supply rice field clay to areas of Banjul, Sere Kunda, and Bakau, possibly adding Gungul to the list. Eventually, however, this practice must be phased out. (Page 24).
- \* 14) In both urban and rural regions a serious effort should be made to introduce the sahelien portable metal woodstove. Local metalsmiths should be making these rather than the inappropriate "ccal pot" stoves. (Pages 13-14).
- \* 15) Simple chimneyless stoves, such as the "Louga" model from Senegal or the "Kamsiliga" stove from Upper Volta should be modified and introduced in areas where they seem most appropriate. (Pages 14-15).

#### Urban Training Program.

- \* 16) It is essential that there be a system whereby urban stove-owners can easily get in touch with a certified stove trainee to make repairs and deal with problems of a poorly functioning stove. (Pages 19, 20).
- \* 17) The urban training sessions should be shortened to run no longer than 10 days. (Pages 19, 28).
- \* 18) Urban trainees having successfully completed the training course should each be issued an official-looking document certifying his skill in stove building and repair. (Page 28).
- 19) Eventually, the urban stove program should offer special courses for certifying new stove-building trainers. (Pages 20, 28).
- \* 20) During the urban training program, trainees should be paid only from shared profits earned from the stoves they build. Stove recipients may be given a 50% discount during the training session. This represents one of the few acceptable forms of stove subsidy. (Page 24, 28).
- 21) The urban training curriculum should include advice to new entrepreneurs on attracting business, keeping records, and maintaining a clientele. (Page 28).
- 22) Greater efforts should be made to introduce stoves to less affluent households. (Pages 13, 19).
- 23) In selecting young men for the urban training session, preference should be given to residents of the area in which training will be given. (Page 19).

Both urban and rural training programs

- \* 24) There needs to be more time devoted to learning how to recognize and repair structural stove damage resulting from normal use. (Pages 16, 28).
- \* 25) The practice of providing a cash stipend for trainees must be discontinued. (Pages 16, 24, 28).
- 26) Local stove-builders' organizations should be promoted to assist and encourage the individual efforts of their members. However, the idea that stoves can be built only by all members together should be discouraged, since it is probably counterproductive. (Pages 19-20).
- 27) Direct and indirect subsidies for woodstoves (materials and labor) should be avoided wherever possible except in narrowly defined training and promotional programs. (Page 24).

Rural training programs.

- 28) All rural training sessions should be followed up by trainers with regular return visits to the villages to answer questions, note any problems, and encourage continued stove-building and stove-using. (Page 17).
- 29) Rural program directors should experiment with training sessions held in several separate stages rather than within a single block of time.
- 30) During the planning for each training session, the villagers should be allowed a greater role in decision-making.

Project design.

- 31) The Gambian stove project must include an active component of research and testing. (Pages 20, 22).
- 32) Promotional campaigns should be continued and expanded to increase public awareness of the advantages and accessibility of domestic wood-burning cookstoves. (Pages 20, 22, 23).
- 33) Four-wheel drive vehicles should be used only when absolutely necessary. For most trips into the field a sturdy two-wheeled vehicle would be economical and perfectly sufficient. (Page 25).
- 34) Both the rural and urban projects need at least one woman working full-time as a field agent. Her job would be to ensure that the program is adequately serving the purpose for which it was designed. (Page 25).
- 35) Additional trainers will eventually be needed in the urban project. (Page 25).

### III. TECHNICAL EVALUATION OF STOVES.

#### A. Description.

The stoves constructed under the urban and rural programs are basically very similar. Both accommodate two pots simultaneously, one placed directly over the firebox and the other in an extension of the flue between firebox and chimney. They are made of a rammed sand-clay mixture in proportions of 3:1, and they perch on a solid foundation of mud or cement blocks. The chimney is a rolled tube fashioned from light-gauge corrugated metal sheet.

In the rural stove the two potholes are in line with the entry (Figure 1). A low baffle under the second pothole helps distribute hot gases around the second pot before they are discharged through the chimney. Over-all stove dimensions are summarized in Table 1 below.

TABLE 1. Exterior dimensions of the rural stove model based on a sample of eleven units.

<u>Dimension</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>
Length	107 cm	75 cm	90.5 cm
Width	70 cm	51 cm	65.5 cm
Height	60 cm	43 cm	49.0 cm
"Bridge"	12 cm	3 cm	9.5 cm

Often in this model the back of the stove is somewhat wider than the front to accommodate both the rear pothole and the chimney. The area between potholes, called the "bridge," was often wider than the optimal 3 m. Most entryways were properly ironed for strength. An apron extends from the entry in front of the stove to support long pieces of wood. A unique feature is having the first pot rest on two pieces of steel rebar spanning

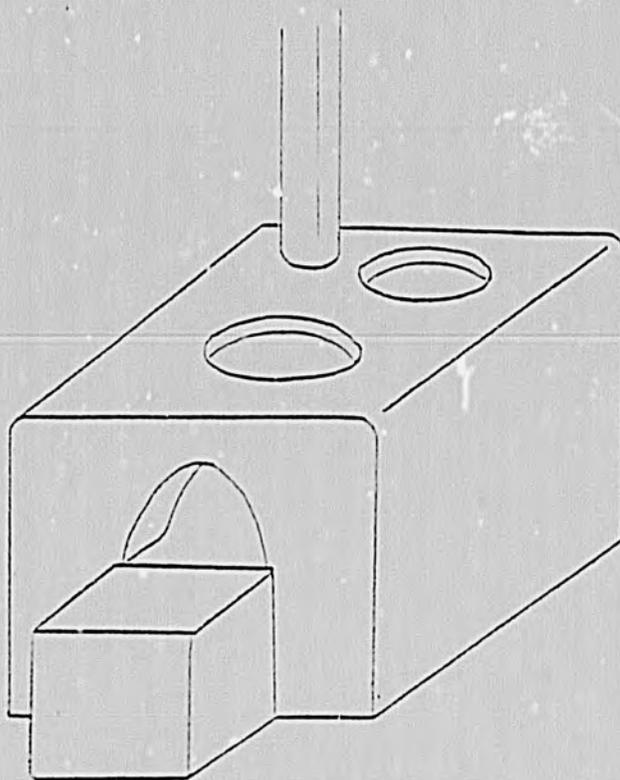


FIGURE 1. Typical stove built during rural training sessions. Scale is approximately 1:10.

the firebox about 15 cm from the bottom, rather than the pot being supported by the pot hole. This height of the pot above the firebox floor is roughly equivalent to half the diameter of the pot hole, which is approximately correct for the maximum heating effect.

