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UNITED STATES OF AMERICA
AGENCY FOR INTERNATIONAL DEVELOPMENT
EAST AFRICA REGIONAL ECONOMIC DEVELOPMENT SERVICES OFFICE

UNITED STATES POSTAL ADDRESS
NAIROBI (ID)
DEPARTMENT OF STATE
WASHINGTON, D. C. 20520

INTERNATIONAL POSTAL ADDRESS
POST OFFICE BOX 30261
NAIROBI, KENYA

March 30, 1983

Mr. Stanley Dunn
Director
CARE
Khartoum, Sudan

Subject: Grant No.650-0064-G-00-3006, Eastern Refugee Reforestation Project

Dear Mr. Dunn,

Pursuant to authority contained in the Foreign Assistance Act of 1961, as amended, the United States of America, acting through the Agency for International Development (hereinafter referred to as "A.I.D." or "Grantor") hereby grants to Cooperative for American Relief Everywhere (hereinafter referred to as "CARE" or "Grantee") the sum of $4,550,000 to be used in pursuit of objectives set forth in Attachment 2, entitled "Program Description". Attachment 2 describes in considerable detail the reforestation project that CARE will undertake in Eastern Sudan.

This Grant is effective and obligation is made as of the date of this letter and shall apply to commitments made by the Grantee in furtherance of project objectives during a five year period beginning April 4, 1983.

This Grant is made to CARE on the condition that the funds will be administered in accordance with terms and conditions as set forth in Attachment 1, the Schedule, Attachment 2, Project Description, and Attachment 3, Standard Provisions. CARE has agreed to the provisions of the aforementioned attachments.

Please sign the original and three copies of this letter to acknowledge your receipt of the grant and return the original and three copies to me.

Sincerely yours,

James A. Anderson
Grant Officer

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Attachments:

1. Schedule
2. Program Description
3. Standard Provisions

ACKNOWLEDGED:

CARE

BY : Stanley Dunn

TITLE : Director, CARE, Sudan

DATE : 4 April 1983

FISCAL DATA

Appropriation : 72-11X1035

Budget Plan Code : 838-50-650-00-85-31

PIO/T No. : 650-0064-30003

Project No. : 650-0064

Total Amount Granted: $4,550,000

Total Obligated Amount: $4,550,000

IRS Employer Identification Number: 13-1685039

Funding Source: AID/W [X] USAID [ ]

ATTACHMENT 1

Grant No.650-0064-G-00

Sudan Eastern Refugee Reforestation Project

SCHEDULE

A. Purpose of Grant

The purpose of this grant is to provide support for the Reforestation Project to be implemented by CARE. The project is fully described in Attachment 2.

B. Period of Grant

The effective date of this grant is April 4, 1983. The estimated completion date of this grant is April 3, 1988.

C. Amount of Grant and Payment

1. A.I.D. hereby obligates the amount of $4,550,000 for purposes of this grant.

2. Payment shall be made to the Grantee in accordance with procedures set forth in Attachment 3, Standard Provision No. 7A, entitled "Payment - Federal Reserve Letter of Credit (FRLC) advance".

D. Financial Plan

The Financial Plan is set forth in the Attachment 2, Project Description (see pages 19 thru 24A).

E. Reporting and Evaluation

1. CARE shall submit trimesterely financial reports to USAID Sudan. In submitting financial reports CARE shall comply with the requirements of A.I.D. Handbook 13 entitled "Grants". Refer to sub-chapter 1M entitled "Financial Reporting Requirements'

2. CARE shall also submit trimesterly progress reports to USAID Sudan. These reports should contain:

(a) the progress under the Project during the Period;

b) problems encountered (also noting problems which are of a longer-term nature);

c) CARE's proposed solution(s) to the problem(s);

d) identify where A.I.D. assistance is necessary for problem solution;

(e) comment on the entire Project in general and raise actual or potential factors, issues, etc. which coul impinge on the future implementation and direction of this project; and,

(f) provide any other information which USAID Sudan may reasonably request.

F. Special Provisions

The following Standard Provisions are inapplicable and hereby deleted:

5A; 7B; 7C; 10A; 13B; and 13C

G. Overhead Rate

At the time this Grant is made, CARE's approved indirect cost rate is 7.42 per cent of total cost. It is agreed that this will be used for billing purposes (under the FRLC) until such time as the rate is changed by agreement between CARE's New York Headquarters and AID Washington.

H. Title to Property

Title to all property acquired hereunder shall vest in CARE until such time as the project is completed or terminated.

Upon completion or termination of the Project title to all property acquired hereunder shall be transferred to the Government of Sudan.

I. Authorized Geographic Codes

Notwithstanding the fact that procurement of goods and services will exceed $250,000 the following geographic sourc: and order of preference shall apply:

All goods (e.g., equipment, materials, and supplies) an services, the costs of which are to be reimbursed under this grant, and which will be financed with United States dollars shall be purchased in and shipped from only "Special Free World" countries (i.e., AID Geographic Code 935) in accordance with the following order of preference:

(1) the United States (AID Geographic Code 000);

(2) "Selected free World" countries (AID Geographic Code 941)

(3) the cooperating country;

(4) "Special Free World" countries (AID Geographic Code 935);

Application of Order of Preference

When the Grantee procures goods and services from other than U.S. sources, under the order of preference in paragraph (c) above, it shall document its files to justify each such instance. The documentation shall set forth the circumstances surrounding the procurement and shall be based on one or more of the followin reasons, which will be set forth in the Grantee's documentation:

(1) the procurement was of an emergency nature, which would not allow for the delay attendant to soliciting U.S. sources,

(2) the price differential for procurement from U.S. sources exceeded by 50% or more the delivered price from the non-U.S. source.

(3) impelling local political considerations precluded consideration of U.S. sources,

(4) the goods or services were not available from U.S. sources, or

(5) procurement of locally available goods or services, as opposed to procurement of U.S. goods and services, would best promote the objectives of the Foreign Assistance program under the grant.

The Grantee's Procurement System

The Grantee may use its own procurement policies and procedures provided they conform to the geographic source and order of preference requirements of this provision and the standards set forth in paragraph IU of AID Handbook 13, "Grants."

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S U D A N

Eastern Reforestation Project 650-0064

Operational Program Grant Proposal

Country: Sudan

Executing Agency: CARE

Duration of Project: Five years

Starting Date: March 1983

Total OPG Request: $ 4,550,000 (African Refugee Assistance Fun

ATTACHMENT 2
Grant No. 650-0064-G-00-3(

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PROPOSAL FOR A
REFUGEE REFORESTATION PROJECT
IN KASSALA PROVINCE

1. INTRODUCTION

Successive influxes of refugees from four of the Sudan's neighboring countries have resulted in the presence of nearly one-half million refugees on Sudanese territory at present time. By far the greatest number of these refugees came from Ethiopia, the majority of whom has been settled by the Government of the Sudan (GOS) in Kassala Province in Eastern Sudan.

The aim of the GOS is to establish a series of self-sufficient refugee settlements of 5-6,000 inhabitants each. Thus far, twenty-one such settlements have been set up in Kassala Province, with each family allotted 5-10 feddans (1 feddan = .42 hectares) of agricultural land. Assistance in establishing these settlements has been received from the United Nations High Commission for Refugees, the United Nations World Food Program, and various voluntary agencies.

In the last ten years, much of the rainfed arable land of Kassala province has been brought under intensive mechanized cultivation of sorghum (dura). This highly profitable agricultural system has attracted many investors and commercial farmers to seek lease-hold lands from the government. As a result, vast tracts of land have been cleared of all tree and ground cover to facilitate the use of tractors and thus hold cultivation costs to a minimum. Profitable though it might be, productivity on these fragile soils declines rapidly after 4 to 5 years of intensive cropping and the cultivators are forced to abandon the lands and seek new areas for exploitation. Increasing demographic pressure both from refugee influxes in the area and from the very large sizes of the Sudanese agribusiness holdings has made it increasingly difficult to find suitable new areas. This has served to shorten the fallow period in the area and led to a generally lower level of environmental stability in the areas as witnessed by accelerated loss of site productivity on the farms, greater susceptibility to drought conditions, and localized incidences of longer-term desertification. In addition to the perturbing evidence of declining agricultural productivity, the local populace, both refugee and Sudanese, is finding it more difficult to obtain the fuelwood and charcoal with which they have traditionally, and almost universally, met their needs for domestic energy. Building materials and thorn fencing have also become increasingly scarce. Both refugee and low income Sudanese in the area must now travel long distances to collect fuelwood, and thorn fencing material which was once readily available, often must be brought by camel or truck to the villages and settlements.

During the dry months (January-June) lack of animal fodder normally available from trees reaches critical proportions, resulting in high animal mortality and chronic ill-health of the livestock belonging to both Sudanese and refugees. Finally, the paucity of trees in the refugee settlements makes the living environment barren and desolate.

To help ameliorate this situation, the GOS commissioner for Refugees has requested that CARE join with them and the Forestry Department to mount a refugee settlement reforestation project. The aims of this project are manifold. Firstly, it will provide immediate income generation to the refugees by creating employment opportunities associated with a labour intensive tree planting campaign near their settlements. It will improve the lot of both refugee and low income Sudanese farmers by making fuelwood obtainable at sites proximate to their dwellings. It will enable private sector agents to harvest the wood under Forestry Department management thereby stimulating the local economy. Over the long term, the project will set out to demonstrate the potential benefits obtainable through a closer integration of forestry and agriculture in terms of increased availability of wood for domestic energy and enhanced environmental stability leading to sustainable agricultural production in the area. Finally, by providing the Forestry Department with the capability to demonstrate the positive effects of trees on the environment, and to train local residents in their establishment and management, the project will further reinforce the Department's role in fostering and sustaining appropriate land use policy and practice in the semi-arid regions of the country.

In short, forests form the cornerstone of the state of the environment on which the destiny of the land and the people so vitally depend. Their functions are basic and indispensable. They provide essential needs; fuel, fodder, shelter and the means to a livelihood to the populace; they mine the deeper layers of the soil to translocate plant nutrients to the topsoil; through their leaf fall they add organic matter necessary for moisture retention in the surface layers of the agricultural field; they provide shelter against the dessicating winds and moderate the extremes of harsh climate in this semi-arid area. The lands of Kassala Province, indeed of all of the semi-arid zone of the Sudan, can be fertile and productive with rationally managed and utilized tree cover, or barren and sterile without it. Unless affirmative measures are soon initiated, and ample demonstration effect achieved, convincing farmer and policy-maker alike of the soundness of a closer integration of forestry and agriculture in the semi-arid areas of the country, little will remain except extensive tracts of land requiring costly and difficult rehabilitation to bring them back to productivity and halt the unrelenting forces of desertification.

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II. PROJECT DESIGN

A. Statement of the Problem:

Intensive mechanized cultivation of sorghum in Kassala Province, combined with large refugee influxes have led to an almost complete deforestation of a region that was not long ago, an important supplier of fuelwood and charcoal for the country. This situation, if allowed to continue unchecked, will lead to destruction of the environment and natural resources upon which the population depends for its livelihood and existence.

1. The diminishing availability of firewood, charcoal and construction wood:

Fuel and construction wood, a renewable resource that has been plentiful in the past, is generally taken for granted. If managed correctly, and if replanted in heavy-use areas, this resource can sustain an increasing demand which would mean a higher standard of living for the population. Given the current trend in the Sudan, however, this resource will gradually disappear until people in the area are forced to reduce their standard of living or move away. In extreme cases, the denuded land will be ruined byond its ability to reconstitute itself.

The gravity of the situation in the Sudan cannot be overstated. Ten years ago, Kassala Province produced fuelwood and charcoal for its own use and for delivery to other regions of the country. As mechanized cultivation led to denuding of the area, charcoal production shifted South and to other areas of the country. Villagers in the Gedaref District of Kassala Province (target area for this project) who for years took for granted the ready availability of free fuelwood and fodder at short distances from their homes, now find themselves obliged to travel 4-6 hours by camel and donkey to secure a week's supply. Many members of the population have been forced into cash procurement of fuelwood further straining their fragile hold on domestic economic stability. The arrival of large numbers of Ethiopian refugees in the area has further exacerbated the demands for these vital commodities.

It is clear that a crisis in fuelwood is developing for the inhabitants of Kassala Province and for those of other regions of the country which were formerly dependent on the production and supply from the area. Large-scale substitiution of fuelwood for domestic energy is unlikely in the near future due to total national dependance on imported petroleum and an increasing foreign deficit with which to purchase such products. With a decline in the availability of fuelwood, rural dwellers are using agricultural residues for cooking, thereby short-circuiting the return of organic matter to the soil either directly or through animal wastes.

Fodder from residues or from trees and brush cover has become more difficult to obtain and villagers must spend increasing amounts of time and energy to secure food for their animals, as well as for fencing and construction material required on their farms.

2. Ecological Equilibrium.

A second critical element of the problem has already been alluded to: the deterioration of the environment. This phenomenon is acknowledged almost universally by both Sudanese and foreign visitors alike. Although its causes are numerous and complex, principal among them is the rampant growth of mechanized agriculture in Kassala, coupled with the demographic growth and concomitant demand for fuelwood and charcoal in the region. The increased demand for these items resulting from the large influx of refugees into the region has certainly compounded the problem. These circumstances have placed monumental pressure on the environement as a result of:

a. Tremendous expansion of the amount of land under mechanized cultivation, with the resultant uprooting of trees and land cover to facilitate tractor utilization;

b. Overgrazing by herds and flocks whose numbers have increased with demographic increases;

c. Unmanaged destruction of woody species for firewood and other domestic purposes.

Given the pressure to produce more food crops, and the rewards from doing so, it is unlikely that, without outside assistance and strong intervention by the GOS, the already limited resources of Kassala Province can continue to sustain sorghum production in its present form. Without a campaign aimed at increasing the tree and brush cover across the landscape, the situation can only worsen. What is required for the long term is a sound land use policy directed by the government, implemented by the people, and in the case of the needs for reforestation, guided and serviced by the Forestry Department. Shelter belts, intensified bush/tree fallow, agroforestry and agrisilviculture, fast-growing fuelwood plantations, reserve and protection forests, are all promising ingredients to an integrated agriculture and forestry system which can sustain both agricultural and forestry productivity and maintain the environmental stability on which human survival depends in these semi-arid regions. This project is intended as the beginning of this process in Gedaref District, and reflects both government policy and practice underway in other threatened areas of the Sudan. If the project can demonstrate the potential for solutions to the problems, it will make an important step in the right direction.

B. Final Goals:

The Final Goals of this project are two-fold. The simplest to state clearly, to achieve, and to measure will be to improve the quality of life and environment of more than 40,000 refugees and rural Sudanese living in Gedaref District of Kassala Province within five years of project completion.

The more difficult to achieve will be the introduction, and acceptance by rural farmers, both refugee and Sudanese, of the practice of integrating argiculture, forestry, and animal husbandry so as to maximize overall land productivity on a sustained basis, and to maintain the environmental stablility upon which production and producers depend.

C. Intermediate Goals:

In pursuing the above mentioned long-term final goals, the project will bring its resources and efforts to bear in furthering more specific intermediate goals. These will include:

- generating income earning employment opportunities over the life of the project for the rural population, particularly the refugee groups;

- demonstrating through physical achievement of planting targets integrated into the agricultural production system, the real potential of forestry support for agriculture in the area;

- providing a proximate source of badly needed fuelwood fodder, fencing and domestic construction materials for both refugee and Sudanese populations in the area;

- establisling a base for training of local villagers and Forestry Department field staff in the proper integration of agriculture and forestry in semi-arid conditions;

- enhancing the institutional capacity of the Forestry Department to guide and service the demands for sound natural resources management;

- creating further income generation possibilities from the production and sale of wood products; and

- enhancing the rural living environment through the addition of tree shade, reduced wind and water erosion and general protection from the harsh climate.

D. Project Activity Targets:

In order to achieve the specified goals, four major types of activities will be undertaken. These will be:

1. Establishment of Nurseries and production of tree seedlings
2. Plantation establishment and maintenance.
3. Training and extension in community and agroforestry.
4. Management and harvesting of established plantations.

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1. Establishment of Nurseries and Seedling Production:

Two central nurseries will be established: one at Showak and one at Abu Rakham. These will provide seedlings for the proposed woodlot plantations, for the farmers encouraged by the extension program to plant shelterbelts, windbreaks, and private woodlots, and for refugee and village settlements to provide shade trees. Each nursery will be on five feddans of land. That at Showak will be on the bank of the Atbara river and irrigated therefrom, while that at Abu Rakham will be sited on the Rahad Scheme canal for irrigation. The two nurseries will also serve as focal points for the extension program. It is felt that establishment of additional nurseries, while possibly providing savings by reducing transport costs, would involve additional foreign exchange capital costs, and would be beyond the ability of the Forestry Department to maintain and operate after the life of the project. Nursery construction will begin in May 1983 and will be completed by December 1983. This will include fencing, pump installation, and construction of warehouse, toolshed, and guardhouse.

Seedling production will be phased according to the requirements for planting of woodlots, shelterbelts, windbreaks, and shade trees. At inception, major production will be for woodlot plantations, but additional plants will be produced for distribution to interested farmers, both refugee and Sudanese, who will be encouraged to undertake planting on their own. As the extension program develops and gains momentum, it is envisaged that seedling production for agroforestry efforts will increase accordingly.

The following table gives a summary of seedling production at each of the two nurseries over the life of the project. It is intended principally as a planning guide, and a certain latitude in seedling production must be assumed due to the unknown extent of the effects of the extension efforts.