The stove built for the urban program is generally somewhat larger than the rural stove (Table 2). However, its major distinction is in having the entry on the long side of the stove and the chimney between the two pot holes (Figure 2). Exhaust gases under the second pot pass around a high baffle and then turn sharply toward the flue leading to the central chimney. Pots are supported by the pot holes. There is no

front apron. The entry is usually rectangular rather than arched, and is occasionally quite low (only 10 cm high in Farafeni, for example).

TABLE 2. Exterior dimensions of the urban stove model based on a sample of nineteen units.

<u>Dimension</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>
Length	123 cm	82 cm	103 cm
Width	70 cm	51 cm	58 cm
Height (standing model)	66 cm	49 cm	57 cm
Height (sitting model)	43 cm	35 cm	37 cm

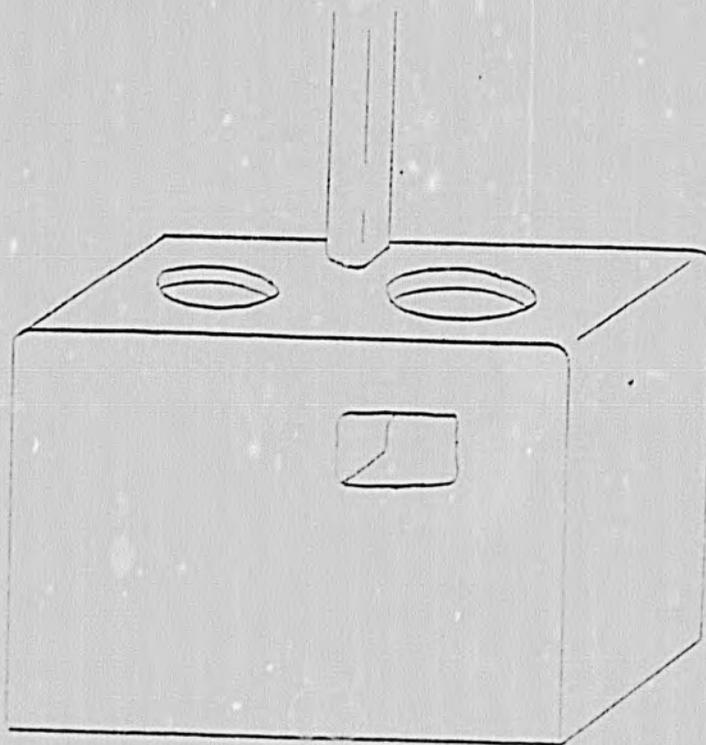


FIGURE 2. Typical stove built during urban training sessions. Scale is approximately 1:10.

3. Durability.

The stoves examined varied in age from a few days to over one year. All exhibited the kind of cracking and wear which is normal for mud stoves, but the damage was often not in proportion to the age of the stove. Certain old stoves were still in excellent condition, while some younger ones were broken and useless. One woman in Keneta insisted that she took better care of her stove than her neighbors do by maintaining only a low fire. Elsewhere we noted a number of women who had built much larger fires than necessary, and it is very likely this that causes the greatest damage.

The following structural problems were the most frequently encountered among both urban and rural stoves:

- 1) Cracks over entry and bridge, and radial cracks around potholes. These are the unavoidable result of normal heating and cooling of the monolithic stove block. Harmless at first, they can lead to further deterioration, especially when licked by flames. If the cracks are wide, they can usually be repaired cosmetically by pressing into them a moist sand-clay mixture. Internal reinforcing of the crack-prone areas may not prevent cracks, but it can help stabilize those areas and increase the life of the stove. Pieces of fired pottery make excellent reinforcing material, but they can be inserted only when the stove is being built. Steel rebar, if available, has also proven to be effective. In the absence of either fired clay or rebar, it may be possible to use a strip of corrugate folded in a "W" along its length (Figure 3).

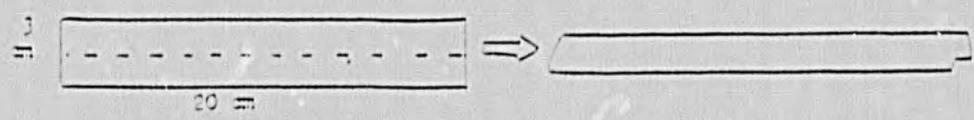


FIGURE 3. Shaping a strip of corrugate for internal reinforcement.

- 2) Cracks along the sides and back of the stove. These are usually the result of firing the stove before it is completely dry. In very humid areas it is advisable to make the first fire small and slow-burning to drive out all remaining moisture.
- 3) Flaking and eroding of the firebox interior. The same sand-clay mixture that gives a hard exterior surface becomes crumbly when exposed to hot flames. The best solution is preventative: keep the fire no larger than necessary. It is possible to pre-fabricate a fired clay firebox and insert it into the stove during construction. Lining the firebox with potters' clay is another option worth exploring.
- 4) Wearing around the potholes. In a number of stoves the potholes have become enlarged, so that smoke escapes around the pot and the pot sits more deeply than intended. This must be caused by daily moving pots in and out, especially in the higher urban stoves. Having the pots resting on stones embedded in the sides of the hole, as in many of the rural stoves, should help avoid this problem. Another solution worth exploring is to embed a cement ring in the stove around each pothole (Figure 4).

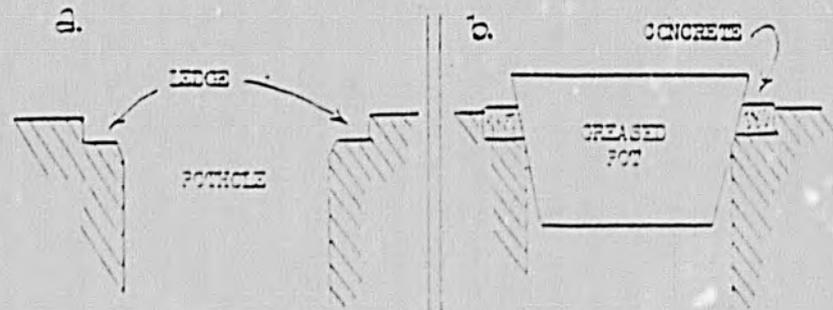


FIGURE 4. To build or repair potholes, a ledge is carved out and filled with concrete with the pot in place. Pot should be re-inserted as cement is setting to be sure the fit is tight and smooth. (Based on an idea by John Graham, Emerson College, Sussex, England, as reported in Locksleve News, 1/3/42, Eugene, Oregon).

- 5) Corrosion at the chimney base. The spattering and subsequent burning of oil on the metal chimney sets up a reaction that eventually corrodes the thin corrugate. There are several ways to prolong chimney life:
  - a) protect the base with a 30 cm wide collar of corrugate or a tin can with both ends removed;
  - b) use banco or cement chimney blocks for the chimney base.
- 6) Rain damage. Rain can cause serious damage to an unprotected mud stove. There are several ways to minimize the damage:
  - a) Install a cap over the chimney to keep the rain out (this was done in nearly all stoves examined).
  - b) When the chimney extends through corrugate roofing, caulk the space around it to prevent water leaks. In the urban stove, twisted plastic bags are stuffed around and into the gap between chimney and roofing, and a mound of cement was applied on the roof around the chimney. This appeared very effective. When making a chimney hole through corrugate roofing, the two sides of the hole should intersect the peaks of the corrugate, not the valleys.
  - c) The chimney flue may be extended horizontally through the wall behind the stove and the chimney then mounted along the exterior. This avoids cutting a hole in the roofing, and it also has other advantages (and disadvantages).
  - d) Where water unavoidably falls on the stove, a protective layer of concrete should be applied (1 part cement, 3 parts sand). The stove must be moistened before the cement is applied, and the cement must not be allowed to dry out for at least three days. A slight crowning to the stove top will allow water to run off to the sides rather than collect on top or in the potholes.

3. Thermal Testing.

A single test for thermal efficiency was conducted during the evaluation, and it was an exploratory test only. The stove was the rural design, on display at the Rural Vocational Training Center at Mansakonko. It had been built November 17, 1961, but had never been fired. Before testing, it was necessary to increase the height of the baffle and to insert a metal chimney, using fresh (moist) sand-clay mixture.

The test roughly simulated a simple cooking process in which 2 liters of water were brought to boiling on each burner and then allowed to simmer. The total percent of heat utilized was 13%, which

compares with 8-10% for the typical open fire. (See Appendix C for data and calculations of percent heat utilized). The first pot came to a boil in 13 minutes, but as the stove became warmer, the second pot heated more and more slowly. At the same time, the stack temperature registered 152°, indicating a significant loss of heat through the chimney. Towards the end of the test, a flat stone was placed over 75% of the chimney hole to reduce the draft, and immediately the heating rate for the second pot more than doubled. The stack temperature dropped to a respectable 76°.

It would be unwise to draw firm conclusions on the basis of a single test, but the strong indication was that the draft on the unmodified stove had been far too strong. It can be reduced by damping the chimney, shortening the chimney, raising the baffle, or partially closing off the entry. In general, if the stove smokes excessively the draft is too weak; if the stack temperature is higher than 100° (or too hot to comfortably hold your hand over it) the draft is too strong.

The problem of draft seems less serious on the urban stoves, where the space between the second pot and its sloping baffle is very restricting. We saw women starting their fires with a cover over the second pothole, but with only the first pot in place. At that time the draft was strong, as it sometimes needs to be when the stove is first warming up. Inserting the second pot then had an appropriate damping effect on the fire. This system is effective only as long as two pots are used for cooking the meal. When only one pot is normally used, as in the preparation of 'benaamin,' the cook should be advised to insert a second pot of water to reduce the draft and conserve fuelwood.

It should be noted in passing that several households had stoves with a firebox under each pot. This is not a fuel-saving design and should be discontinued.

#### IV. SOCIOLOGICAL EVALUATION OF GAMBIAN STOVES.

The observed urban and rural stoves seem suitably adapted to the cooking demands of their users. Rice and stew can be prepared quickly and conveniently and kept warm without burning for considerable lengths of time. However, in many households where there is a stove, an open fire is still used for

- a) space heating during the cool season;
- b) lighting at night;
- c) a social gathering point;
- d) roasting peanuts or manioc;
- e) heating small amounts of water or preparing porridge in pots too small to fit the stove.

These are wood-burning functions for which the "improved woodstove" is not intended. Even in families without stoves, however, most of these functions are performed not by the main cooking fire, but in smaller auxiliary fireplaces.

A large group of people for whom the "sinkirikoto" is unsuitable is the middle-to-low income families living in Banjul, Bakau, and Sere Kunda. Most of them do not own their land and would be unwilling to invest in a stove they could not take with them if they were to move. Many families have so little living space that there is simply not room for a permanent high-rack stove. For these people a more appropriate stove would be something inexpensive and portable, which still heats more efficiently than an open fire.