Nursery Production (numbers of seedlings)

Year	1	2	3	4	5
Nursery					
Showak	0	300,000	500,000	500,000	500,000
Abu Rakham	0	300,000	500,000	500,000	500,000
Total	0	600,000	1,000,000	1,000,000	1,000,000

In addition to raising and distributing over three million seedlings during the life of the project, the nurseries are expected to serve as

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focal points for demonstrating the possibilities and potential of tree planting in the area. Accordingly, extension programs will be organized at each nursery site, and promotion and training exercises carried out there throughout the project and hopefully thereafter. Success in this extension aspect of the project will create a genuine interest in tree planting and a consequent demand for seedlings which will encourage the Forestry Department to continue to maintain and operate the nurseries beyond the life of this project.

2. Plantation Establishment and Maintenance:

The target of this project will be to bring 10,000 feddans under tree cultivation during five years. Of this amount, it is tentatively estimated that some 6,000 feddans will consist of block fuelwood plantations, proximate to the refugee settlements. The remainder of the target will be shelterbelt, agrisilviculture, and village woodlot plantings on privately held lands. It must be emphasized that these targets are tentative and flexible, and the actual mixture of plantings will depend in large part upon the success of the extension efforts in encouraging farmers and villagers to embrace agro-forestry techniques by demonstrating their economic value and impact. The following projected planting targets, therefore, should be viewed not as rigid planning targets, but rather as indicative margins under which the project will be implemented. They may, indeed they will, be subject to change as the dictates of field experience indicate.

Plantation Targets (in feddans)

Year	1		2		3		4		5	
Site	FP	SB/AS	FP	SB/AS	FP	SB/AS	FP	SB/AS	FP	SB/AS
Um Gargur		0	500	50		150	500	300	500	300
Karkora		0		50	500	150		300	500	300
Wad Awad		0	500	50		150	500	300	500	300
Abu Rakham		0		50	500	150		300	500	300
Tenebda		0		50	500	150	500	300		300
TOTAL		0	1000	250	1500	750	1500	1500	2000	1500

Note: FP - fuelwood plantations planted in block form
SB/AS - Shelterbelt plantings/Agrisilviculture. The former are rows of five wide trees planted perpendicular to prevailing winds; the latter are plantings carried out on farm lands in the last year before they are left for fallow. Both expressed in total areas planted.

As can be seen from the above, it is tentatively planned to establish tree plantings of various types on 10,000 feddans of land during the life of the project. All three types of plantings will produce fuelwood, although different management systems will be used and therefore different yields may be expected from each. The following is a graphic calender of activities through a typical annual cycle.

NURSERY/PLANTATION CALENDAR

Activity \ Month	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Nursery seedling production	←					→						
Site Preparation					←	→						
Pit digging						←	→					
Prepositioning * of seedlings						←	→					
Pre-planting * cultivation							←	→				
Planting							←	→				
Supplementary * watering							←		→			
Weeding								←	→			
Seedling * live fence							←		→			
Maintenance *												

Note:* indicates activity will be carried out as required.

3. Training and Extens[illegible] in Community and Agro-Forestry:

In order to complement and make optimum use of the physical demonstration to be achieved through tree planting, the project will undertake modest but well-rounded training and extension programs. In the first and second years of the project, professional and technical personnel will participate in training courses organized at Gedaref, to fully acquaint them with the policy issues, goals, activities, techniques, targets, and possible problems of the project. Regular monthly meetings of the project staff and frequent field visits by the project managers will help to mould the staff into a motivated, field-oriented team, able to respond to the changes, problems, and opportunities which the project encounters.

Agricultural production objectives of the project would be strengthened by efforts to build closer institutional cooperation between forestry and agricultural extension services. Extension training activities supported by the project should include agricultural extension service staff where possible, as well as forestry service staff, as a means of strengthening such cooperation.

Short worker training courses for both nursery and plantation workers will be organized by the project staff, in order to ensure that optimum nursery stock is raised, and that losses from transporting and transplanting seedlings are kept to a minimum. In addition, these courses will be used to explain the broader aspects of the project goals and activities, thereby serving as extension courses for the laborers, who are in fact farmers, and making them spokesmen for project activities.

It would be both premature and presumptuous to assume that a full-fledged extension campaign aimed at motivating refugee and Sudanese farmers to engage in woodlot and agro-forestry activities can be detailed at this time. Only one or two years of field level experience working with the local populace can determine the shape and methodology of such a program. The approach in the early years will center around tangible incentives to refugees and farmers. These will be in the form of provision of shade tree seedlings for their homes, fruit tree seedlings for planting in their compounds and irrigated with waste water, school programs for improving school compounds and educating school children in planting techniques, etc.

As fuelwood plantations are successfully established, the pace of the extension program will expand and quicken. Utilizing the demonstration effect of the woodlots, village meetings with farmers and refugees will be organized and addressed by project staff.
The use of visual presentations such as puppet shows will be tried. Liason with FAO extension experts should also help in formulating a workable extension and education program. The burden of devising and implementing this aspect of the project will fall almost completely upon the project staff, and it is hoped that after their initial experience with refugees and farmers in establishing the fuelwood plantations, they will be in an excellent position to design a workable and effective extension effort.

In summary, the extension program must be flexible. It will be action and incentive oriented, rather than merely promotional. Once demonstration plantings provide evidence of the value of fuelwood and agro-forestry activities, farmers and refugees may be expected to conclude that tree planting is an economically sound proposition. With the existence of the nurseries and their continued ability to provide seedlings for these activities, it is hoped that the land put under forestry and agro-forestry programs will far exceed the modest targets which this project aims to achieve.

4. Management and Harvesting of Forest Products:

While the fuelwood plantations will only reach production after the project has reached completion, something must be said about the formal arrangements for management of these woodlots. Production has been conservatively estimated at 10 cubic meters standing volume per feddan in the seventh year after planting. The woodlots will be managed by the Forestry Department, and fuelwood licenses granted on a tender basis, with opportunities to bid offered to both refugees and Sudanese alike. Proceeds from sale of licenses will be used to support continuation of the program by the Forestry Department. Shelter belts and agrisilviculture plantings will be managed somewhat differently, since in the case of woodlots sustained fuelwood production is presumed, while for shelter belts harvesting is necessarily more selective and spread out to maintain the protective function. Agrisilviculture plots, when used as improved tree-fallow, may be clearfelled and the land returned to agriculture. Both of these activities will produce fuelwood and charcoal for domestic use and off-site sale by the farmers.

E. Technical Considerations:

Nursery and plantation technique has been described above to some degree. These will be further refined by the Project Manager, Co-Manager and the Silviculturalist who will prepare a detailed work plan at the beginning of the Project, annual working plans, a nursery production manual and a plantation work guide.

Species will be chosen for appropriateness as fuel and charcoal producers, palatability as fodder, and for construction and shade tree uses. They will also be selected according to suitability for integration with agriculture. Considerable experience has already been gained by the Forestry Department in the Sudan and species may be expected to include the following:

Acacia Seyal (Talh): This the predominant species in the Kassala Province. It provides wood of high caloric value, and its seed pods provide good fodder for livestock. This will be the predominant species produced by the nurseries and used at the plantations.

Azadirachta Indica (Neem): Neem provides a good fuelwood, in addition to being an excellent and fast-growing shade tree. Its wood can be used for construction purposes provided the bark is removed to avoid damage from borers.

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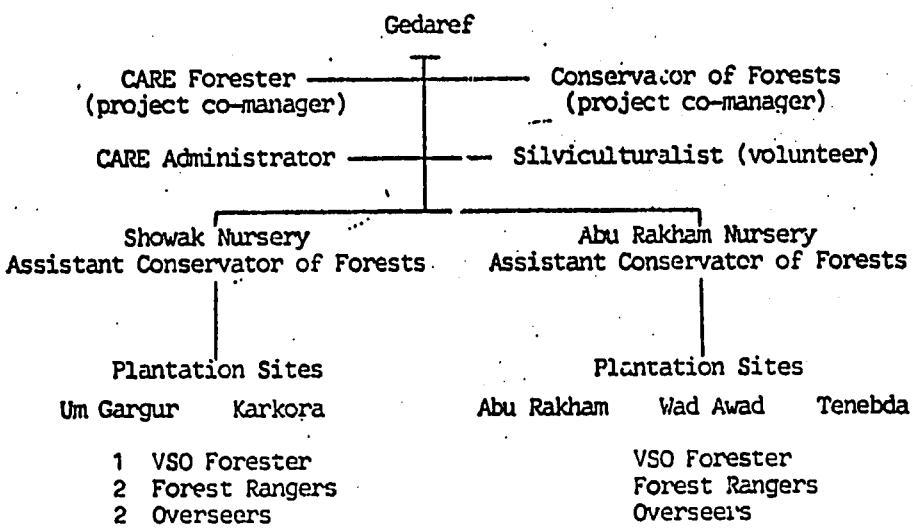
Acacia Senegal (Hashab): This is a well known species in the country producing gum Arabic and often employed for interplanting in the fields throughout the country. It is a palatable forage/fodder species and produces good fuelwood and charcoal.

Other species to be emplcyed include Acacia Mellifera and Acacia Nubica (for live fences) and mango and guava (as fruit trees). Further trials and small demonstration plots of well-known arid known species may be experimented in the course of the Project upon recommendation of the Forestry Department.

F. Personnel Requirements:

Management and administrative responsibility will be shared by a CARE representative and the GOS Conservator of Forests for the Gedaref District, both posted in Gedaref. As co-project managers they will be responsible for overall policy and implementation of the project. A Peace Corps or VSO silviculturalist also posted in Gedaref will provide technical guidance to the project. There will be an Assistant Conservator of Forests and his counterpart, a VSO Forester, assigned to each of the two project areas. Each project nursery/plantation area will have two Forest Oversees/Rangers assigned to plantation protection and extension activities, and a Nursery Supervisor. A CARE international staff member will provide administrative support in the project area, liason with GOS officials in Khartoum, and back-up support for the project co-managers.

Personnel Organization



The use of PCVs as foresters at the plantation sites was initially considered. However, due to the considerably shorter lead time required for recruitment of VSO volunteers and the fact that a well-developed VSO administrative support structure exists in Sudan, it is planned that the first volunteers will be VSO's. There will be consideration of replacing VSO's with USPCV's in year 3 of the project. The silviculturalist volunteer, however, will be requested on individual placement from US Peace Corps.

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The following is a description of the role which consultants will play in project design, implementation, and evaluation.

1) Rural Sociologist (5 months)

This consultant will arrive in June 1983, and will spend six months gathering baseline information on both refugee and Sudanese populations in the project area. Information will include economic activities (income, occupation, labor calendar), demographic data (total population, family size and structure, distribution), land use data (farm size, cropping patterns, crop yields, seasonal employment), and short and long term expectations for change in employment patterns, and of refugees for repatriation. Utilizing this information, the consultant will analyze the implications of the project design, with special emphasis on the integration of agriculture and forestry, and possible means and incentives to be used to stimulate farmer participation in the project.

As land tenure systems are a critical variable in the long-term sustainability of forestry and fuelwood production, the major tenure systems in the project area will be examined.

2) Forestry Extension Specialist (4 months)

The consultant will arrive in early November 1983, in order to have a two-month overlap with the Rural Sociologist. His objective will be to work with the project staff, utilizing the data and analyses of the sociologist, to formulate the forestry extension program. This will include extension agent guidelines, presentational materials and methodology, and the setting up of training programs for project extension agents.

3) Agronomist (2 months)

Arriving in March 1984, the consultant will study soil and climatic characteristics, domestic food consumption habits, agronomic techniques, and off-farm market potential, with a view to recommending species of fruit and fodder trees, and annual crops, that can be successfully grown in agro-forestry systems in the project area.

4) Evaluation (2 persons, 1 month in year 3; 2 persons, 2 months in year 5)

A mid-term evaluation will be carried out in December 1985, in conjunction with GOS, CARE, and USAID representatives, in order to examine the progress of the project. Attention will be given to the level of refugee participation and support, success of the fuelwood plantations, success of the extension efforts in agro-forestry, and the need and potential for adjustments in project strategy. The study will include examination of the effectiveness of the project in delivering extension services, monitoring and reporting, and follow-up support, and will recommend changes where required.

A final project evaluation will take place in November-December 1987. The same procedure used in the mid-term evaluation will be repeated. The study team will also address the question of the need for, and desireability of continuation and/or expansion of outside support for Forestry Department activities in the area. The evaluation will also address the lessons learned from the project activities, as well as the policy and management options available to the GOS for future activities.

As the project contains several untested project elements and may require some adjustments during implementation, project personnel will devise a project monitoring mechanism which periodically provides data related to the progress of major project issues, critical assumptions, objectives, and outputs. Mission and CARE are expected to define the monitoring system and salient points to be covered by the system which will be reviewed during project evaluations.

G. Implementation Schedule:

The following is a tentative implementation schedule for the project activities. Since years 3-5 (1985-87) will be repetitions of the initial two years, only additional activities have been noted for those years.

1983	
Feb.	signature of USAID-CARE OPG agreement signature of GOS-CARE agreement
March	arrival of international staff
June - Dec.	construction of nurseries at Showak and Abu Rakham baseline survey by rural sociologist and extension expert.
1984	
Jan. - June	nursery preparation and seedling production fencing of two 500 feddan woodlot plantations site preparation at woodlot plantations extension activities
June - July	pre-positioning of seedlings
July - Sept.	transplanting of seedlings; supplementary watering if needed.
Sept. - Oct.	maintenance and seeding of live fencing
1985	(repeat of 1984 activities)
Jan. - June	extension activities
Dec.	mid-term evaluation
1986	(repeat of 1985 activities)
1987	(repeat of 1986 activities)
Dec.	final evaluation of project.

III. PROJECT OVERVIEW:

A. PROJECT DEVELOPMENT:

The project was developed in response to the fuelwood shortage and deteriorating ecological conditions in eastern Sudan. While certainly not uniquely due to the influx of some 400,000 refugees from Ethiopia during the past decade, the existing problem was worsened by their arrival, and it has added to the burdens of their situation.

In response to this need, CARE-Sudan and the GOS Forestry Department prepared an initial project proposal during mid - 1981. After review, CARE-Sudan prepared a revised and condensed project profile in April, 1982. This was presented to the U.S. State Department RP team during their visit two months later, who approved the project in principal and urged CARE-Sudan to prepare a complete project proposal.

The project proposal was submitted to CARE Headquarters and AID/Sudan in July 1982, after a consultancy by ex-CARE Forester Michael McGahuey. The proposal addressed certain issues raised by CARE Headquarters and additional issues raised by AID/Sudan were addressed by follow-up correspondence.

However, in the light of further issues raised by CARE, AID/REDSO and AID/W, a team of three foresters, one from each unit, visited Sudan during November, 1982. The result of this consultancy, it is believed, addresses the remaining issues through the present proposal.

It should be noted that during all phases of the project design, CARE-Sudan has been in close contact and agreement with GOS Forestry Department, GOS Refugee Commissioner and UNHCR. In addition, extensive visits have been made to refugee and Sudanese villages, where inhabitants indicated their willingness to support a reforestation project.

B. PROJECT STRATEGY:

The project complements the policies and strategies of both GOS agencies and external donors with regard to reforestation activities as wel as refugee settlements. To the knowledge of the project designers, it does not conflict with or duplicate any ongoing or planned activity in the proje area. The following more specifically delineates GOS and other donor policies, strategies and activities.

1. GOS Strategy:

Until recently the basic philosophy of the GOS has been to conserve forest resources. This has resulted in a defensive posture by the Forestry Administration which is often in direct conflict with and unable to react to competing demands for Sudan's land resources. However, this posture recently has begun to change. For example, in August, 1982 the

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National Energy Agency in a widely circulated draft Energy Assessment, recommended integrating incorporation of trees into farming systems. Earlier the GOS Ministry of Natural Resources had promulgated a policy of retaining a portion of agricultural land for tree production. In the Northern province, occupied mostly by small holder farmers, this policy has been codified to require that 5 percent of cultivated land be set aside for tree growing. Shelterbelts or wind breaks and agroforestry are the most feasible and least obtrusive means of realizing this objective.

In the eastern region the GOS has three main objectives for the forestry sector. These are planting of trees for wood production along the Rahad River, halting the process of desertification that is taking place in large areas, and large scale planting of Acacia Senegal for provision of firewood, fodder and gum arabic. This project is clearly integrated with the first two objectives, and Acacia Senegal will be a principal species planted along with Acacia Seyal, both of which are suited to the project site and supply gum arabic and fuelwood production.

The GOS policy toward refugees is based on volutary repatriation whenever that becomes possible. Until such time, however, the GOS will host the refugees and help them strive toward economic self-sufficiency. In agricultural based settlements, this translates into maintaining land productivity and proximate, sustained-yield fuelwood supplies. The GOS has urged donor governments, intergovernmental, and voluntary organizations to provide special support for development programs in major refugee - affected areas.

2. Other Donor Programs:

a. UNSO Gum Belt Reforestation:

This project has established a successful model for smallholder agroforestry in the central gum belt region. In 1982 approximately 1.5 million Acacia Senegal seedlings will be distributed in the North Kordofan province. Although this model can not be replicated in the Eastern province because of its incompatibility with mechanized agriculture, it does demonstrate the GOS commitment to agroforestry systems.

b. USAID Energy Strategy:

In July 1982, USAID prepared a report on Bioenergy for the Sudan which recommended that a massive tree planting program should be a high priority for the GOS. The report also stated that the efforts of the Forestry Department to formulate programs to meet present and future firewood needs deserve support. An AID/Sudan energy project has begun which will assist the GOS in meeting national demands for energy.

c. UNHCR:

UNHCR is providing assistance to the refugee settlements in the project area in the form of tractors and other agricultural implements, water supply, etc. The reforestation effort will complement their activities by enhancing the prospects for refugee self-sufficiency.