The simple metal woodstove (Figure 5A) used for years in the Sahel is apparently unknown in The Gambia. Elsewhere it is locally made from scrap metal in a variety of different sizes. In side-by-side tests with an open fire, I have found the typical metal stove in Upper Volta to use 27% less wood in calm weather. Where there is a breeze, the savings are considerably greater. The efficiency can be

even further increased with slight modifications (smaller and better-designed entry, raised collar around the pot as in Figure 5B).

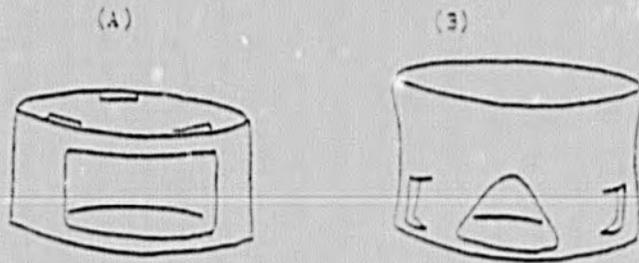


FIGURE 5. A) Typical metal wood-burning stove used throughout Niger, Upper Volta, and Mali. B) Modified metal stove for greater thermal efficiency (redesigned entry, directed side-vents, higher collar to enclose pot). Smokes and combustion gases escape around the pot.

Currently many Gambians are using a metal "coal pot" stove for their cooking. The stove is designed to heat with charcoal, but since charcoal is now unavailable in The Gambia, small pieces of wood are used instead. It seems unlikely that such a system can be any more efficient than the traditional three-stone fireplace.

As part of the Gambian woodstove program, it would be easy to introduce the metal Senegalian woodstove (or a more efficient variant). It is almost certain to find a ready market, and the construction can be done by the same metalmiths who currently turn out the inappropriate coal pots.

In several urban and rural regions there is an implied demand for efficient chimneyless stoves. At the village of Janioria, for example, one woman had in her kitchen both the chimneyless Louga (Senegalese) stove and the regular chimneyed two-pot stove. Despite the thin smoke, she preferred the Louga model because it cooked more rapidly. In Janjul, the leader of the local stovebuilders' association expressed interest in a chimneyless stove because, he said, many families have no kitchen and so their cooking out-of-doors.

The Louga stove (Figure 6) has been successfully promoted in Senegal by the Peace Corps and JERER projects, and it should be

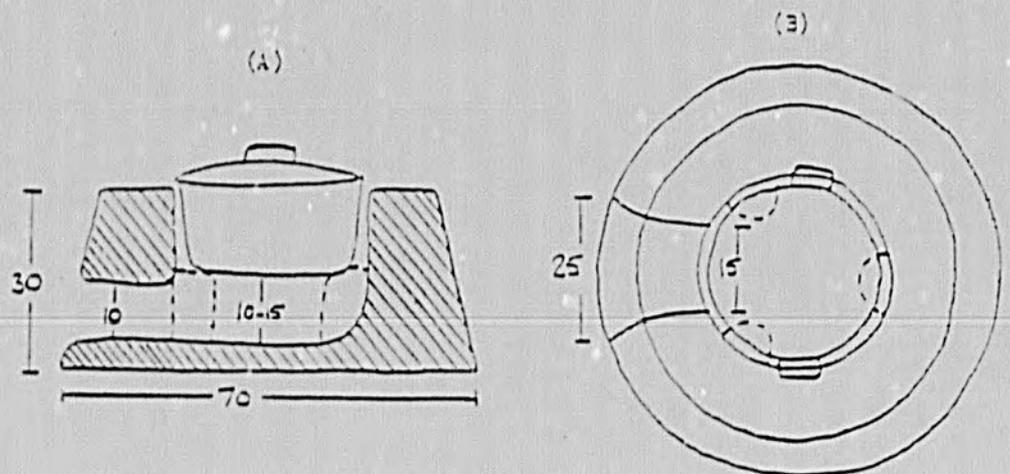


FIGURE 6. Louga stove (Senegal). A) Sagittal section; B) Top view. Dimensions are given in centimeters. From "Improved Cookstoves for Rural Senegal," by Evans et al.; VITA, Mt. Rainier, Maryland. 57pp.

considered also for The Gambian program. Another excellent chimneyless stove is the "Komsilaga" model from Upper Volta (Figure 7). It accommodates two pots at a time and has been shown to cook faster and with greater efficiency than most chimned stoves.

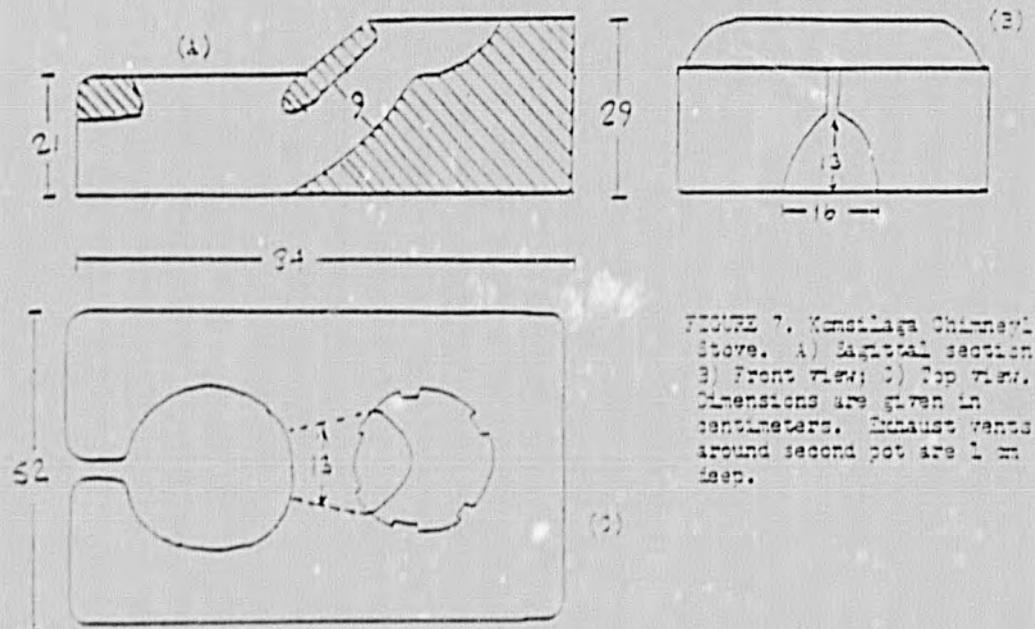


FIGURE 7. Komsilaga Chimneyless Stove. A) Sagittal section; B) Front view; C) Top view. Dimensions are given in centimeters. Exhaust vents around second pot are 1 cm deep.

A. Rural Program.

The stated purpose of the rural program was 1) "...to introduce the wood-conserving stoves in several villages in rural areas" and 2) to evaluate the stoves with respect to acceptability, durability, and efficiency. This is a logical first step to any new woodstove project. While "introducing" stoves, the program trained 112 people in stove-building techniques. Eventually over 400 stoves are reported to have been constructed.

Certain changes were made during the 4-month evolution of the training program. Sessions were lengthened from 3 to 10 days, and the number of participants increased from 6 to 10. In most cases, training in each session was given to both men and women three or villages in an area. In all thirteen sessions the program subsidized the modest cost of materials and provided a daily stipend of 4/50 dalassiss to each trainee.

The trainees we spoke with expressed continued interest in stove-building, but most admitted they had built no new stoves for many months. A number of reasons were given:

- 1) Scarcity and/or cost of materials. In Brinkmanding and Keneta it was said that the source of good clay is not easily accessible. In Walli Junda and Surukung trainees complained of a lack of repair, corrugate, wire, and such tools as shovels and trowels.
- 2) Lack of time. In Brinkana Ba a male trainee said he could no longer make stoves because the women with whom he normally works were all busy in the rice fields.
- 3) Poor compensation. Nearly everywhere we were told that people would not pay either for new stoves or for repairs to old ones. Villagers knew that stoves built during training had been essentially free of charge, and since the trainees had been paid a stipend it was widely assumed they were still on a payroll. One trainee in Bareng said he has resorted to building stoves in Pakalaba, a village which had had no trainees and where people willingly paid 5 dalassiss for his labor.
- 4) Insufficient training. In Jassong trainees felt they needed more training in stove repair, especially to deal with the problem of worm and enlarged potholes.

- 5) Morale. In Baren trainees were discouraged because of the cracks in their stoves which they did not know how to avoid. In Brikama Ba and Brikamanding many stove owners, including trainees themselves, have abandoned their stoves after hearing of a house fire in nearby Wilingara reportedly ignited from a stove chimney.

It was not possible to judge whether most of these concerns reflected genuine obstacles to village stovebuilding or whether they were only excuses for having done so little with their training. In either case, there seems a clear need for more rigorous follow-up to the sessions. Nearly all of the issues brought to our attention could have been resolved long ago. The matters of compensation, house fires, and of the "need" for rebar, for example, should be easily resolved. Perhaps the trainees' greatest need is for continued encouragement and moral support, to have small questions answered and to be reassured on their stove-building techniques.

Frequent follow-up visits to trainees' villages are also essential if the objectives of the program are to be fulfilled. The evaluation of stoves with respect to acceptability, durability, and efficiency is extremely important. Of the 22 stoves examined, 10 had been abandoned for various reasons. Among those still in use, one owner complained that hers was too low, another found too much smoke escaping around the pots. Other stoves were in good condition and being properly used. It is vital that all of these stoves be examined and their owners questioned. Follow-up visits are costly and time-consuming, but a successful long-term project absolutely depends on the quality of feed-back information from the field. Without it, the remarkable achievement of having already built over 400 stoves in rural Gambia pales to insignificance in the long run.

### B. Urban Program.

The urban stove-building program of the Forestry Department arose partly from the unhappiness of urban women over the banning of charcoal production in The Gambia. The introduction of improved wood-burning stoves was intended to "convince women that there is a feasible, clean and economical alternative to the use of charcoal...." Of course, the ultimate objective is to substantially reduce the domestic consumption of firewood in urban areas.

To effectively carry out these objectives, a program was set up to train young men in the construction and repair of the stove model shown in Figure 2. In each of seven urban areas, men were taken through a 21-day training program. Stoves were constructed during the session at deliberately scattered locations throughout the region at the homes of influential people in the community. At the end of the training period, trainees were encouraged to work together in the construction of more stoves. It was expected that the initial stoves would spark a consumer demand and that the men could earn a reasonable wage with their new skills. Altogether in 1982, 121 men were trained and approximately 130 stoves constructed. Seventy-three stoves are said to have been built by the participants after their training, of which over half of these are in the town of Farafenni.

In two-and-a-half days I examined stoves built both during and after the training sessions in the seven urban areas. I discussed the training program with trainees from six of these areas and with the Forestry Department trainer who has worked full-time in the program. The following are my major impressions:

- 1) In most cases the stoves built during the training session are still in good condition, except for the relatively unimportant shedding of the outer cement layer. However, among stoves built after the session by the trainees, over half of those examined are not being used, either because of serious defects or misunderstandings by the owners on how to use them properly.