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3. Related CARE Projects:

Development of a CARE project is underway to institute dissemination of fuel efficient wood/charcoal stoves in North Kordofan province. When an acceptable stove design is found and feasibility of local construction and dissemination is demonstrated, the Refugee Reforestation project will incorporate fuel efficient stoves into its forestry extension program.

C. PROJECT IMPACT:

1. Employment Generation:

The project will directly generate 423,000 person-days of labor in nursery and plantation activities. This is equivalent to $ 933,600 in 1982 dollars or 20% of the total project cost (including inflation). It is expected that the majority of the nursery and plantation staff will be refugees because of the proximity of the project sites to their camps.

In addition there are unquantitied direct employment benefits for the target group arising from construction of project buildings and incidental labor. There will also be a significant generation of employment in harvesting and marketing of wood and forest products, although this will not occur during the project life.

2. Fuelwood Production:

It is estimated that rural Sudanese burn between 1.0 and 1.5 m^3 of wood per person per year. At a conservative estimate of 4 m^3/ha/yr sustained yield of fuelwood on project plantations, the project will be able to supply 15,200 m^3 of fuelwood per year. With an estimated population of 15,000 in the targetted refugee camps, the project will be able to meet their basic fuelwood requirements. As there are some stands of natural forest which can produce 1-2 m^3/ha/yr and are accessible to the refugee and neighboring Sudanese population, the project will be able to make a significant contribution to the fuelwood needs of a much larger population.

3. Agricultural Productivity:

The project will introduce shelterbelts and agroforestry practices in the eastern region. Evaluation of CARE's shelterbelt project in Niger indicated that there was an increase of 23% in sorghum production over unprotected fields after allowing for a 6% reduction in cultivated land due to the windbreak lines. In addition it may be possible that windbreaks and agroforestry will allow cultivation for longer periods before fallowing. It may be possible to achieve a 33% increase, equivalent to an additional year of production during a typical cropping cycle.

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Some farmers have voiced concerns that trees will attract birds with a resultant crop loss. This has not been CARE's experience in Niger nor did it seem to be a problem with those farmers in the Gedaref region whose fields were close to natural forests. Indeed, it is hard to imagine that flocking birds, which would cause the only significant crop loss, would not travel considerable distances to reach a feeding grounds. Thus even though trees are proximate to cultivated fields, there should be little increase in crop loss.

4. Other Forest Products:

The reforestation accomplished during the project will generate positive impacts resulting from production of fodder, thorns for fencing, domestic construction wood, fruit, and gum arabic.

a. Fodder:

Many of the refugees brought their livestock to Sudan. Because of fodder scarcity these animals have not fared well. One farmer reported he had lost his entire herd of 180 sheep. Around Um Gargur their are numerous animal skeletons. The project will utilize species that provide nutritious fodder that can be used as a drought reserve.

b. Thorns:

Rural homes, both refugee and Sudanese, utililize thorn fences to restrict animal ingress and egress, i.e., to keep their neighbors animals out of their compound and to pen their own livestock at night.

These fences require considerable quantities of thorns to build and maintain. An additional burden is added to rural life by the long walks required to gather thorns. The project will have a positive impact by providing proximate sources of thorns and seeds that can be used for planting live fences.

c. Construction Wood:

The project will have another positive impact by providing larger dimension stock for use in building homes, donkey carts, furniture, etc. Demand of this size wood is high as it is preferred for charcoal production. The project will help ensure a supply proximate to the beneficiary group, thus reducing the cost of obtaining this wood and increasing the likelihood of their access to the supply.

d. Fruit:

The project will supply a small number of fruit seedlings to refugees for planting in their compounds. They can be irrigated with

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domestic waste water and fertilized with manure. The fruit will provide diversity to the rural diet and a greatly needed source of nutrition particularly vitamins.

e. Gum Arabic:

Both A. senegal and A. seyal produce the valuable gum arabic. This was once a major export crop of the Sudan and is becoming so again. It is estimated that one A. senegal tree can produce 125 gm of gum per year from years 5 through 25 when it can be cut for wood. The optimum spacing for mature gum trees is 6-8 m which would allow thinning of trees for fuelwood production.

5. Rural Living Environment:

Shade trees planted around compounds, market places, clinics, schools and along paths and roads provide a welcome relief from the sun. Though the impact cannot be quantified, it is real and significant. Currently there are literally no shade trees in refugee villages and only a few in the Sudanese villages. This component of the project will foster good will of the beneficiaries toward project officials, instill a further appreciation of trees. and provide knowledge about the feasibility and means of tree planting and maintenance.

6. Women:

The project will benefit women by providing proximate sources of fuelwood, thus freeing them for other domestic tasks and/or income generating employment. It is expected that a considerable number of women will be employed in nursery and plantation labor. A further benefit to women will arise from the dissemination of fuel efficient cook stoves, which save labor in gathering fuelwood and/or cash and smoke less, a relief to cooks.

7. Institutional Strengthening:

The project will have a significant but unquantifiable positive impact on the effectiveness of the Forestry Department. Personnel will be better trained, better equipped, and have a newly defined, supportive relationship with the rural people of Kassala province. It is interesting to note that in the recent NEA Energy Assessment one of the most widely mentioned institutional benefits of the UNSO gum belt project was the provision of vehicles and fuel that enabled the Forestry Department to fulfill their mandate. The result of these changes will be increased prestige and improved moral of Department personnel. This should manifest itself in greater willingness to continue and to expand community reforestation and agroforestry initiatives.

D. PROJECT CONTINUITY:

Depending on the level of farmer acceptance of tree planting, and the socio-economic success of the reforestation models, the Forestry Department will hopefully continue operation of the project nurseries when external funding ceases.

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In the seventh year after project initiation, benefits from the harvest of fuelwood will begin to accrue. Experience in other community reforestation efforts have shown that farmers and villagers are more willing to pay for seedlings at this point. This could make the nurseries self-reliant. It is uncertain whether one can expect refugees at this time to make long-term investments such as the purchase and planting of seedlings as long as they retain hope of repatriation. However, in Showak and Abu Rakham there are sizeable Sudanese populations which could sustain these nurseries in the absence of refugees.

The recurrent costs of forest block plantations will be minimal after five years. Principal costs are associated with protection and maintenance of younger stands and the Forestry Department should have no problem absorbing this activity. While it is difficult to estimate the recurrent costs associated with shelterbelts and agroforestry plantations, the costs of their maintenance and protection are absorbed by farmer, thus the cost to the GOS will be only those of maintaining the nurseries. Plantations will have significant costs associated with harvesting but these will be more than covered from the proceeds of the harvest.

E. PROJECT POTENTIAL:

It has been discussed in detail above that the project will develop models for incorporating trees into the agricultural systems of the eastern region. These models must be both socially appropriate and economically feasible. As such the potential for project replication is good.

However, the project is designed to demonstrate the compatability of trees with agriculture. Beyond the target villages it does not foresee a widespread extension program. To do this, a follow-up project would be required. However, if successful models are developed, it is reasonable to expect that financing could be found for an expanded reforestation program.

F. PROJECT CONSTRAINTS:

1. Land Availability:

Reforestation programs have often meant the loss of farmland or pasture land and unfavorable reaction to this can be a project constraint. In the Sudan, the government in effect controls all land which, in the project area, it leases in turn to farmers. The government has already agreed to make enough land available to carry out the project. More important than this, however, is the project approach which will seek ways to integrate trees and agriculture and reduce the competition for land.

2. Labor Availability:

The project will utilize considerable numbers of refugees and Sudanese laborers, and labor availability could be a project constraint. The project employment calendar, however, complements the agricultural labor

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needs by providing considerable employment during the dry season when unemployment is highest. The project's peak labor requirements are for planting which does not compete significantly with the mechanized agriculture practised in the region.

Salaries to be paid by the project are in line with those paid in the area. In addition, as local refugee officials have pointed out, employment with the project will be much closer to the homes of the laborers and therefore more attractive than work on agricultural schemes far from their villages. Interviews with villagers have confirmed their willingness to work for the project in adequate numbers.

3. GOS Counterpart Availability:

A concern has been raised with regard to the availability of skilled Forestry Department personnel. This concern has been forwarded to the Forestry Department top officials, and assurances have been received that the personnel will be available.

BUDGET SUMMARY (IN U.S. DOLLARS)

Line	Item	FX/LC	1	2	3	4	5	Total
A	Vehicles (Capital costs).	FX	186,000		86,000	-	-	272,000
B	Vehicles (operating costs).	LC	19,000	34,000	34,000	39,100	41,000	167,000
C	Equipment & Materials.	FX	310,000	25,500	62,500	45,500	28,500	472.000
D	Buildings (rent & const.).	LC	36,500	41,500	41,500	41,500	41,500	202,500
E	Labor nuseries)	LC	3,600	11,600	11,600	14,400	14,400	55,600
F	Labor (plantations).	LC	-	128,000	211,000	230,000	309,000	878,000
G	International staff.	FX	223,000	153,000	163,000	153,000	153,000	845,000
H	Local Staff & Administration	LC	79,100	79,100	81,100	81,100	81,100	401,500
	Subtotals		857,200	472,700	690,700	604,500	668,500	3,293,60
	Inflation*		92,118	136,518	277,615	365,992	535,330	1,407,59
	Subtotals		949,318	609,218	968,315	970,492	1,203,830	4,701,17
	CARE/N.Y. Admin. ([redacted])		70,439	45,204	71,849	72,011	89,324	348,82
	Totals:		1,019,757	654,422	1,040,164	1,042,503	1,293,154	5,050,000

* Inflation assumptions:

FX, C.6% year 1, C.8% years 2-5 (compounded)

LC, labor costs, C.10% (compounded)

LC, non-labor costs, C.25% (compounded)

Breakdown of FX/LC:

1)	FX, lines A, C, G, inflation, CARE/N.Y. admin.	$ 2,337,500
2)	LC, lines B, D, E, F, H, inflation	2,712,500
		$ 5,050,000

Total project costs and contributions

	AID	$ 4,550,000	86%	
	CARE	500,000	9%	14%
(See line I, page 24A for breakdown)	GOS	241,477	5%	
	Total	$ 5,291,477		

DETAILED EXPLANATION OF BUDGET

Line A - Vehicles (capital costs)

Item	Year 1	2	3	4	5	Totals
Four-wheel drive Pick-ups	(6) 78,000	-	(4) 60,000	-	-	138,000
85 h.p. tractors	(2) 50,000	-	-	-	-	50,000
Plows/discs	(2) 10,000	-	-	-	-	10,000
Flat bed trailers*	(2) 8,000	-	-	-	-	8,000
Water tankers*	(2) 20,000	-	-	-	-	20,000
Spare parts	20,000	-	26,000	-	-	46,000
TOTALS	186,000	-	86,000	-	-	272,000

* Local procurement items. All other are U.S. procurement.

Line B - Vehicle Operating Costs

Item	Year 1	2	3	4	5	Totals
Fuel	12,000	18,000	18,000	20,000	20,000	88,000
Maintenance	2,000	4,000	4,000	4,000	6,000	20,000
Truck rental for transport	5,000	12,000	12,000	15,000	15,000	59,000
TOTALS	19,000	34,000	34,000	39,000	41,000	167,000

Line C - Equipment and Material

Item	Year 1	2	3	4	5	Total
Pump and engines	(2) 12,000	-	-	(1) 8,000	-	20,000
Operations and Maintenance	8,000	5,000	5,000	7,000	5,000	30,000
Nursery fencing	15,000	-	-	-	-	15,000
Nursery tools	10,000	-	-	5,000	-	15,000
Seedling carriers	-	2,000	2,000	2,000	-	6,000
Plastic bags	-	15,000	20,000	20,000	20,000	75,000
Seeds	-	1,500	1,500	1,500	1,500	6,000
Plantation fencing	185,000	-	-	-	-	185,000
Plantation tools	10,000	-	5,000	-	-	15,000
Furniture/ Fixtures	30,000	-	10,000	-	-	40,000
Office supplies	10,000	-	5,000	-	-	15,000
Shipping/ Inland freight	30,000	2,000	14,000	2,000	2,000	50,000
TOTALS	310,000	25,500	62,500	45,500	28,500	472,000

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Line D - Building Rental and Construction

Item	Year 1	2	3	4	5	Total
Gedaref office	12,000	12,000	12,000	12,000	12,000	60,000
Sub-offices (2)	12,000	12,000	12,000	12,000	12,000	60,000
Forestry staff housing (2)	5,000	5,000	5,000	5,000	5,000	25,000
VSO housing (3)	7,500	7,500	7,500	7,500	7,500	37,500
Miscellaneous huts/guard houses	-	5,000	5,000	5,000	5,000	20,000
TOTALS	36,500	41,500	41,500	41,500	41,500	202,500

Line E - Nursery Labor Force
(includes full time and seasonal)

Site	Year 1	2	3	4	5	Total
Showak	1,800	5,800	5,800	7,200	7,200	27,800
Abu Rakham	1,800	5,800	5,500	7,200	7,200	27,800
TOTALS	3,600	11,600	11,600	14,400	14,400	55,600

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Line F - Plantation Labor Force

Activity		Year 1	2	3	4	5	Total
Fencing:	mandays	-	5,000	7,500	7,500	10,000	30,000
	cost	-	12,000	18,000	18,000	24,000	72,000
Planting:	mandays	-	50,000	75,000	75,000	100,000	300,000
	cost	-	116,000	174,000	174,000	232,000	696,000
Maintenance:		-	-	8,000	16,200	23,000	47,200
mandays cost		-	-	19,000	38,000	53,000	110,000
Totals:	mandays	-	55,000	90,500	98,700	133,000	377,200
	cost	-	128,000	211,000	230,000	309,000	878,000

Note: Labor costs and mandays computed only for the block fuelwood plantations Shelterbelts and agroforestry acreage will be planted at farmer's cost, with the project providing seelings and technical advice only.

Line G - International Staff

Position	Year 1	2	3	4	5	Total
CARE project mgr.	60,000	60,000	60,000	60,000	60,000	300,000
CARE administrator	55,000	55,000	55,000	55,000	55,000	275,000
Silviculturist (volunteer)	6,000	6,000	6,000	6,000	6,000	30,000
VSO (2)	12,000	12,000	12,000	12,000	12,000	60,000
Consultants (18 man months)	90,000	20,000	30,000	20,000	20,000	180,000
Totals	223,000	153,000	163,000	153,000	153,000	845,000

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Line H - Local Project Staff and Administration

Position	Year 1	2	3	4	5	Total
Driver (4)	6,000	6,000	8,000	8,000	8,000	36,000
Tractor driver (2)	1,500	1,500	1,500	1,500	1,500	7,500
Secretary	3,600	3,600	3,600	3,600	3,600	18,000
Accountant	4,000	4,000	4,000	4,000	4,000	20,000
Messenger (3)	2,000	2,000	2,000	2,000	2,000	10,000
CARE Admin. (Khartoum costs)	60,000	60,000	60,000	60,000	60,000	300,000
TOTALS	79,100	79,100	81,100	81,100	81,100	401,500

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Line T - GOS Project Inputs (in Kind and therefore not included in budget summary)

1. Forest Department Staff (Base salaries in US $)

Position	Year 1	2	3	4	5	Total
Conservator	3,250	3,250	3,250	3,250	3,250	16,250
Asst. Conservator (2)	4,350	4,350	4,350	4,350	4,350	21,750
Forest Rangers (4)	-	3,100	3,100	3,100	3,100	12,400
Overseas (4)	-	3,100	3,100	3,100	3,100	12,400
Nursery Supervisors (2)	1,550	1,550	1,550	1,550	1,550	7,750
Administrative Support	1,830	3,070	3,070	3,070	3,070	14,110
Subtotal	10,980	18,420	18,420	18,420	18,420	84,660
Inflation	1,372	4,942	7,981	11,481	15,656	41,432
Totals	12,352	23,362	26,401	29,901	34,076	126,092

2. Land value to Government

Total land assigned by GOS to project is 10,000 feddans. Government lease charges per feddan per year should be LS. 3 per year.

10,000 feddans x LS 3 x 5 years = LS 150,000 ÷ 1.3 (LS/US $) $115,385

3. Total GOS inputs:

1. $126,092
2. $115,385

$241,477

IV. PROJECT IMPACT

A. Social Soundness:

It should be patently obvious that the principal beneficiaries of the project will be the rural poor, both refugee and Sudanese. The lack of forest products in Kassala Province is at present felt principally by both the rural and urban poor. The former must go increasingly longer distances to secure fuel, fodder, and building materials, while the latter must pay higher prices for these items due to increased transport costs. Small animal herds which provide protein and income for the village family are being reduced or sold due to the lack of perennial plants and trees on which to browse for fodder. Thus, provision of a proximate source of fuel-wood, fodder, and construction materials will immediately benefit both rural and urban poor, in terms of money and energy expended.

Charcoal production from GOS forest reserves is contracted out by the Forestry Department. The sales price and quantities purchased of the final product are also controlled by the Forestry Department, to avoid price gouging by unscrupulous merchants. This project will ensure not only a near-by fuelwood and fodder supply for the refugees, but a reasonably-priced charcoal supply for town dwellers of Gedaref and Showak.

The nourishing effect on the soil provided by the woodlots and, more importantly, the shelterbelts will provide benefits to farmers in the area through increases in crop yields and reduction of soil erosion from the wind. The extension facet of the project will encourage both small and large farmers to plant woodlots and windbreaks.
The nurseries will provide seedlings to private farmers to enable them to carry out this program.