- 2) In Lamin, Bakau, and Sere Kunda, stove owners claim they have been unable to contact the trainees to answer questions or make needed repairs. In many cases, trainees have apparently left the area or found other employment and are no longer available for stove-building. Had more of the trainees been area residents rather than transients, it is possible this problem of attrition might not have arisen.
- 3) Many trainees feel that stove-building does not offer attractive financial rewards. The two trainees remaining in Sere Kunda work together to build stoves for 40 dalassiss each, from which they each make a profit of 6 dalassiss for five hours of work. In Gunjul I was told the most anyone would pay for a stove is 30 dalassiss, and even that is considered very expensive.
- 4) Trainees have been told to use only clay from rice fields, which is often expensive to transport. The Forestry Department now will supply clay in Banjul, Sere Kunda, and Bakau. Trainees in Gunjul also would like to have their clay provided.
- 5) Except in Gunjul, every stove I saw had been placed in an affluent household. The urban stove program has not reached the urban poor, where the need and potential impact may be greatest.
- 6) It was never clear to me why it takes 21 days to instruct a small group of people in stove construction and repair. Such long sessions represent a considerable investment of time and money - an investment which is lost on the majority of trainees who choose not to build stoves after their training period. An alternative curriculum based on ten days is proposed in Appendix B.
- 7) Once the training session was over, there seems to have been little subsequent contact with the trainees to answer questions and to give support and encouragement. It is probably unrealistic to expect inexperienced trainees to set up a business of stove building and repair without further contact with the Forestry Department trainer.

#### C. Local stove-builders' associations.

After the urban training sessions, trainees are encouraged to work together as an association, with one person chosen as their leader. This is an excellent idea, especially if the group leader can be responsible for:

- 1) Making initial contacts with potential stove owners;
- 2) Purchasing and maintaining a central stock of materials and tools;
- 3) Keeping records on every stove built and repaired;
- 4) Acting as spokesman in communications with program administrators.

The association leader may serve as the local resource person on woodstoves. He might be provided with an attractive sign or plaque for his house indicating local stove headquarters. Stove owners should know they can come here for information or assistance with their stoves. The group leader should himself be an excellent builder of stoves. He should have additional training in stove repair beyond that given in the regular session. He should also be qualified to certify the stove-building skills of others. Finally, the leader must have access to a postal address and/or telephone so he can be easily contacted.

It is important to note that a stove-builders' association should assist and encourage the individual efforts of its members. However, the notion that stoves must be built only by all members together should be discouraged, since it is probably counterproductive.

## VI. ECONOMIC ISSUES

### A. The use of external funding.

As with any new product to be marketed on a large scale, woodstoves will initially require substantial financial backing. This support is needed specifically for:

- 1) evaluating the performance of stoves in actual use so that new models can be modified and improved;
- 2) creating a construction and service network; that is, having trained men and women accessible for building and repairing stoves;
- 3) increasing the demand for efficient woodstoves through creative and effective promotional efforts.

Among these three program components (evaluation, training, and promotion) substantial progress in The Gambia has already been made on the latter two. The training of stove-builders has been the focus of both urban and rural projects. This emphasis should continue, with a program carefully structured to maximize the benefits from this investment. The promotional efforts of the Forestry Department through

a weekly radio program is said to have already increased general awareness about the "sinkirikuto." This promotional activity should be expanded, using radio and other existing channels of communication.

In the area of evaluation there is much room for improvement. Money may fuel a program, but only information from the field can accurately chart its course. Although both the rural and urban programs had planned some follow-up activities, most of them were too little and too late. Major constraints included the lack of available time or personnel and the high cost of transportation. Both of these must be remedied if the programs are to continue.

In The Gambia, program evaluation in the field should be coupled with a modest amount of research and development. A number of program-specific issues inevitably arise which can be resolved only by a well-developed program of research and testing. For example, among questions needing immediate attention are the following:

- 1) Is local banco or termite-mound "clay" suitable substitute for clay from rice fields? If not, can it be made more acceptable by treating with animal dung or other additives?
- 2) Is the strong draft observed in the Mansakonko test stove also found in other stoves built during 1981? If so, how can old stoves be most easily modified and new ones be redesigned to eliminate this problem?
- 3) How can the current stove models be modified to be more cheaply and easily made, perhaps in a shorter time (and therefore less expensively)?

#### B. Can a woodstove project become financially independent?

This question reduces to whether the demand for fuel-efficient cookstoves can be strong enough to support an active market for stove building and repair services. In urban areas particularly the economic issue has paramount importance. Attention should be focussed on

- 1) creating a high, sustained demand for stoves, and
- 2) bringing down the cost within reasonable reach of the average family.

Woodstoves have a natural appeal in The Gambia, where fuel costs are perceived as high and cooking with wood considered messy. But the

"demand" for woodstoves will be expressed only among women who are convinced of its advantages and know how they can obtain one. In most cases, since it is the husband who makes large purchases, it is he that must also be convinced of the stove's benefits and assured that his money will be well spent. Therefore, demand for the "windrikuto" will grow to the extent that the public gains awareness and confidence in this new technology. This trend will be assisted by:

- 1) a growing number of satisfied stove owners who pass the word on to friends, neighbors, and family;
- 2) a large and visible number of persons trained in the construction and repair of efficient cookstoves;
- 3) continuous, creative, and diversified promotional campaigns throughout the country.

Currently, the urban stove model can be bought for 35-40 dalassiss, materials and labor included. In Farafeni a stove costs 30 dalassiss if corrugate is provided. I was told by several people that over half the stove cost is for materials only. For many Gambian families, money does not accumulate, and there are no savings to draw upon to pay 35 dalassiss for a stove. A number of strategies can be devised to make the purchase easier.

- 1) Lower the price by training young teenagers or other people who are willing to accept a net profit of less than 12 dalassiss per stove.
- 2) Find ways to construct the stove more quickly and easily so that one person can build several in one day. For example, offer a low-cost stove that sits directly on the floor rather than on a high base, thus saving not only construction time, but also materials and transport costs.
- 3) Encourage stove builders to offer substantial discounts to families providing their own corrugate, water, sand, or sifted clay, or who participate fully in the actual construction.
- 4) Devise an arrangement that would enable the local stove-builders' association to accept payment for stoves in installments extended over 2-3 months. Such a credit system should be undertaken only in consultation with people experienced with similar programs elsewhere in the region.

It can be expected that as the demand for woodstoves increases, the price may become more acceptable. Many families have already invested 10 dalassis in their pots alone, presumably convinced that the money was well-spent. In one way or another, demand and price of cookstoves will eventually accommodate each other. That point will mark the beginning of financial independence for the woodstove program.

#### C. The question of subsidies.

Project funds should seldom be used to subsidize the cost of private woodstoves. Underwriting the cost of a stove has several drawbacks. First, it creates a false demand, after which the support is difficult to withdraw without wrecking the project. Secondly, any subsidy destroys market forces, blocking the potential diffusion of stoves by entrepreneurs who cannot match the low cost of "project" stoves. Only when used in certain promotional and training activities should subsidies be considered, and then only on a very limited basis.

In the Gambian urban stove project the Forestry Department provides an indirect subsidy to stoves in certain areas by transporting clay from distant rice fields to several central locations. This practice may be justified for the moment in the interest of promoting the woodstove concept and assisting the training program. However, it cannot continue indefinitely. Eventually, either the cost of transporting clay must be included in the price of the stove, or else a more accessible clay substitute must be found.

## VII. ELEMENTS OF PROJECT DESIGN.

Time in The Gambia did not allow an adequate examination of program structure in terms of personnel. I was unable, for example, to meet with the urban "home demonstrator" or the RVTP "home economics trainer." Nor was there an opportunity to study existing extension service networks of government agencies for possible collaborative roles with the woodstove program. The following comments on program design, therefore, are necessarily general.

- 1) Both rural and urban projects each need at least one field agent working full-time to follow up stove-building activities. The field agent should be a woman; she plays a key role in the project and must work closely with the project director. Her job would be to make sure stoves are being properly used, to note problems that women encounter with their stoves, seek ideas on improving stove models, and conduct wood consumption studies to help estimate the amount of wood being saved. Essentially, her role is to ensure that the program is adequately serving the purpose for which it was designed.
- 2) The field agent cannot function without ready and suitable transport. A sturdy two-wheeled vehicle appropriate for sandy roads and trails would be economical and well-suited for the job required.
- 3) Both urban and rural projects need a technical adviser, who may be the same person. This should be someone with experience in experimental design and in handling empirical data, who can work at least half-time on problems related to stove materials, design, and construction.
- 4) Last year, in both urban and rural programs, the project directors, (or team leader) took major responsibility for training. This seems to have worked well, and should be continued. However, in the urban program particularly, the trainers' responsibilities must now include returning to training sites from time to time to ensure the stove-building activities are running smoothly. This additional burden may warrant one or two assistant trainers to help share the work load.

## APPENDIX A: List of Stoves Examined.

<u>Stove No.</u>	<u>Location</u>	<u>Owner</u>	<u>Remarks</u>
1	Lamin	Jammen Kunda	Good condition, normal crack.
2	Lamin	Sukau Joof	Minor radial cracks.
3	Lamin	Yaya Jallow	Baffle had been removed.
4	Lamin	Kassama Kunda	Owner has metal pot adapter.
5	Brikama	Sambou Kinte	Firebox under each pot.
6	Brikama	Bujang Kunda	Firebox under each pot.
7	Brikama	Joof Kunda	2nd pot hole worn, widened.
8	Brikama	Adian Joof	Freestanding, small pots.
9	Brikama	Saderr Ceessay	Interior heat damage.
10	Brikama	Ceessay Kunda	Entry badly broken.
11	Gunjul	Malanding Jammen	Used occasionally.
12	Gunjul	Demba Jammen	Good condition, repaired.
13	Gunjul	Arokey Gibba	Good condition, repaired.
14	Gunjul	Fansu Touray	UNUSED, rain-damaged.
15	Gunjul	Hatab Bojang	UNUSED, repair unfinished.
16	Gunjul	Tako Yanneh	Front badly damaged.
17	Gunjul	Qmar Jop	Good condition, repaired.
18	Banjul	Yamu Corr	Good condition.
19	Banjul	Eai Joof	Two fireboxes, large fires.
20	Banjul	Tam Sir Jange	2nd pot "heats slowly."
21	Banjul	Musa Kolley	Fair condition, large fire.
22	Banjul	Musa Kolley	Uses peanut briquettes.
23	Bakau	Safi Mdure	UNUSED, fear of cracking.
24	Bakau	Bantum Kunda	Used only once/day.
25	Bakau	Joof Kunda	Baffle crumbling, usual crack.
26	Sere Kunda	Touray Kunda	Good condition.
27	Sere Kunda	Jutuyand Sanden	Good condition, well-used.
28	Sere Kunda	Danso Kunda	UNUSED, 2nd pot "doesn't heat."
29	Sere Kunda	Jaith Kunda	UNUSED, poorly repaired.
30	Sere Kunda	Asiatou Colley	Fair condition.
31	Sere Kunda	Bintou Jammen	Used before fully dry.
32	Keneba	Hangila Menten	Poor condition, flue blocked.
33	Keneba	Lei Kunda	Entry saved in, still used.
34	Keneba	Unknown	Entry broken, no chimney.
35	Keneba	Saraba Menten	UNUSED, badly broken.
36	Keneba	Milanding Ceessay	No chimney, flue blocked.
37	Sankorria	Mourouang Kanyi	Entry broken, heat damage.
38	Sankorria	Binta Jallow	Used rarely, prefers lounge.
39	Sankorria	Saidy Kan	UNUSED, says "doesn't work."
40	Jassong	Naba Kanyi	UNUSED, too much smoke.
41	Jassong	Tambong Barrow	UNUSED, poorly repaired.
42	Barang	Naba Kanyi	Entry reinforced w/ corrugated iron.
43	Barang	Mai Jop	Built by RWTP mason.
44	Barang	Wymonding Barco	Entry strong, bridge weak.