To summarize the chain of beneficiaries and benefits from the program, they are as follows:

1) Refugees and low-income Sudanese farmers:

   a) Earnings of more than US$ 800,000 over the five-year life of the project.

   b) Near-by source of fire-wood, construction materials, fodder, and thorn fencing beginning seven years from the inception of the project.

   c) The opportunity to earn additional income through producing and selling charcoal under Forestry Department supervision.

   d) Increases in crop yields in lands proximate to the tree plantings as a result of increased soil fertility and reduction of topsoil losses through wind erosion.

   e) Improvement in the settlement and village living environment through the planting of shade trees produced by the nurseries.

2) Town Dwellers:

a) Increased availability of charcoal and building materials at reasonable prices.

3) Private Sector:

a) Increased opportunity to produce and market charcoal.

B. Institutional Capability of Forestry Department:

That the GOS Forestry Department has the capability to carry out the plantation project, given the requisite assistance of capital inputs, has been demonstrated in North Kordofan in the UNSO project to restock the gum arabic belt. The Department has sufficient capable human resources, but is woefully lacking in funds for the capital and logistic needs of even its existing programs. Provision of the equipment for this program will have a wide-ranging impact on their ability to carry-out other projects in the region.

Partly as a result of lack of funds, the Forestry Department's extension service has been inadequate in recent years. This project will, in addition to improving the logistic capacity of the Department, work to increase the quantity and quality of the extension service in Kassala Province. The CARE staff will work closely with the Forestry Department staff to up-grade its extension service, and introduce techniques which have proven successful in other CARE programs of a similar nature.

The combination of increased logistical capacity, improved and broadened extension service, and the addition of two multi-purpose nurseries, should enable the Forestry Department in Kassala to provide better and more extensive services to farmers and villagers in the Province far beyond the life of this project. The recurrent costs to the Forestry Department of maintaining the forest plantations will be almost nil. Harvesting of wood products for charcoal production is done by contract, with the proceeds going to the Forestry Department to finance supervision and maintenance. These funds will be sufficient to maintain the two nurseries after the five-year project period ends. The nurseries will continue to provide seedlings for private farmers and future forest reserves.

C. Ancillary Programs:

In view of the fact that the vast majority of Sudanese now use, and will continue to use for the immediate future, renewable energy resources for cooking purposes, this project will also seek to incorporate the efforts of CARE and other agencies working in the field of fuel-efficient cookstoves and charcoal kilns. While it is impossible to say at this stage just how such efforts will be incorporated, CARE will maintain close contact with the National Energy Administration and others in an attempt to discover a mechanism for inclusion of the introduction of energy-efficient cookstoves and charcoal producing kilns in the project.

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While the principal results expected from the project are immediate income and fuel-wood availability, the extension service improvement should not be neglected in examining the objectives. CARE and the Forestry Department will work with private farmers and villagers to encourage them to establish private woodlots for fuel-wood, construction material, and fodder production. Windbreaks for large machanized farm areas will also be encouraged to avoid wind erosion and enhance soil fertility. The multi-purpose nurseries will make available seedlings to interested farmers and villagers for these purposes both during the life of the project and after. Village meetings, planting of demonstration plots, and possibly audio-visual materials will be utilized to popularize the idea of woodlots and windbreaks.

D. Economic and Financial Analysis:

1. Economic Analysis:

The model selected for the economic analysis envisions clear felling of all block fuelwood plantations seven years from their inception. While the intention is to allow these forest reserves to remain standing for 25 years in order to continuously produce fodder and gum arabic, and to then cut them for charcoal, it was felt that a "worst-case" analysis of cutting after seven years should be presented. Therefore, fodder and gum arabic yields are those from shelterbelt and agrisilviculture programs after year eleven. It should be noted that by leaving the block plantations standing for one complete cycle (25-28 years), fodder and gum arabic returns will remain at a much higher level, and returns for charcoal would appear in year 24. Also, no returns for fuelwood or charcoal have been shown for the agroforestry plantations.

A shadow rate of U.S.$ 1.00 = LS. 1.6 has been used for the analysis. Local currency project costs have been converted at this rate, while dollar costs have been shown as actuals.

No provision has been made for inflation, although mention should be made of the fact that the charcoal/ fuelwood price has increased by 800% in the last ten years in the Sudan. Based upon this fact, and the increasing scarcity of this commodity, it is felt that the inflation rate of the benefits will be higher than that of the costs, thereby giving an even higher internal rate of return if inflation had been taken into account.

2. Financial Analysis:

The financial analysis has been done in two parts: benefits to the GOS (Forestry Department) and benefits to the individual farmer. The former has been done in two ways: clear-felling of block plantations commencing after year 7 (to match the economic analysis), and continuation of the block plantations for 28 years. In both, constant 1982 values have been used for land (lease value), and for benefits (charcoal, fodder, gum arabic), with no provision for inflation.

.../26

The financial analysis for the individual farmer assumes a five-year production/fallow cycle for sorghum. No increase in crop yields has been shown on the benefits side, although increased crop yields are expected as a result of adoption of agroforestry techniques. Also, no provision has been made for inflation in any of the costs or benefits.

The financial analysis under both scenarios for the forest Department (the charcoal model and the fuelwood model) clearly indicate that the benefits derived from either of these approaches as a result of the project are more than sufficient to offset the recurrent operating costs after the life of the project. Thus there is a definite positive financial return to the forest Department.

ECONOMIC ANALYSIS

(In U.S. Dollars)

Shadow Rate U.S.$ 1 = LS. 1.600

YEAR	COSTS						BENEFITS									NET
	COSTS CAPITAL (1)	COSTS OPERATING (1)	VALUE OF FOREGONE OUTPUT SORGHUM PRODUCTION (M.T.) (2)	VALUE $ 117/MT (NET) (3)	TOTAL COSTS	FEDDANS PLANTED BLOCK	SB/AS	BLOCK M³ (6)	YIELDS VALUE $19/M3	SB/AS M³	YIELDS VALUE $19/M³ (7)	FODDER ANIMAL UNITS	VALUE $113/UNIT (8)	GUM ARABIC YIELD KGS	VALUE $0.38/KG (9)	TOTAL BENEFITS	
1	532,500	395,738	-0-	-0-	928,238												- 928,238
2	67,000	427,912	438	19,996	514,933	1000	250										- 415,933
3	150,000	533,733	1,225	55,825	784,558	1500	750										- 784,558
4	87,000	544,228	2,275	103,675	734,903	1500	1500						1250	141,250			141,250 - 953,653
5	70,000	624,618	3,500	159,500	854,318	2000	1500						3500	395,500			395,500 - 458,818
6		(4)50,000	3,500	159,500	209,500								6500	734,500	24,562	9,334	743,834 534,334
7		(4)18,860	3,062	139,504	158,364			14,000	266,000	125	2375		10000	1,130,000	68,774	26,134	1,156,134 997,830
8		(5) 6,556	1,838	83,796	90,352			21,000	399,000	500	9500		9000	1,017,000	127,724	48,535	1,333,910 1,243,558
9		(5) 8,975	0,438	19,996	28,971			21,000	399,000	1250	23750		7500	847,500	176,849	67,203	1,323,203 1,291,232
10		(5) 9,313	-0-	-0-	9,313			28,000	532,000	2000	38000		6000	678,000	147,374	56,002	1,156,752 1,147,439
11		(5)11,900	-0-	-0-	11,900					2000	38000		4000	952,000	117,859	44,802	1,066,802 1,054,902
12		2,000	0,438	19,996	22,896					1250	23750		4000	452,000	78,599	29,868	519,868 496,972
13		2,563	1,225	55,825	58,388					500	9500		4000	452,000	78,599	29,868	505,618 447,230
14		2,225	2,275	103,675	105,900					25	2375		4000	452,000	78,599	29,868	491,368 385,468
15		2,056	3,500	159,500	161,556								4000	452,000	78,599	29,868	481,243 312,687
16		2,000	3,500	159,500	161,500								4000	452,000	78,599	29,868	481,868 320 9
17		2,000	3,062	139,504	141,504								4000	452,000	78,599	29,868	481,868 340
18		2,000	1,838	83,796	85,796								4000	452,000	78,599	29,868	481,868 396,072
19		2,000	0,438	19,996	21,996								4000	452,000	78,599	29,868	481,868 459,872
20		2,000	-0-	-0-	2,000								4000	452,000	78,599	29,868	481,868 479,868
21		2,000	-0-	-0-	2,000								4000	452,000	78,599	29,868	481,868 479,868
22		2,000	0,438	19,996	21,996								4000	452,000	78,599	29,868	481,868 459,872
23		2,000	1,225	55,825	57,825								4000	452,000	78,599	29,868	481,868 424,043
24		2,000	2,275	103,675	105,675								4000	452,000	78,599	29,868	481,868 376,193
25		2,000	3,500	159,500	161,500								4000	452,000	78,599	29,868	481,868 320,368
26		2,000	3,500	159,500	161,500								4000	452,000	73,687	28,001	480,001 318,501
27		2,000	3,062	139,504	141,504								4000	452,000	58,950	22,401	474,401 332,897
28		2,000	1,838	83,796	85,796								4000	452,000	29,475	11,201	463,201 377,405
				TOTAL COSTS	5,824,657											(10) TOTAL BENEFITS	15,454,765 9,630,108

IRR = 15.9

LS 25.000/Feddan Sorghum Production Costs (Labor & Capital)

ECONOMIC ANALYSIS

FOOTNOTES

1) Costs: U.S. dollar figure for local project costs (first five years) calculated at U.S.$ 1 = LS. 1.6 (shadow rate). No inflation factor included in either costs or benefits, since the model assumes the inflation rate will affect foregone output (opportunity) costs and benefits equally. GOS contributions of land and personnel not included in operating costs for first five years, but valued at approximately U.S.$ 200,000 for this period.

2) Shadow rate of U.S.$ 1 = LS. 1.6 used for calculating foregone output costs and all economic benefits.

3) If project land were planted in sorghum, average yield would be 0.35 mt/feddan. Unit farmgate price is LS. 15/80kg or LS. 187,50/mt = U.S.$117/mt. Model assumes sorghum production for five year cycles with five year fallow periods. In reality, land is often not re-usable due to high cost of rehabilitation, so figures are probably high.

4) Operating costs in years 6 and 7 are basically recurrent costs of plantation maintenance (same as years 4 and 5) plus $ 2000 for supervisory and miscellaneous costs. Labor costs are estimated to be LS. 5 for maintenance and LS. 3 for other operations. Although maintenance of the Shelterbelt/Agroforestry (SB/AS) systems will be provided by leaseholders without cost, this shadow cost has also included in maintenance costs.

5) Harvest costs are estimate at LS. 0.95/m^3 (stumpage) including LS. 0.10 town improvement tax and LS. 0.10 development tax. Shadow harvesting costs for SB/AS systems were included in the analysis. Harvest costs do not include marketing costs as no information available. One might assume that marketing costs might add an additional LS. 1.000 - 2.000/m^3 to the stumpage price.

6) Yields: mean average increment is estimated to be 2.0m^3/feddan/year or a standing volume of approximately 14 m^3/feddan after seven years. This is a conservative figure, since actual yields should be about 18 m^3/feddan, with a mean annual increment of 2.5 m^3/feddan/year.

7) The wholesale price of fuelwood in the Gedaref area is LS. 9-15/m^3. Actual retail price as estimated by the National Energy Administration at 2-3 times the wholesale price. A conservative figure of LS. 30.000 (U.S.$ 19.00/m^3) was taken as an average.

8) Fodder: The Ministry of Agriculture estimates that one feddan of unimproved rangeland in the Gedaref area can produce 0.15 tons of usable forage per year. Improved fodder production using acacia seval and senegal can

CONT. - 41

increase yields to 1.0 - 1.5 tons/feddan/year. A yield of 1 ton/feddan/year or one animal unit was used in the model. Value of one animal unit per year is LS. 180 = U.S.$ 113. No estimates available for cost of harvesting or marketing fodder.

9) Gum Arabic: Benefits for gum arabic were calculated assuming an average of 262 trees/feddan (4 x 4 meter spacing). With 60% of the trees gum producing species, one gum tree yields 125 grams/year from years 5-25. Market value of gum arabic is LS. 27/100lbs or U.S.$ 0.32 per kilogram. No estimate available for costs of harvesting gum arabic.

10) Apart from the measurable benefits, those which are unquantifiable include reduced soil erosion, increased crop yields, production of thorns for fencing, production of construction poles, improvement in the environment of the villages and refugee settlement, and income generation among the refugees.

FINANCIAL ANALYSIS (In Sudanese Pounds)

FORESTRY DEPARTMENT

ASSUMES GUM ARABIC & CHARCOAL PRODUCTION FOR 28 YEARS

YEAR	OPERATING COSTS (1)	LAND VALUE (2)	TOTAL	FEDDANS ANNUAL	FEDDANS CUMULATIVE	BENEFITS FODDER ANIMAL UNITS (3)	FODDER VALUE	CHARCOAL BAGS (4)	CHARCOAL VALUE	GUM ARABIC KILOS (5)	GUM ARABIC VALUE	TOTAL BENEFITS	
1	14.274		14.274										- 14.279
2	23.946	3.000	26.946	1000	1000								- 26.916
3	23.946	7.500	31.446	1500	2500								31.446
4	23.946	12.000	35.946	1500	4000	1000	18.000					18.000	17.946
5	23.946	18.000	41.946	2000	6000	2500	45.000					45.000	3.054
6	21.528	18.000	39.528		6000	4000	72.000			19.650	2.358	74.358	34.830
7	3.300	18.000	21.300		6000	6000	108.000			49.125	5.895	113.895	92.595
8	3.300	18.000	21.300		6000	6000	108.000			78.600	9.432	117.432	96.132
9	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
10	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
11	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
12	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
13	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
14	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
15	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
16	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
17	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
18	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
19	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
20	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
21	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
22	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
23	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
24	3.300	18.000	21.300		6000	6000	108.000	85.000	51.000	98.250	11.790	152.790	131.490
25	3.300	18.000	21.300		5000	5000	90.000	127.500	76.500	68.775	8.253	147.753	129.453
26	3.300	15.000	18.300		3500	3500	63.000	127.500	76.500	39.300	4.716	117.216	103.416
27	3.300	10.000	13.800		2000	2000	36.000	170.000	102.000	-	-	102.000	92.700
28	3.300	6.000	9.300		-	-	-						
		TOTAL COSTS	636,186						TOTAL BENEFITS			2842,812	2206,626

IRR = 38.7

FINANCIAL ANALYSIS

Footnotes (Forestry Department; Charcoal Model)

1) Operating cost: assumes nursery ceases to operate after year five. In actuality, nurseries will contenue to function for agroforestry program.

2) Land value: Present lease value of Land set at LS. 3:000 per feddan.

3) Fodder: value calculated at LS. 180 per feddan per year, or equivalent of one animal unit. Assumes 10% of value will accrue to the Forestry Department for grazing and /or harvesting rights.

4) Charcoal: market price is LS. 3.50 per bag (100 lbs). Production calculated at 85 bags per feddan. Assumes LS. 0.600 per bag accrues to Forestry Department for harvesting rights and royalties. (average tender price)

5) Gum arabic: present market value LS. 0.600/kilo. Assumes 20% of market value accrues to Forestry Department for harvesting rights

FINANCIAL ANALYSIS (In Sudanese Pounds)

FORESTRY DEPARTMENT

ASSUMES CLEAR FELLING OF BLOCKS FOR FUELWOOD

YEAR	COSTS			FEDDANS PLANTED (BLOCK)	BENEFITS (NET)					NET
	OPERATING COSTS (1)	LAND VALUE (2)	TOTAL		FUELWOOD m^3 (3)	YIELD LS. 6 /m^3	FODDER ANIMAL UNITS (4)	LS 18/UNIT	TOTAL	
1	14,274	-	14,274							- 14,274
2	23,916	3,000	26,916	1000						- 26,916
3	23,916	7,500	31,416	1500						- 31,416
4	23,916	12,000	35,916	1500			1000	18,000	18,000	- 17,916
5	23,916	18,000	41,916	2000			2500	45,000	45,000	3,054
6	21,528	18,000	39,528				4000	72,000	72,000	32,472
7	21,528	18,000	39,528				6000	108,000	108,000	68,472
8	3,300	18,000	21,300		14,000	89,000	5000	90,000	174,000	152,700
9	3,300	15,000	18,300		21,000	126,000	3500	63,000	189,000	170,700
10	3,300	10,500	13,800		21,000	126,000	2000	36,000	162,000	148,200
11	3,300	6,000	9,300		28,000	168,000			168,000	158,700
		TOTAL COSTS	292,314						936,000	643,686

IRR = 39.4

FINANCIAL ANALYSIS

Footnotes (Forestry Department; Fuelwood Model)

The model assumes clear felling of all block fuelwood plantations by year 10.

1) Operating costs: assumes for purposes of this analysis that nurseries cease to operate after year five. In actuality, nurseries will continue to operate to provide seedlings for agroforestry program.

2) Land value: present lease value of land set at LS. 3.000 per feddan.

3) Fuelwood: assumes yields of 14 m^3 per feddan. Estimates that 20% of market value will accrue to Forestry Department for clearing rights, etc.

4) Fodder: value calculated at LS. 180 per feddan per year, or equivalent of one animal unit. Assumes 10% of value will accrue to Forestry Department for grazing and/or harvesting rights.

FINANCIAL ANALYSIS

(In Sudanese Pounds Per Feddan)

INDIVIDUAL FARMER

	WITHOUT PROJECT						WITH PROJECT					
YEAR	CAPITAL & LABOR COSTS	LAND COSTS	NET PROFIT FOREGONE OUTPUT (OPPORTUNITY)	GROSS TOTAL	NO. FEDDANS YR SB/AS CUM		FODDER (1)	CHARCOAL (2)	GUM ARABIC (3)	SORGHUM	TOTAL	NET
2	22.000	3.000	25.400	50.400	250	250				47.380	47.380	- 3.020
3	22.000	3.000	25.400	50.400	750	1000				47.380	47.380	- 3.020
4	22.000	3.000	25.400	50.400	1500	2500	9.790			47.380	57.170	6.770
5	22.000	3.000	25.400	50.400	7500	4000	9.790			47.380	57.170	6.770
6	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
7						4000	9.790		0.350		10.140	10.140
8						4000	9.790		0.350		10.140	10.140
9						4000	9.790		0.350		10.140	10.140
10						4000	9.790		0.350		10.140	10.140
11						4000	9.790		0.350		10.140	10.140
12	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
13	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
14	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
15	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
16	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
17						4000	9.790		0.350		10.140	10.140
18						4000	9.790		0.350		10.140	10.140
19						4000	9.790		0.350		10.140	10.140
20						4000	9.790		0.350		10.140	10.140
21						4000	9.790		0.350		10.140	10.140
22	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
23	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
24	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
25	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
26	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
27						4000	9.790		0.350		10.140	10.140
28						4000		8.930			8.930	8.930
			TOTAL COSTS	756.000					TOTAL BENEFITS		962.290	206.290

IRR = 84.9

FINANCIAL ANALYSIS

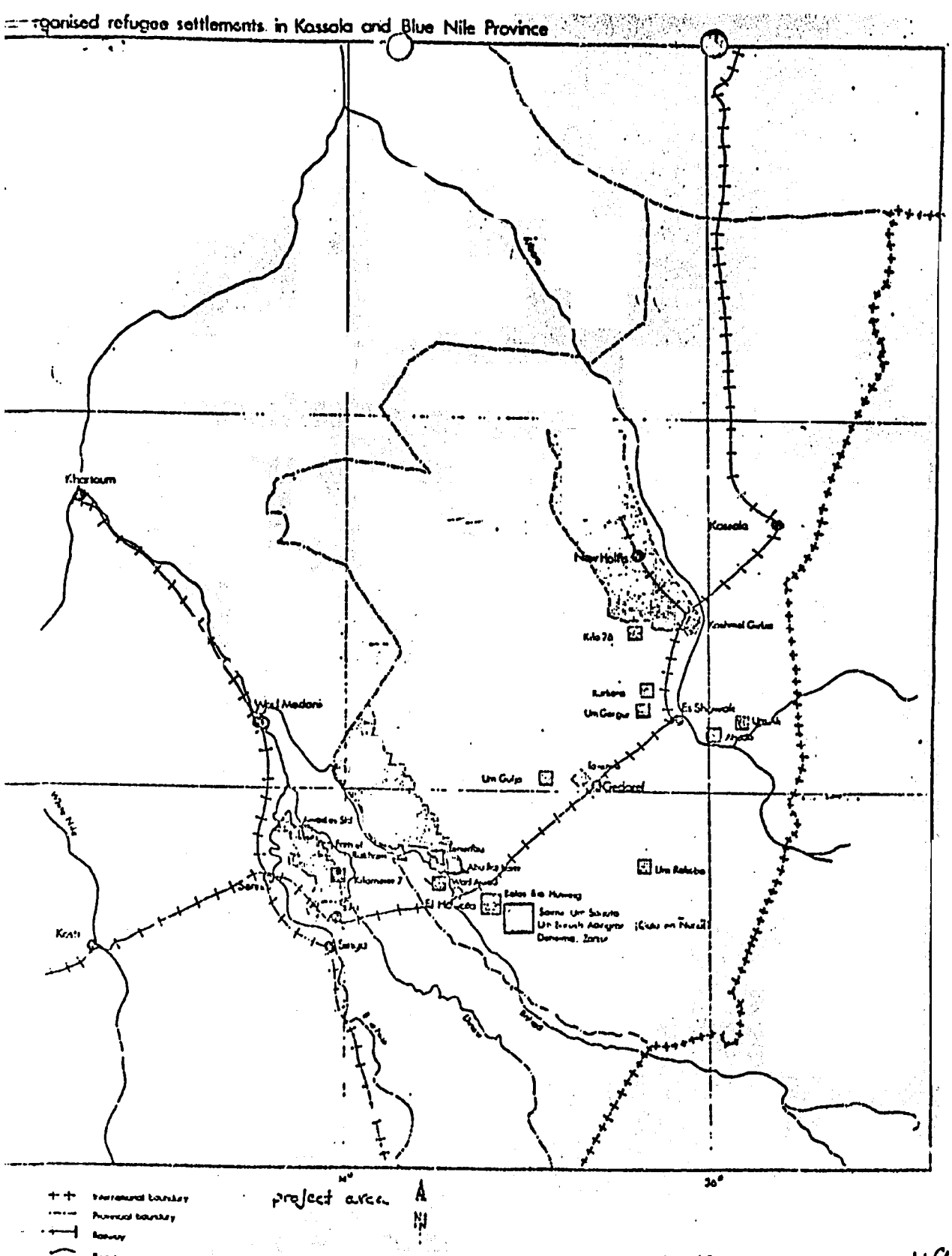
Footnotes (Individual Farmer; Agroforestry)

1) Fodder: yield calculated at one ton per feddan per year equal to one animal unit. Value calculated at LS. 180 per ton x 6% of land used for agroforestry = LS. 10.80. Harvesting costs calculated at 5.6 man days per feddan x LS. 3 per man day x 6% = LS. 1.010 labor costs for net value of LS. 9.790.

2) Charcoal: assumes farmer will receive 50% of market price of LS. 3.500 per bag. Assumes yield of 85 bags per feddan x 6% = 5.10 bags per feddan x LS. 1.750 per bag = LS. 8.930.

3) Gum arabic: yield is calculated at 19.65 kilos per feddan x 6% = 1.18 kilos. Assumes 50% of market price of LS. 0.600 kg. accrues to farmer or 1.18 x 0.300 = LS. 0.350 per feddan.

4) Dura: assumes 6% reduction in output. No provision for increased yields as result of agroforestry efforts.


ganised refugee settlements in Kassala and Blue Nile Province
Khartoum
Wad Medani
Kassala
New Halfa
Kilo 28
Kashmel Girba
Um Gulja
Gedaref
Um Rakuba
Kosti
project area
A
N
Scale 1:3 million

No. IOI/A/I

Date: 25.II.1982

Forests Administration
P.O. Box 658
Khartoum.

Director
C.A.R.E. Sudan

Subject:- Refuree REforestation Project

Ref. Conversation with Mr. Dunn 24th Nov. This is to confirm that Forestry staff on secondment from bath central and Reginal Forestry will be Porvided to the Refugee Reforestation Project.

Kamal Hassan Badi
Director General
Central Forests Administration
Khartoum.

جمهورية السودان الديمقراطي

الاقليم الشرقي

23 AUG 1982

وزارة الزراعة والموارد الطبيعية

مكتب الوزير

الثمرة ... 3o / A/I ...

التاريخ ... 21.8.1982 ...

Mr. Stanley Dunn ,
Director ,
CARE - Sudan ,
Khartoum .

ubject : Letter of Intent .

Dear Mr. Dunn

Reference recent contacts and correspondence , please convey to your organization the concurrence of the Governor .. Estem Region to assign Io.ooo feddans for the proposed refugee forests . Five thousand feddans are located in Showak area; ---- another five thousand feddans are in Abu Rakham area .

We Expect that project facilities and activities will be extended, whenver possible , to cover adjoining areas where the tree cover has been completely removed. Present locol funds fall short of meeting 5% of the proposed annual afforestration programme .

Sincerely,

Dr. H.A. Habish ,
Minister of Agric

Initial Environmental Examination

Project Location: Gedaref, Sudan

Project title: Sudan Eastern Reforestation (650-0064)

Funding: $4,550,000

Life of Project: FY 1983 - 1988

IEE Prepared by: Dennis Panther, AFR/TR/SDP

Environmental Action Recommended:

This project will have a beneficial effect on the environment and therefore a negative determination is recommended along with a model evaluation system as developed for Somalia CDA Forestry Project.

Concurrence [signature] AID/AFR/PD/EAP

Bureau Environmental Officer Action:

Approved [signature]

Disapproved _____

Date 30 DEC 82

Clearance:
GC/AFR [signature]

Examination of Nature, Scope, and Magnitude of Environmental Impacts

A. Description of Project

1. General

Ethiopian refugees have been settled in the Kassala region of Eastern Sudan and they were provided with land by the Sudanese government and wells by the U.N. This area has been subject to intensive mechanized cereals farming in the past, which depleted the soil of plant nutrients and in the process, deforested large tracts of land.

The purpose of this project is to enhance the quality of life for the refugees and Sudanese living in this area. Its objectives are:

a. increasing the local fuelwood supply,

b. generating income potentials,

c. increasing the productive capacity of the soil through the extension of agroforestry technics,

d. increasing the institutional capacity and quality of the Sudanese Forest service to manage plantations and enable it to provide tree and shrub seedlings for windbreaks, shade and soil improvement,

2. Activities

Funding will be provided through CARE for three sub-regional nurseries to be built. These nurseries will provide 300,000 seedling/year for outplanting at five plantation sites and for distribution to farmers for their fields. Two tractors will be purchased for transporting the seedlings, land preparation, and weeding.

Technical assistance, in addition to principal forestry advisor/project manager and a project silviculturalist, will include:

a. a forestry extension specialist (4 pm) to devise an extension training program.

b. an agronomist (2 pm) to study soil and climatic conditions and to recommend agro-forestry systems in the project area.

c. a rural sociologist (6 pm) to initiate baseline data collection for use in evaluations and when analyzed, to provide guidelines for stimulating farmer participation.

B. Identification and Evaluation of Environmental Impacts

Tractors will be used for site preparation on five tracts of approximately 600 ha. each and to form dikes to direct rainfall to the seedlings. All

plantation sites have been inspected by AID/W, REDSO/EA and CARE staff. The soil is deep sand with sloping of less than 10%. Potential water erosion will be checked by the diking system thereby increasing the infiltration rate and ground water.

Building construction will be confined to office/sheds/some housing at each nursery. These buildings will be modest in size and not have a significant effect on the environment. Fences will be erected around each plantation to exclude animals from the young trees.

The agroforestry activities will have a beneficial effect on farmers fields. Native nitrogen-fixing species will be used as wind breaks, fuelwood, and animal fodder. They will decrease wind erosion and increase soil fertility with decaying leaves and protect the soil against direct sunlight.

Technical assistance will provide for a better environmental awareness to both the farming community and government officials.

II. Recommendation for Environmental Actions

The foregoing examination indicates that the long term effects of this project will significantly improve the local environment. A negative determination is recommended.

It is also recommended that Evaluations should use system developed for the Somalia CDA Forestry Project (649-0122).

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SUDAN EASTERN REFORESTATION

OPERATIONAL PROGRAM GRANT PROPOSAL

Country :	Sudan
Executing Agency:	CARE
Duration of Project:	Five years
Starting Date of Project:	February, 1983
Total OPG Request:	$ 4,550,000

CARE OPG
SUDAN: 650-0064 FY8
Eastern Reforestation
C# 13
D# 3

PROPOSAL FOR A REFUGEE REFORESTATION PROJECT IN KASSALA PROVINCE

1. INTRODUCTION

Successive influxes of refugees from four of the Sudan's neighboring countries have resulted in the presence of nearly one-half million refugees on Sudanese territory at present time. By far the greatest number of these refugees came from Ethiopia, the majority of whom has been settled by the Government of the Sudan (GOS) in Kassala Province in Eastern Sudan.

The aim of the GOS is to establish a series of self-sufficient refugee settlements of 5-6,000 inhabitants each. Thus far, twenty -one such settlements have been set up in Kassala Province, with each family allotted 5-10 feddans (1 feddan = .42 hectares) of agricultural land. Assistance in establishing these settlements has been received from the United Nations High Commission for Refugees, the United Nations World Food Program, and various voluntary agencies.

In the last ten years, much of the rainfed arable land of Kassala province has been brought under intensive mechanized cultivation of sorghum (dura). This highly profitable agricultural system has attracted many investors and commercial farmers to seek lease-hold lands from the government. As a result, vast tracts of land have been cleared of all tree and ground cover to facilitate the use of tractors and thus hold cultivation costs to a minimum. Profitable though it might be, productivity on these fragile soils declines rapidly after 4 to 5 years of intensive cropping and the cultivators are forced to abandon the lands and seek new areas for exploitation. Increasing demographic pressure both from refugee influxes in the area and from the very large sizes of the Sudanese agribusiness holdings has made it increasingly difficult to find suitable new areas. This has served to shorten the fallow period in the area and led to a generally lower level of environmental stability in the areas as witnessed by accelerated loss of site productivity on the farms, greater susceptibility to drought conditions, and localized incidences of longer-term desertification. In addition to the perturbing evidence of declining agricultural productivity, the local populace, both refugee and Sudanese, is finding it more difficult to obtain the fuelwood and charcoal with which they have traditionally, and almost univerally, met their needs for domestic energy. Building materials and thorn fencing have also become increasingly scarce. Both refugee and low income Sudanese in the area must now travel long distances to collect fuelwood, and thorn fencing material which was once readily available, often must be brought by camel or truck to the villages and settlements.

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During the dry months (January-June) lack of animal fodder normally available from trees reaches critical proportions, resulting in high animal mortality and chronic ill-health of the livestock belonging to both Sudanese and refugees. Finally, the paucity of trees in the refugee settlements makes the living environment barren and desolate.

To help ameliorate this situation, the GOS commissioner for Refugees has requested that CARE join with them and the Forestry Department to mount a refugee settlement reforestation project. The aims of this project are manifold. Firstly, it will provide immediate income generation to the refugees by creating employment opportunities associated with a labour intensive tree planting campaign near their settlements. It will improve the lot of both refugee and low income Sudanese farmers by making fuelwood obtainable at sites proximate to their dwellings. It will enable private sector agents to harvest the wood under Forestry Department management thereby stimulating the local economy. Over the long term, the project will set out to demonstrate the potential benefits obtainable through a closer integration of forestry and agriculture in terms of increased availability of wood for domestic energy and enhanced environmental stability leading to sustainable agricultural production in the area. Finally, by providing the Forestry Department with the capability to demonstrate the positive effects of trees on the environment, and to train local residents in their establishment and management, the project will further reinforce the Department's role in fostering and sustaining appropriate land use policy and practice in the semi-arid regions of the country.

In short, forests form the cornerstone of the state of the environment on which the destiny of the land and the people so vitally depend. Their functions are basic and indispensable. They provide essential needs; fuel, fodder, shelter and the means to a livelihood to the populace; they mine the deeper layers of the soil to translocate plant nutrients to the topsoil; through their leaf fall they add organic matter necessary for moisture retention in the surface layers of the agricultural field; they provide shelter against the dessicating winds and moderate the extremes of harsh climate in this semi-arid area. The lands of Kassala Province, indeed of all of the semi-arid zone of the Sudan, can be fertile and productive with rationally managed and utilized tree cover, or barren and sterile without it. Unless affirmative measures are soon initiated, and ample demonstration effect achieved, convincing farmer and policy-maker alike of the soundness of a closer integration of forestry and agriculture in the semi-arid areas of the country, little will remain except extensive tracts of land requiring costly and difficult rehabilitation to bring them back to productivity and halt the unrelenting forces of desertification.

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II. PROJECT DESIGN

A. Statement of the Problem:

Intensive mechanized cultivation of sorghum in Kassala Province, combined with large refugee influxes have led to an almost complete deforestation of a region that was not long ago, an important supplier of fuelwood and charcoal for the country. This situation, if allowed to continue unchecked, will lead to destruction of the environment and natural resources upon which the population depends for its livelihood and existence.

1. The diminishing availability of firewood, charcoal and construction wood:

Fuel and construction wood, a renewable resource that has been plentiful in the past, is generally taken for granted. If managed correctly, and if replanted in heavy-use areas, this resource can sustain an increasing demand which would mean a higher standard of living for the population. Given the current trend in the Sudan, however, this resource will gradually disappear until people in the area are forced to reduce their standard of living or move away. In extreme cases, the denuded land will be ruined byond its ability to reconstitute itself.

The gravity of the situation in the Sudan cannot be overstated. Ten years ago, Kassala Province produced fuelwood and charcoal for its own use and for delivery to other regions of the country. As mechanized cultivation led to denuding of the area, charcoal production shifted South and to other areas of the country. Villagers in the Gedaref District of Kassala Province (target area for this project) who for years took for granted the ready availability of free fuelwood and fodder at short distances from their homes, now find themselves obliged to travel 4-6 hours by camel and donkey to secure a week's supply. Many members of the population have been forced into cash procurement of fuelwood further straining their fragile hold on domestic economic stability. The arrival of large numbers of Ethiopian refugees in the area has further exacerbated the demands for these vital commodities.

It is clear that a crisis in fuelwood is developing for the inhabitants of Kassala Province and for those of other regions of the country which were formerly dependent on the production and supply from the area. Large-scale substitiution of fuelwood for domestic energy is unlikely in the near future due to total national dependance on imported petroleum and an increasing foreign deficit with which to purchase such products. With a decline in the availability of fuelwood, rural dwellers are using agricultural residues for cooking, thereby short-circuiting the return of organic matter to the soil either directly or through animal wastes.

Fodder from residues or from trees and brush cover has become more difficult to obtain and villagers must spend increasing amounts of time and energy to secure food for their animals, as well as for fencing and construction material required on their farms.