<u>Stove No.</u>	<u>Location</u>	<u>Owner</u>	<u>Remarks</u>
45	Sutukung	Bakoto Sora	UNUSED, no apparent reason.
46	Sutukung	Jomma Jawneh	UNUSED, flue partly blocked.
47	Sutukung	Jonsaba Sanneh	UNUSED, never had chimney.
48	Sutukung	Jontan Sanneh	UNUSED, not trainee-built.
49	Sutukung	Mama Danaba	UNUSED, no apparent reason.
50	Sutukung	Dado Dabo	Good condition, seldom used.
51	Walli Kunda	Jommeh Yanneh	Side crack, needs cleaning.
52	Walli Kunda	Dandan Ketta	Good condition, used twice/yr
53	Brikama Ba	Sona Drameh	UNUSED, fear of fire.
-	Brikamanding	- - - -	No stoves seen, fear of fire.
54	Farafenni	Sorry Marong	Restaurant, good condition.
55	Farafenni	Fatou Mata	Good condition, repaired.
56	Farafenni	Mama Dibba	Good condition, owner pleased
57	Farafenni	Julanding Touray	Good condition, repaired.
58	Farafenni	Fanata Sanneh	Good condition, repaired.
59	Farafenni	Mama Sabaly	Poor repair of pothole.
60	Farafenni	Kaddy Marong	Good condition, repaired.
61	Farafenni	Absa Jammeh	Waiting for chimney.

Objectives: To provide young men training that will enable them to

- 1) Construct and repair woodstoves that are structurally sound, convenient to use, and thermally efficient for domestic cooking.
- 2) Advise women on practical aspects of stove use and maintenance.
- 3) Market their own stoves and sell their services to make a reasonable profit and promote the widespread use of efficient cookstoves.

Financial aspects: During the training session, the cost of each stove built will be fixed at 30 dalassiss. Any family receiving a stove during the session will get a 50% discount, paying only 15 dalassiss. An assumed "profit" of 15-20 dalassiss per stove will be divided among the trainees.

Certification: Upon completion of the 8-10 day session, each trainee should satisfactorily demonstrate stove construction, skills and knowledge of basic principles. He is then awarded with an attractive certificate testifying to his having successfully completed the training program.

A certified builder of sinkirikutos may, upon further training, become a certified trainer. Requirements may include:

- 1) building at least ten stoves, including two different models;
- 2) receiving additional instruction on stove repair, testing, and evaluation;
- 3) participation as co-trainer in at least one 8-10 day session.

Proposed curriculum:

Day 1: Prepare sand and clay, make test bricks using different measured proportions, set them aside to dry. Note various wet properties of the different mixtures.

Instruction on basic principles of combustion and stove design.

Day 2: Review and continuation with combustion principles and stove design.

Practical experience in comparing performance of the sinkirikuto with an open fire. This requires access to a previously built and tried stove. Trainees should see for themselves changes in draft and smoke, effects of too much fuel, blocked flues, etc.

Day 3: Trainees divided into two carefully supervised groups, each builds one stove using sand/clay proportions judged best from Day 1 tests.

Days 4-5: The same groups construct more stoves, with less supervision.

Days 6-7: Groups of two trainees each build 2 stoves on which they will be judged for their certification.

Day 8: Trainees assemble to discuss any problems, go over basic dimensions, techniques, precautions on drying, advice to new stove owners, etc. Also on this day, discussion on marketing stoves, drumming up business, remaining accessible for follow-up. Finally, introduction on basic repairs, how to obtain assistance.

Days 9-10. Held at least one month after Day 8 through arrangement with association leader. Basic instruction on normal stove wear and repair, plus any other topics the group wishes to cover.

DATE January 11, 1982STOVE Mansakonko tung banco sinkiroWEATHER Calm, 34°TEST NO. 1

	<u>Start of Test</u>	<u>End of Test</u>
Time	1703 hrs	1749 hrs
Weight, pot A + 2 liters water	3465 grams	2851 gram
Weight, pot B + 2 liters water	3450 grams	3240 grams
Weight of wood	4275 grams	3050 grams
Weight of charcoal	- - - -	132 grams
Water temperature, pot A	32°	100°
Water temperature, pot B	32°	100°

<u>Minutes</u>	<u>Temp pot A</u>	<u>Temp pot B</u>	<u>Minutes</u>	<u>Temp pot A</u>	<u>Temp pot B</u>
2	39	32	24	-	84
4	43	37	26	-	85
6	62	46	28	-	86
8	69	51	30	-	89
10	78	57	32	-	91
12	88	63	34	-	92
14	97	66	36	-	94
16	BOIL	68	38	-	99
18	-	72	40	-	BOIL
20	-	76	42	-	-
22	-	81	44	-	-
			46	-	-

Energy Input:Weight of wood consumed: 1225 grams;  $\times 18$  kJ/g = 22,050 kJWeight of charcoal remaining: 132 grams;  $\times 30$  kJ/g = 3,960 kJ

Total energy input: 19,410 kJ

Energy utilized:

Change in water temperature:  $68^\circ$   $68^\circ$   
 Initial weight of water:  $2$  kg  $2$  kg  
 Energy used to heat water:  $136$  kcal -  $136$  kcal =  $272$  kcal

Weight of water evaporated: 614 grams - 610 grams = 44 grams

Total energy utilized:  $272$  kcal  $\times 4.184$  kJ/kcal =  $1138.048$  kJ  
 $+ 324$  g  $\times 3.26$  kJ/g  
 =  $1000.29$  kJ.

Percent energy utilized:  $1000.29 / 19,410 = 5.15\%$