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2. Ecological Equilibrium:

A second critical element of the problem has already been alluded to: the deterioration of the environment. This phenomenon is acknowledged almost universally by both Sudanese and foreign visitors alike. Although its causes are numerous and complex, principal among them is the rampant growth of mechanized agriculture in Kassala, coupled with the demographic growth and concomitant demand for fuelwood and charcoal in the region. The increased demand for these items resulting from the large influx of refugees into the region has certainly compounded the problem. These circumstances have placed monumental pressure on the environement as a result of:

a. Tremendous expansion of the amount of land under mechanized cultivation, with the resultant uprooting of trees and land cover to facilitate tractor utilization;

b. Overgrazing by herds and flocks whose numbers have increased with demographic increases;

c. Unmanaged destruction of woody species for firewood and other domestic purposes.

Given the pressure to produce more food crops, and the rewards from doing so, it is unlikely that, without outside assistance and strong intervention by the GOS, the already limited resources of Kassala Province can continue to sustain sorghum production in its present form. Without a campaign aimed at increasing the tree and brush cover across the landscape, the situation can only worsen. What is required for the long term is a sound land use policy directed by the government, implemented by the people, and in the case of the needs for reforestation, guided and serviced by the Forestry Department. Shelter belts, intensified bush/tree fallow, agroforestry and agrisilviculture, fast-growing fuelwood plantations, reserve and protection forests, are all promising ingredients to an integrated agriculture and forestry system which can sustain both agricultural and forestry productivity and maintain the environmental stability on which human survival depends in these semi-arid regions. This project is intended as the beginning of this process in Gedaref District, and reflects both government policy and practice underway in other threatened areas of the Sudan. If the project can demonstrate the potential for solutions to the problems, it will make an important step in the right direction.

B. Final Goals:

The Final Goals of this project are two-fold. The simplest to state clearly, to achieve, and to measure will be to improve the quality of life and environment of more than 40,000 refugees and rural Sudanese living in Gedaref District of Kassala Province within five years of project completion.

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The more difficult to achieve will be the introduction, and acceptance by rural farmers, both refugee and Sudanese, of the practice of integrating argiculture, forestry, and animal husbandry so as to maximize overall land productivity on a sustained basis, and to maintain the environmental stablility upon which production and producers depend.

C. Intermediate Goals:

In pursuing the above mentioned long-term final goals, the project will bring its resources and efforts to bear in furthering more specific intermediate goals. These will include:

- generating income earning employment opportunities over the life of the project for the rural population, particularly the refugee groups;

- demonstrating through physical achievement of planting targets integrated into the agricultural production system, the real potential of forestry support for agriculture in the area;

- providing a proximate source of badly needed fuelwood, fodder, fencing and domestic construction materials for both refugee and Sudanese populations in the area;

- establishing a base for training of local villagers and Forestry Department field staff in the proper integration of agriculture and forestry in semi-arid conditions;

- enhancing the institutional capacity of the Forestry Department to guide and service the demands for sound natural resources management;

- creating further income generation possibilities from the production and sale of wood products; and

- enhancing the rural living environment through the addition of tree shade, reduced wind and water erosion and general protection from the harsh climate.

D. Project Activity Targets:

In order to achieve the specified goals, four major types of activities will be undertaken. These will be:

1. Establishment of Nurseries and production of tree seedlings
2. Plantation establishment and maintenance.
3. Training and extension in community and agroforestry.
4. Management and harvesting of established plantations.

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1. Establishment of Nurseries and Seedling Production:

Two central nurseries will be established: one at Showak and one at Abu Rakham. These will provide seedlings for the proposed woodlot plantations, for the farmers encouraged by the extension program to plant shelterbelts, windbreaks, and private woodlots, and for refugee and village settlements to provide shade trees. Each nursery will be on five feddans of land. That at Showak will be on the bank of the Atbara river and irrigated therefrom, while that at Abu Rakham will be sited on the Rahad Scheme canal for irrigation. The two nurseries will also serve as focal points for the extension program. It is felt that establishment of additional nurseries, while possibly providing savings by reducing transport costs, would involve additional foreign exchange capital costs, and would be beyond the ability of the Forestry Department to maintain and operate after the life of the project. Nursery construction will begin in May 1983 and will be completed by December 1983. This will include fencing, pump installation, and construction of warehouse, toolshed, and guardhouse.

Seedling production will be phased according to the requirements for planting of woodlots, shelterbelts, windbreaks, and shade trees. At inception, major production will be for woodlot plantations, but additional plants will be produced for distribution to interested farmers both refugee and Sudanese, who will be encouraged to undertake planting on their own. As the extension program develops and gains momentum, it is envisaged that seedling production for agroforestry efforts will increase accordingly.

The following table gives a summary of seedling production at each of the two nurseries over the life of the project. It is intended principally as a planning guide, and a certain latitude in seedling production must be assumed due to the unknown extent of the effects of the extension efforts.

Nursery Production (numbers of seedlings)

Year	1	2	3	4	5
Nursery					
Showak	0	300,000	500,000	500,000	500,000
Abu Rakham	0	300,000	500,000	500,000	500,000
Total	0	600,000	1,000,000	1,000,000	1,000,000

In addition to raising and distributing over three million seedlings during the life of the project, the nurseries are expected to serve as

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focal points for demonstrating the possibilities and potential of tree planting in the area. Accordingly, extension programs will be organized at each nursery site, and promotion and training exercises carried out there throughout the project and hopefully thereafter. Success in this extension aspect of the project will create a genuine interest in tree planting and a consequent demand for seedlings which will encourage the Forestry Department to continue to maintain and operate the nurseries beyond the life of this project.

2. Plantation Establishment and Maintenance:

The target of this project will be to bring 10,000 feddans under tree cultivation during five years. Of this amount, it is tentatively estimated that some 6,000 feddans will consist of block fuelwood plantations, proximate to the refugee settlements. The remainder of the target will be shelterbelt, agrisilviculture, and village woodlot plantings on privately held lands. It must be emphasized that these targets are tentative and flexible, and the actual mixture of plantings will depend in large part upon the success of the extension efforts in encouraging farmers and villagers to embrace agro-forestry techniques by demonstrating their economic value and impact. The following projected planting targets, therefore, should be viewed not as rigid planning targets, but rather as indicative margins under which the project will be implemented. They may, indeed they will, be subject to change as the dictates of field experience indicate.

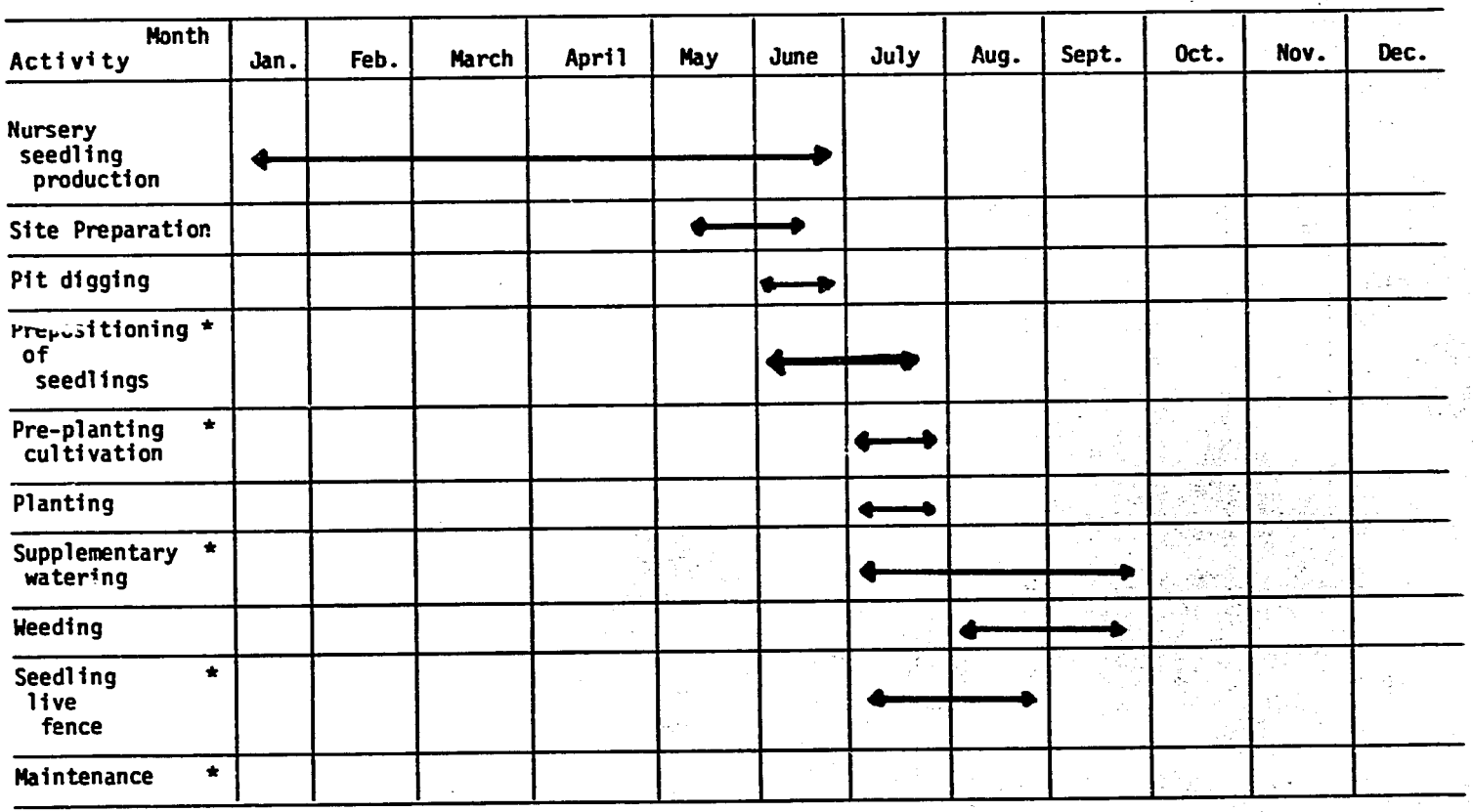
Plantation Targets (in feddans)

Year	1		2		3		4		5	
Site	FP	SB/AS	FP	SB/AS	FP	SB/AS	FP	SB/AS	FP	SB/A
Um Gargur		0	500	50		150	500	300	500	300
Karkora		0		50	500	150		300	500	300
Wad Awad		0	500	50		150	500	300	500	300
Abu Rakham		0		50	500	150		300	500	300
Tenebda		0		50	500	150	500	300		300
TOTAL		0	1000	250	1500	750	1500	1500	2000	1500

Note: FP - fuelwood plantations planted in block form
SB/AS - Shelterbelt plantings/Agrisilviculture. The former are rows of five wide trees planted perpendicular to prevailing winds; the latter are plantings carried out on farm lands in the last year before they are left for fallow. Both expressed in total areas planted.

As can be seen from the above, it is tentatively planned to establish tree plantings of various types on 10,000 feddans of land during the life of the project. All three types of plantings will produce fuelwood, although different management systems will be used and therefore different yields may be expected from each. The following is a graphic calendar of activities through a typical annual cycle.

NURSERY/PLANTATION CALENDAR



Note:* indicates activity will be carried out as required.

3. Training and Extension in Community and Agro-Forestry:

In order to complement and make optimum use of the physical demonstration to be achieved through tree planting, the project will undertake modest but well-rounded training and extension programs. In the first and second years of the project, professional and technical personnel will participate in training courses organized at Gedaref, to fully acquaint them with the policy issues, goals, activities, techniques, targets, and possible problems of the project. Regular monthly meetings of the project staff and frequent field visits by the project managers will help to mould the staff into a motivated, field-oriented team, able to respond to the changes, problems, and opportunities which the project encounters.

Short worker training courses for both nursery and plantation workers will be organized by the project staff, in order to ensure that optimum nursery stock is raised, and that losses from transporting and transplanting seedlings are kept to a minimum. In addition, these courses will be used to explain the broader aspects of the project goals and activities, thereby serving as extension courses for the laborers, who are in fact farmers, and making them spokesmen for project activities.

It would be both premature and presumptuous to assume that a full-fledged extension campaign aimed at motivating refugee and Sudanese farmers to engage in woodlot and agro-forestry activities can be detailed at this time. Only one or two years of field level experience working with the local populace can determine the shape and methodology of such a program. The approach in the early years will center around tangible incentives to refugees and farmers. These will be in the form of provision of shade tree seedlings for their homes, fruit tree seedlings for planting in their compounds and irrigated with waste water, school programs for improving school compounds and educating school children in planting techniques, etc.

As fuelwood plantations are successfully established, the pace of the extension program will expand and quicken. Utilizing the demonstration effect of the woodlots, village meetings with farmers and refugees will be organized and addressed by project staff.
The use of visual presentations such as puppet shows will be tried. Liason with FAO extension experts should also help in formulating a workable extension and education program. The burden of devising and implementing this aspect of the project will fall almost completely upon the project staff, and it is hoped that after their initial experience with refugees and farmers in establishing the fuelwood plantations, they will be in an excellent position to design a workable and effective extension effort.

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In summary, the extension program must be flexible. It will be action and incentive oriented, rather than merely promotional. Once demonstration plantings provide evidence of the value of fuelwood and agro-forestry activities, farmers and refugees may be expected to conclude that tree planting is an economically sound proposition. With the existence of the nurseries and their continued ability to provide seedlings for these activities, it is hoped that the land put under forestry and agro-forestry programs will far exceed the modest targets which this project aims to achieve.

4. Management and Harvesting of Forest Products:

While the fuelwood plantations will only reach production after the project has reached completion, something must be said about the formal arrangements for management of these woodlots. Production has been conservatively estimated at 10 cubic meters standing volume per feddan in the seventh year after planting. The woodlots will be managed by the Forestry Department, and fuelwood licenses granted on a tender basis, with opportunities to bid offered to both refugees and Sudanese alike. Proceeds from sale of licenses will be used to support continuation of the program by the Forestry Department. Shelter belts and agrisilviculture plantings will be managed somewhat differently, since in the case of woodlots sustained fuelwood production is presumed, while for shelter belts harvesting is necessarily more selective and spread out to maintain the protective function. Agrisilviculture plots, when used as improved tree-fallow, may be clearfelled and the land returned to agriculture. Both of these activities will produce fuelwood and charcoal for domestic use and off-site sale by the farmers.

E. Technical Considerations:

Nursery and plantation technique has been described above to some degree. These will be further refined by the Project Manager, Co-Manager and the Silviculturalist who will prepare a detailed work plan at the beginning of the Project, annual working plans, a nursery production manual and a plantation work guide.

Species will be chosen for appropriateness as fuel and charcoal producers, palatability as fodder, and for construction and shade tree uses. They will also be selected according to suitability for integration with agriculture. Considerable experience has already been gained by the Forestr Department in the Sudan and species may be expected to include the following

Acacia Seyal (Talh): This the predominant species in the Kassala Province. It provides wood of high caloric value, and its seed pods provide good fodder for livestock. This will be the predominant species produced by the nurseries and used at the plantations.

Azadirachta Indica (Neem): Neem provides a good fuelwood, in addition to being an excellent and fast-growing shade tree. Its wood can be used for construction purposes provided the bark is removed to avoid damage from borers.

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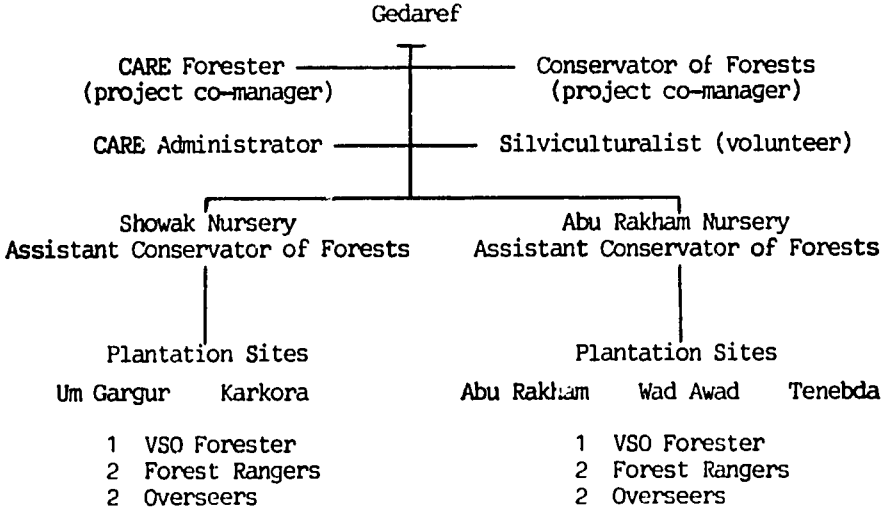
Acacia Senegal (Hashab): This is a well known species in the country producing gum Arabic and often employed for interplanting in the fields throughout the country. It is a palatable forage/fodder species and produces good fuelwood and charcoal.

Other species to be employed include Acacia Mellifera and Acacia Nubica (for live fences) and mango and guava (as fruit trees). Further trials and small demonstration plots of well-known arid known species may be experimented in the course of the Project upon recommendation of the Forestry Department.

F. Personnel Requirements:

Management and administrative responsibility will be shared by a CARE representative and the GOS Conservator of Forests for the Gedaref District, both posted in Gedaref. As co-project managers they will be responsible for overall policy and implementation of the project. A Peace Corps or VSO silviculturalist also posted in Gedaref will provide technical guidance to the project. There will be an Assistant Conservator of Forests and his counterpart, a VSO Forester, assigned to each of the two project areas. Each project nursery/plantation area will have two Forest Oversees/Rangers assigned to plantation protection and extension activities, and a Nursery Supervisor. A CARE international staff member will provide administrative support in the project area, liason with GOS officials in Khartoum, and back-up support for the project co-managers.

Personnel Organization



The use of PCVs as foresters at the plantation sites was initially considered. However, due to the considerably shorter lead time required for recruitment of VSO volunteers and the fact that a well-developed VSO administrative support structure exists in Sudan, it is planned that the first volunteers will be VSO's. There will be consideration of replacing VSO's with USPCV's in year 3 of the project. The silviculturalist volunteer, however, will be requested on individual placement from US Peace Corps.

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The following is a description of the role which consultants will play in project design, implementation, and evaluation.

1) Rural Sociologist (6 months)

This consultant will arrive in June 1983, and will spend six months gathering baseline information on both refugee and Sudanese populations in the project area. Information will include economic activities (income, occupation, labor calendar), demographic data (total population, family size and structure, distribution), land use data (farm size, cropping patterns, crop yields, seasonal employment), and short and long term expectations for change in employment patterns, and of refugees for repatriation. Utilizing this information, the consultant will analyze the implications of the project design, with special emphasis on the integration of agriculture and forestry, and possible means and incentives to be used to stimulate farmer participation in the project.

2) Forestry Extension Specialist (4 months)

The consultant will arrive in early November 1983, in order to have a two-month overlap with the Rural Sociologist. His objective will be to work with the project staff, utilizing the data and analyses of the sociologist, to formulate the forestry extension program. This will include extension agent guidelines, presentational materials and methodology, and the setting up of training programs for project extension agents.

3) Agronomist (2 months)

Arriving in March 1984, the consultant will study soil and climatic characteristics, domestic food consumption habits, agronomic techniques, and off-farm market potential, with a view to recommending species of fruit and fodder trees, and annual crops, that can be successfully grown in agro-forestry systems in the project area.

4) Evaluation (2 persons, 1 month in year 3; 2 persons, 2 months in year 5)

A mid-term evaluation will be carried out in December 1985, in conjunction with GOS, CARE, and USAID representatives, in order to examine the progress of the project. Attention will be given to the level of refugee participation and support, success of the fuelwood plantations, success of the extension efforts in agro-forestry, and the need and potential for adjustments in project strategy. The study will include examination of the effectiveness of the project in delivering extension services, monitoring and reporting, and follow-up support, and will recommend changes where required.

A final project evaluation will take place in November-December 1987. The same procedure used in the mid-term evaluation will be repeated. The study team will also address the question of the need for, and desireability of continuation and/or expansion of outside support for Forestry Department activities in the area. The evaluation will also address the lessons learned from the project activities, as well as the policy and management options available to the GOS for future activities.

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G. Implementation Schedule:

The following is a tentative implementation schedule for the project activities. Since years 3-5 (1985-87) will be repetitions of the initial two years, only additional activities have been noted for those years.

1983	
Feb.	signature of USAID-CARE OPG agreement signature of GOS-CARE agreement
March	arrival of international staff
June - Dec.	construction of nurseries at Showak and Abu Rakham baseline survey by rural sociologist and extension expert.
1984	
Jan. - June	nursery preparation and seedling production fencing of two 500 feddan woodlot plantations site preparation at woodlot plantations extension activities
June - July	pre-positioning of seedlings
July - Sept.	transplanting of seedlings; supplementary watering if needed.
Sept. - Oct.	maintenance and seeding of live fencing
1985	(repeat of 1984 activities)
Jan. - June	extension activities
Dec.	mid-term evaluation
1986	(repeat of 1985 activities)
1987	(repeat of 1986 activities)
Dec.	final evaluation of project.

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III. PROJECT OVERVIEW:

A. PROJECT DEVELOPMENT:

The project was developed in response to the fuelwood shortage and deteriorating ecological conditions in eastern Sudan. While certainly not uniquely due to the influx of some 400,000 refugees from Ethiopia during the past decade, the existing problem was worsened by their arrival, and it has added to the burdens of their situation.

In response to this need, CARE-Sudan and the GOS Forestry Department prepared an initial project proposal during mid - 1981. After review, CARE-Sudan prepared a revised and condensed project profile in April, 1982. This was presented to the U.S. State Department RP team during their visit two months later, who approved the project in principal and urged CARE-Sudan to prepare a complete project proposal.

The project proposal was submitted to CARE Headquarters and AID/Sudan in July 1982, after a consultancy by ex-CARE Forester Michael McGahuey. The proposal addressed certain issues raised by CARE Headquarters and additional issues raised by AID/Sudan were addressed by follow-up correspondence.

However, in the light of further issues raised by CARE, AID/REDSO and AID/W, a team of three foresters, one from each unit, visited Sudan during November, 1982. The result of this consultancy, it is believed, addresses the remaining issues through the present proposal.

It should be noted that during all phases of the project design, CARE-Sudan has been in close contact and agreement with GOS Forestry Department, GOS Refugee Commissioner and UNHCR. In addition, extensive visits have been made to refugee and Sudanese villages, where inhabitants indicated their willingness to support a reforestation project.

B. PROJECT STRATEGY:

The project complements the policies and strategies of both GOS agencies and external donors with regard to reforestation activities as well as refugee settlements. To the knowledge of the project designers, it does not conflict with or duplicate any ongoing or planned activity in the project area. The following more specifically delineates GOS and other donor policies, strategies and activities.

1. GOS Strategy:

Until recently the basic philosophy of the GOS has been to conserve forest resources. This has resulted in a defensive posture by the Forestry Administration which is often in direct conflict with and unable to react to competing demands for Sudan's land resources. However, this posture recently has begun to change. For example, in August, 1982 the

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National Energy Agency in a widely circulated draft Energy Assessment, recommended integrating incorporation of trees into farming systems. Earlier the GOS Ministry of Natural Resources had promulgated a policy of retaining a portion of agricultural land for tree production. In the Northern province, occupied mostly by small holder farmers, this policy has been codified to require that 5 percent of cultivated land be set aside for tree growing. Shelterbelts or wind breaks and agroforestry are the most feasible and least obtrusive means of realizing this objective.

In the eastern region the GOS has three main objectives for the forestry sector. These are planting of trees for wood production along the Rahad River, halting the process of desertification that is taking place in large areas, and large scale planting of Acacia Senegal for provision of firewood, fodder and gum arabic. This project is clearly integrated with the first two objectives, and Acacia Senegal will be a principal species planted along with Acacia Seyal, both of which are suited to the project site and supply gum arabic and fuelwood production.

The GOS policy toward refugees is based on volutary repatriation whenever that becomes possible. Until such time, however, the GOS will host the refugees and help them strive toward economic self-sufficiency. In agricultural based settlements, this translates into maintaining land productivity and proximate, sustained-yield fuelwood supplies. The GOS has urged donor governments, intergovernmental, and voluntary organizations to provide special support for development programs in major refugee - affected areas.

2. Other Donor Programs:

a. UNSO Gum Belt Reforestation:

This project has established a successful model for smallholder agroforestry in the central gum belt region. In 1982 approximately 1.5 million Acacia Senegal seedlings will be distributed in the North Kordofan province. Although this model can not be replicated in the Eastern province because of its incompatibility with mechanized agriculture, it does demonstrate the GOS commitment to agroforestry systems.

b. USAID Energy Strategy:

In July 1982, USAID prepared a report on Bioenergy for the Sudan which recommended that a massive tree planting program should be a high priority for the GOS. The report also stated that the efforts of the Forestry Department to formulate programs to meet present and future firewood needs deserve support. An AID/Sudan energy project has begun which will assist the GOS in meeting national demands for energy.

c. UNHCR:

UNHCR is providing assistance to the refugee settlements in the project area in the form of tractors and other agricultural implements, water supply, etc. The reforestation effort will complement their activities by enhancing the prospects for refugee self-sufficiency.

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3. Related CARE Projects:

Development of a CARE project is underway to institute dissemination of fuel efficient wood/charcoal stoves in North Kordofan province. When an acceptable stove design is found and feasibility of local construction and dissemination is demonstrated, the Refugee Reforestation project will incorporate fuel efficient stoves into its forestry extension program.

C. PROJECT IMPACT:

1. Employment Generation:

The project will directly generate 423,000 person-days of labor in nursery and plantation activities. This is equivalent to $ 933,600 in 1982 dollars or 20% of the total project cost (including inflation). It is expected that the majority of the nursery and plantation staff will be refugees because of the proximity of the project sites to their camps.

In addition there are unquantitied direct employment benefits for the target group arising from construction of project buildings and incidental labor. There will also be a significant generation of employment in harvesting and marketing of wood and forest products, although this will not occur during the project life.

2. Fuelwood Production:

It is estimated that rural Sudanese burn between 1.0 and 1.5 m^3 of wood per person per year. At a conservative estimate of 4 m^3/ha/yr sustained yield of fuelwood on project plantations, the project will be able to supply 15,200 m^3 of fuelwood per year. With an estimated population of 15,000 in the targetted refugee camps, the project will be able to meet their basic fuelwood requirements. As there are some stands of natural forest which can produce 1-2 m^3/ha/yr and are accessible to the refugee and neighboring Sudanese population, the project will be able to make a significant contribution to the fuelwood needs of a much larger population.

3. Agricultural Productivity:

The project will introduce shelterbelts and agroforestry practices in the eastern region. Evaluation of CARE's shelterbelt project in Niger indicated that there was an increase of 23% in sorghum production over unprotected fields after allowing for a 6% reduction in cultivated land due to the windbreak lines. In addition it may be possible that windbreaks and agroforestry will allow cultivation for longer periods before fallowing. It may be possible to achieve a 33% increase, equivalent to an additional year of production during a typical cropping cycle.

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Some farmers have voiced concerns that trees will attract birds with a resultant crop loss. This has not been CARE's experience in Niger nor did it seem to be a problem with those farmers in the Gedaref region whose fields were close to natural forests. Indeed, it is hard to imagine that flocking birds, which would cause the only significant crop loss, would not travel considerable distances to reach a feeding grounds. Thus even though trees are proximate to cultivated fields, there should be little increase in crop loss.

4. Other Forest Products:

The reforestation accomplished during the project will generate positive impacts resulting from production of fodder, thorns for fencing, domestic construction wood, fruit, and gum arabic.

a. Fodder:

Many of the refugees brought their livestock to Sudan. Because of fodder scarcity these animals have not fared well. One farmer reported he had lost his entire herd of 180 sheep. Around Um Gargur their are numerous animal skeletons. The project will utilize species that provide nutritious fodder that can be used as a drought reserve.

b. Thorns:

Rural homes, both refugee and Sudanese, utililize thorn fences to restrict animal ingress and egress, i.e., to keep their neighbors animals out of their compound and to pen their own livestock at night.

These fences require considerable quantities of thorns to build and maintain. An additional burden is added to rural life by the long walks required to gather thorns. The project will have a positive impact by providing proximate sources of thorns and seeds that can be used for planting live fences.

c. Construction Wood:

The project will have another positive impact by providing larger dimension stock for use in building homes, donkey carts, furniture, etc. Demand of this size wood is high as it is preferred for charcoal production. The project will help ensure a supply proximate to the beneficiary group, thus reducing the cost of obtaining this wood and increasing the likelihood of their access to the supply.

d. Fruit:

The project will supply a small number of fruit seedlings to refugees for planting in their compounds. They can be irrigated with

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domestic waste water and fertilized with manure. The fruit will provide diversity to the rural diet and a greatly needed source of nutrition particularly vitamins.

e. Gum Arabic:

Both A. senegal and A. seyal produce the valuable gum arabic. This was once a major export crop of the Sudan and is becoming so again. It is estimated that one A. senegal tree can produce 125 gm of gum per year from years 5 through 25 when it can be cut for wood. The optimum spacing for mature gum trees is 6-8 m which would allow thinning of trees for fuelwood productic .

5. Rural Living Environment:

Shade trees planted around compounds, market places, clinics, schools and along paths and roads provide a welcome relief from the sun. Though the impact cannot be quantified, it is real and significant. Currently there are literally no shade trees in refugee villages and only a few in the Sudanese villages. This component of the project will foster good will of the beneficiaries toward project officials, instill a further appreciation of trees, and provide knowledge about the feasibility and means of tree planting and maintenance.

6. Women:

The project will benefit women by providing proximate sources of fuelwood, thus freeing them for other domestic tasks and/or income generating employment. It is expected that a considerable number of women will be employed in nursery and plantation labor. A further benefit to women will arise from the dissemination of fuel efficient cook stoves, which save labor in gathering fuelwood and/or cash and smoke less, a relief to cooks.

7. Institutional Strengthening:

The project will have a significant but unquantifiable positive impact on the effectiveness of the Forestry Department. Personnel will be better trained, better equipped, and have a newly defined, supportive relationship with the rural people of Kassala province. It is interesting to note that in the recent NEA Energy Assessment one of the most widely mentioned institutional benefits of the UNSO gum belt project was the provision of vehicles and fuel that enabled the Forestry Department to fulfill their mandate. The result of these changes will be increased prestige and improved moral of Department personnel. This should manifest itself in greater willingness to continue and to expand community reforestation and agroforestry initiatives.

D. PROJECT CONTINUITY:

Depending on the level of farmer acceptance of tree planting, and the socio-economic success of the reforestation models, the Forestry Department will hopefully continue operation of the project nurseries when external funding ceases.

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In the seventh year after project initiation, benefits from the harvest of fuelwood will begin to accrue. Experience in other community reforestation efforts have shown that farmers and villagers are more willing to pay for seedlings at this point. This could make the nurseries self-reliant. It is uncertain whether one can expect refugees at this time to make long-term investments such as the purchase and planting of seedlings as long as they retain hope of repatriation. However, in Showak and Abu Rakham there are sizeable Sudanese populations which could sustain these nurseries in the absence of refugees.

The recurrent costs of forest block plantations will be minimal after five years. Principal costs are associated with protection and maintenance of younger stands and the Forestry Department should have no problem absorbing this activity. While it is difficult to estimate the recurrent costs associated with shelterbelts and agroforestry plantations, the costs of their maintenance and protection are absorbed by farmer, thus the cost to the GOS will be only those of maintaining the nurseries. Plantations will have significant costs associated with harvesting but these will be more than covered from the proceeds of the harvest.

E. PROJECT POTENTIAL:

It has been discussed in detail above that the project will develop models for incorporating trees into the agricultural systems of the eastern region. These models must be both socially appropriate and economically feasible. As such the potential for project replication is good.

However, the project is designed to demonstrate the compatability of trees with agriculture. Beyond the target villages it does not foresee a widespread extension program. To do this, a follow-up project would be required. However, if successful models are developed, it is reasonable to expect that financing could be found for an expanded reforestation program.

F. PROJECT CONSTRAINTS:

1. Land Availability:

Reforestation programs have often meant the loss of farmland or pasture land and unfavorable reaction to this can be a project constraint. In the Sudan, the government in effect controls all land which, in the project area, it leases in turn to farmers. The government has already agreed to make enough land available to carry out the project. More important than this, however, is the project approach which will seek ways to integrate trees and agriculture and reduce the competition for land.

2. Labor Availability:

The project will utilize considerable numbers of refugees and Sudanese laborers, and labor availability could be a project constraint. The project employment calendar, however, complements the agricultural labor

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needs by providing considerable employment during the dry season when unemployment is highest. The project's peak labor requirements are for planting which does not compete significantly with the mechanized agriculture practised in the region.

Salaries to be paid by the project are in line with those paid in the area. In addition, as local refugee officials have pointed out, employment with the project will be much closer to the homes of the laborers and therefore more attractive than work on agricultural schemes far from their villages. Interviews with villagers have confirmed their willingness to work for the project in adequate numbers.

3. GOS Counterpart Availability:

A concern has been raised with regard to the availability of skilled Forestry Department personnel. This concern has been forwarded to the Forestry Department top officials, and assurances have been received that the personnel will be available.

BUDGET SUMMARY (IN U.S. DOLLARS)

Line	Item	FX/LC	1	2	3	4	5	Total
A	Vehicles (Capital costs).	FX	186,000	-	86,000	-	-	272,000
B	Vehicles (operating costs).	LC	19,000	34,000	34,000	39,100	41,000	167,000
C	Equipment & Materials.	FX	310,000	25,500	62,500	45,500	28,500	472,000
D	Buildings (rent & const.).	LC	36,500	41,500	41,500	41,500	41,500	202,500
E	Labor museries)	LC	3,600	11,600	11,600	14,400	14,400	55,600
F	Labor (plantat-ions).	LC	-	128,000	211,000	230,000	309,000	878,000
G	Internat-ional staff.	FX	223,000	153,000	163,000	153,000	153,000	845,000
H	Local Staff & Administration	LC	79,100	79,100	81,100	81,100	81,100	401,500
	Subtotals		857,200	472,700	690,700	604,500	668,500	3,293,600
	Inflation*		69,852	122,229	254,904	343,230	507,095	1,297,310
	Subtotals		927,052	594,929	954,604	947,730	1,175,595	4,590,910
	CARE/N.Y. Admin. (10%)		92,705	59,493	94,560	94,773	117,559	459,090
	Totals:		1,019,757	654,422	1,040,164	1,042,503	1,293,154	5,050,000

* Inflation assumptions:

FX, C.6% year 1, C.8% years 2-5 (compounded)

LC, labor costs, C.10% (compounded)

LC, non-labor costs, C.25% (compounded)

Breakdown of FX/LC:

1)	FX, lines A, C, G, inflation, CARE/N.Y. admin.	$ 2,337,500
2)	LC, lines B, D, E, F, H, inflation	2,712,500
		$ 5,050,000

Total project costs and contributions

AID	$ 4,550,000	86%	
CARE	500,000	9%	14%
GOS	241,477	5%	
Total	$ 5,291,477		

(See line I, page 24A for breakdown)

DETAILED EXPLANATION OF BUDGET

Line A - Vehicles (capital costs)

Item	Year 1	2	3	4	5	Totals
Four-wheel drive Pick-ups	(6) 78,000	-	(4) 60,000	-	-	138,000
85 h.p. tractors	(2) 50,000	-	-	-	-	50,000
Plows/discs	(2) 10,000	-	-	-	-	10,000
Flat bed trailers*	(2) 8,000	-	-	-	-	8,000
Water tankers*	(2) 20,000	-	-	-	-	20,000
Spare parts	20,000	-	26,000	-	-	46,000
TOTALS	186,000	-	86,000	-	-	272,000

* Local procurement items. All other are U.S. procurement.

Line B - Vehicle Operating Costs

Item	Year 1	2	3	4	5	Totals
Fuel	12,000	18,000	18,000	20,000	20,000	88,000
Maintenance	2,000	4,000	4,000	4,000	6,000	20,000
Truck rental for transport	5,000	12,000	12,000	15,000	15,000	59,000
TOTALS	19,000	34,000	34,000	39,000	41,000	167,000

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Line C - Equipment and Material

Item	Year 1	2	3	4	5	Total
Pump and engines	(2) 12,000	-	-	(1) 8,000	-	20,000
Operations and Maintenance	8,000	5,000	5,000	7,000	5,000	30,000
Nursery fencing	15,000	-	-	-	-	15,000
Nursery tools	10,000	-	-	5,000	-	15,000
Seedling carriers	-	2,000	2,000	2,000	-	6,000
Plastic bags	-	15,000	20,000	20,000	20,000	75,000
Seeds	-	1,500	1,500	1,500	1,500	6,000
Plantation fencing	185,000	-	-	-	-	185,000
Plantation tools	10,000	-	5,000	-	-	15,000
Furniture/ Fixtures	30,000	-	10,000	-	-	40,000
Office supplies	10,000	-	5,000	-	-	15,000
Shipping/ Inland freight	30,000	2,000	14,000	2,000	2,000	50,000
TOTALS	310,000	25,500	62,500	45,500	28,500	472,000

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Line D - Building Rental and Construction

Item	Year 1	2	3	4	5	Total
Gedaref office	12,000	12,000	12,000	12,000	12,000	60,000
Sub-offices (2)	12,000	12,000	12,000	12,000	12,000	60,000
Forestry staff housing (2)	5,000	5,000	5,000	5,000	5,000	25,000
VSO housing (3)	7,500	7,500	7,500	7,500	7,500	37,500
Miscellaneous huts/guard houses	-	5,000	5,000	5,000	5,000	20,000
TOTALS	36,500	41,500	41,500	41,500	41,500	202,500

Line E - Nursery Labor Force
(includes full time and seasonal)

Site	Year 1	2	3	4	5	Total
Showak	1,800	5,800	5,800	7,200	7,200	27,800
Abu Rakham	1,800	5,800	5,500	7,200	7,200	27,800
TOTALS	3,600	11,600	11,600	14,400	14,400	55,600

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Line F - Plantation Labor Force

Activity	Year 1	2	3	4	5	Total
Fencing: mandays	-	5,000	7,500	7,500	10,000	30,000
cost	-	12,000	18,000	18,000	24,000	72,000
Planting: mandays	-	50,000	75,000	75,000	100,000	300,000
cost	-	116,000	174,000	174,000	232,000	696,000
Maintenance:	-	-	8,000	16,200	23,000	47,200
mandays cost	-	-	19,000	38,000	53,000	110,000
Totals: mandays	-	55,000	90,500	98,700	133,000	377,200
cost	-	128,000	211,000	230,000	309,000	878,000

Note: Labor costs and mandays computed only for the block fuelwood plantations. Shelterbelts and agroforestry acreage will be planted at farmer's cost, with the project providing seelings and technical advice only.

Line G - International Staff

Position	Year 1	2	3	4	5	Total
CARE project mgr.	60,000	60,000	60,000	60,000	60,000	300,000
CARE administrator	55,000	55,000	55,000	55,000	55,000	275,000
Silviculturist (volunteer)	6,000	6,000	6,000	6,000	6,000	30,000
VSO (2)	12,000	12,000	12,000	12,000	12,000	60,000
Consultants (18 man months)	90,000	20,000	30,000	20,000	20,000	180,000
Totals	223,000	153,000	163,000	153,000	153,000	845,000

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Line H - Local Project Staff and Administration

Position	Year 1	2	3	4	5	Total
Driver (4)	6,000	6,000	8,000	8,000	8,000	36,000
Tractor driver (2)	1,500	1,500	1,500	1,500	1,500	7,500
Secretary	3,600	3,600	3,600	3,600	3,600	18,000
Accountant	4,000	4,000	4,000	4,000	4,000	20,000
Messenger (3)	2,000	2,000	2,000	2,000	2,000	10,000
CARE Admin. (Khartoum costs)	60,000	60,000	60,000	60,000	60,000	300,000
TOTALS	79,100	79,100	81,100	81,100	81,100	401,500

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Line I - GOS Project Inputs (in Kind and therefore not included in budget summary)

1. Forest Department Staff (Base salaries in US $)

Position	Year 1	2	3	4	5	Total
Conservator	3,250	3,250	3,250	3,250	3,250	16,250
Asst. Conservator (2)	4,350	4,350	4,350	4,350	4,350	21,750
Forest Rangers (4)	-	3,100	3,100	3,100	3,100	12,400
Overseas (4)	-	3,100	3,100	3,100	3,100	12,400
Nursery Supervisors (2)	1,550	1,550	1,550	1,550	1,550	7,750
Administrative Support	1,830	3,070	3,070	3,070	3,070	14,110
Subtotal	10,980	18,420	18,420	18,420	18,420	84,660
Inflation	1,372	4,942	7,981	11,481	15,656	41,432
Totals	12,352	23,362	26,401	29,901	34,076	126,092

2. Land value to Government

Total land assigned by GOS to project is 10,000 feddans. Government lease charges per feddan per year should be LS. 3 per year.

10,000 feddans x LS 3 x 5 years = LS 150,000 ÷ 1.3 (LS/US $) $115,385

3. Total GOS inputs:

1. $126,092
2. $115,385

$241,477

IV. PROJECT IMPACT

A. Social Soundness:

It should be patently obvious that the principal beneficiaries of the project will be the rural poor, both refugee and Sudanese. The lack of forest products in Kassala Province is at present felt principally by both the rural and urban poor. The former must go increasingly longer distances to secure fuel, fodder, and building materials, while the latter must pay higher prices for these items due to increased transport costs. Small animal herds which provide protein and income for the village family are being reduced or sold due to the lack of perennial plants and trees on which to browse for fodder. Thus, provision of a proximate source of fuel-wood, fodder, and construction materials will immediately benefit both rural and urban poor, in terms of money and energy expended.

Charcoal production from GOS forest reserves is contracted out by the Forestry Department. The sales price and quantities purchased of the final product are also controlled by the Forestry Department, to avoid price gouging by unscrupulous merchants. This project will ensure not only a near-by fuelwood and fodder supply for the refugees, but a reasonably-priced charcoal supply for town dwellers of Gedaref and Showak.

The nourishing effect on the soil provided by the woodlots and, more importantly, the shelterbelts will provide benefits to farmers in the area through increases in crop yields and reduction of soil erosion from the wind. The extension facet of the project will encourage both small and large farmers to plant woodlots and windbreaks.
The nurseries will provide seedlings to private farmers to enable them to carry out this program.

To summarize the chain of beneficiaries and benefits from the program, they are as follows:

1) Refugees and low-income Sudanese farmers:

   a) Earnings of more than US$ 800,000 over the five-year life of the project.

   b) Near-by source of fire-wood, construction materials, fodder, and thorn fencing beginning seven years from the inception of the project.

   c) The opportunity to earn additional income through producing and selling charcoal under Forestry Department supervision.

   d) Increases in crop yields in lands proximate to the tree plantings as a result of increased soil fertility and reduction of topsoil losses through wind erosion.

   e) Improvement in the settlement and village living environment through the planting of shade trees produced by the nurseries.

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2) Town Dwellers.

a) Increased availability of charcoal and building materials at reasonable prices.

3) Private Sector:

a) Increased opportunity to produce and market charcoal.

B. Institutional Capability of Forestry Department:

That the GOS Forestry Department has the capability to carry out the plantation project, given the requisite assistance of capital inputs, has been demonstrated in North Kordofan in the UNSO project to restock the gum arabic belt. The Department has sufficient capable human resources, but is woefully lacking in funds for the capital and logistic needs of even its existing programs. Provision of the equipment for this program will have a wide-ranging impact on their ability to carry-out other projects in the region.

Partly as a result of lack of funds, the Forestry Department's extension service has been inadequate in recent years. This project will, in addition to improving the logistic capacity of the Department, work to increase the quantity and quality of the extension service in Kassala Province. The CARE staff will work closely with the Forestry Department staff to up-grade its extension service, and introduce techniques which have proven successful in other CARE programs of a similar nature.

The combination of increased logistical capacity, improved and broadened extension service, and the addition of two multi-purpose nurseries, should enable the Forestry Department in Kassala to provide better and more extensive services to farmers and villagers in the Province far beyond the life of this project. The recurrent costs to the Forestry Department of maintaining the forest plantations will be almost nil. Harvesting of wood products for charcoal production is done by contract, with the proceeds going to the Forestry Department to finance supervision and maintenance. These funds will be sufficient to maintain the two nurseries after the five-year project period ends. The nurseries will continue to provide seedlings for private farmers and future forest reserves.

C. Ancillary Programs:

In view of the fact that the vast majority of Sudanese now use, and will continue to use for the immediate future, renewable energy resources for cooking purposes, this project will also seek to incorporate the efforts of CARE and other agencies working in the field of fuel-efficient cookstoves and charcoal kilns. While it is impossible to say at this stage just how such efforts will be incorporated, CARE will maintain close contact with the National Energy Administration and others in an attempt to discover a mechanism for inclusion of the introduction of energy-efficient cookstoves and charcoal producing kilns in the project.

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While the principal results expected from the project are immediate income and fuel-wood availability, the extension service improvement should not be neglected in examining the objectives. CARE and the Forestry Department will work with private farmers and villagers to encourage them to establish private woodlots for fuel-wood, construction material, and fodder production. Windbreaks for large machanized farm areas will also be encouraged to avoid wind erosion and enhance soil fertility. The multi-purpose nurseries will make available seedlings to interested farmers and villagers for these purposes both during the life of the project and after. Village meetings, planting of demonstration plots, and possibly audio-visual materials will be utilized to popularize the idea of woodlots and windbreaks.

D. Economic and Financial Analysis:

1. Economic Analysis:

The model selected for the economic analysis envisions clear felling of all block fuelwood plantations seven years from their inception. While the intention is to allow these forest reserves to remain standing for 25 years in order to continuously produce fodder and gum arabic, and to then cut them for charcoal, it was felt that a "worst-case" analysis of cutting after seven years should be presented. Therefore, fodder and gum arabic yields are those from shelterbelt and agrisilviculture programs after year eleven. It should be noted that by leaving the block plantations standing for one complete cycle (25-28 years), fodder and gum arabic returns will remain at a much higher level, and returns for charcoal would appear in year 24. Also, no returns for fuelwood or charcoal have been shown for the agroforestry plantations.

A shadow rate of U.S.$ 1.00 = LS. 1.6 has been used for the analysis. Local currency project costs have been converted at this rate, while dollar costs have been shown as actuals.

No provision has been made for inflation, although mention should be made of the fact that the charcoal/ fuelwood price has increased by 800% in the last ten years in the Sudan. Based upon this fact, and the increasing scarcity of this commodity, it is felt that the inflation rate of the benefits will be higher than that of the costs, thereby giving an even higher internal rate of return if inflation had been taken into account.

2. Financial Analysis:

The financial analysis has been done in two parts: benefits to the GOS (Forestry Department) and benefits to the individual farmer. The former has been done in two ways: clear-felling of block plantations commencing after year 7 (to match the economic analysis), and continuation of the block plantations for 28 years. In both, constant 1982 values have been used for land (lease value), and for benefits (charcoal, fodder, gum arabic), with no provision for inflation.

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The financial analysis for the individual farmer assumes a five-year production/fallow cycle for sorghum. No increase in crop yields has been shown on the benefits side, although increased crop yields are expected as a result of adoption of agroforestry techniques. Also, no provision has been made for inflation in any of the costs or benefits.

The financial analysis under both scenarios for the forest Department (the charcoal model and the fuelwood model) clearly indicate that the benefits derived from either of these approaches as a result of the project are more than sufficient to offset the recurrent operating costs after the life of the project. Thus there is a definite positive financial return to the forest Department.

ECONOMIC ANALYSIS

(In U.S. Dollars)

Shadow Rate U.S.$ 1 = LS. 1.600

YEAR	COSTS CAPITAL (1)	COSTS OPERATING (1)	COSTS VALUE OF FOREGONE OUTPUT SORGHUM PRODUCTION (M.T.) (2)	COSTS VALUE $ 117/MT (NET) (3)	TOTAL COSTS	FEDDANS PLANTED BLOCK	FEDDANS PLANTED SB/AS	BENEFIT BLOCK M^3 (6)	BENEFIT YIELDS VALUE $19/$M^3$	BENEFIT SB/AS M^3	BENEFIT SB/AS YIELDS VALUE $19/$M^3$ (7)	BENEFIT FODDER ANIMAL UNITS (8)	BENEFIT FODDER VALU $113
1	532,500	395,738	-0-	-0-	928,238								
2	67,000	427,942	,438	19,996	514,938	1000	250						
3	190,000	538,733	1,225	55,825	784,558	1500	750						
4	87,000	544,228	2,275	103,675	734,903	1500	1500					1250	141,
5	70,000	624,848	3,500	159,500	854,348	2000	1500					3500	395,
6		(4)50,000	3,500	159,500	209,500							6500	734,
7		(4)18,800	3,062	139,504	158,304							10000	1,130,
8		(5) 6.556	1,838	83,796	90,352			14,000	266,000	125	2375	9000	1,017,
9		(5) 8,975	0,438	19,996	28,971			21,000	399,000	500	9500	7500	847,
10		(5) 9,313	-0-	-0-	9,313			21,000	399,000	1250	23750	6000	678,
11		(5)11,900	-0-	-0-	11,900			28,000	532,000	2000	38000	4000	952,
12		2,900	0,438	19,996	22,896					2000	38000	4000	452,
13		2,563	1,225	55,825	58,388					1250	23750	4000	452,
14		2,225	2,275	103,675	105,900					500	9500	4000	452,
15		2,056	3,500	159,500	161,556					125	2375	4000	452,
16		2,000	3,500	159,500	161,500							4000	452,
17		2,000	3,062	139,504	141,504							4000	452,
18		2,000	1,838	83,796	85,796							4000	452,
19		2,000	0,438	19,996	21,996							4000	452,
20		2,000	-0-	-0-	2,000							4000	452,
21		2,000	-0-	-0-	2,000							4000	452,
22		2,000	0,438	19,996	21,996							4000	452,
23		2,000	1,225	55,825	57,825							4000	452,
24		2,000	2,275	103,675	105.675							4000	452,
25		2,000	3,500	159,500	161,500							4000	452,
26		2,000	3,500	159,500	161,500							4000	452,
27		2,000	3,062	139,504	141,504							4000	452,
28		2,000	1,838	83,796	85,796							4000	452,

TOTAL COSTS 5,824,657

LS 25.000/Feddan Sorghum Production Costs (Labor & Capital)

ECONOMIC ANALYSIS (In U.S. Dollars)

Shadow Rate U.S.$ 1 = LS. 1.600

)UTPUT :ODUCTION :)	VALUE $ 117/MT (NET) (3)	TOTAL COSTS	FEDDANS PLANTED BLOCK	SB/AS	BENEFITS BLOCK M^3 (6)	YIELDS VALUE $19/M^3	SB/AS M^3	YIELDS VALUE $19/M^3 (7)	FODDER ANIMAL UNITS (8)	VALUE $113/UNIT	GUM ARABIC YIELD KGS (9)	VALUE $0.38/KG	TOTAL BENEFITS	NET
	-0-	928,238												- 928,238
38	19,996	514,938	1000	250										- 415,938
25	55,825	784,558	1500	750										- 784,558
75	103,675	734,903	1500	1500					1250	141,250			141,250	- 953,653
00	159,500	854,348	2000	1500					3500	395,500			395,500	- 458,848
00	159,500	209,500							6500	734,500	24,562	9,334	743,834	534,334
52	139,504	158,304							10000	1,130,000	68,774	26,134	1,156,134	997,830
38	83,796	90,352			14,000	266,000	125	2375	9000	1,017,000	127,724	48,535	1,333,910	1,243,558
38	19,996	28,971			21,000	399,000	500	9500	7500	847,500	176,849	67,203	1,323,203	1,294,232
-	-0-	9,313			21,000	399,000	1250	23750	6000	678,000	147,374	56,002	1,156,752	1,147,439
-	-0-	11,900			28,000	532,000	2000	38000	4000	952,000	117,899	44,802	1,066,802	1,054,902
38	19,996	22,896					2000	38000	4000	452,000	78,599	29,868	519,868	496,972
25	55,825	58,388					1250	23750	4000	452,000	78,599	29,868	505,618	447,230
75	103,675	105,900					500	9500	4000	452,000	78,599	29,868	491,368	385,468
00	159,500	161,556					125	2375	4000	452,000	78,599	29,868	484,243	322,687
00	159,500	161,500							4000	452,000	78,599	29,868	481,868	320,368
52	139,504	141,504							4000	452,000	78,599	29,868	481,868	340,364
38	83,796	85,796							4000	452,000	78,599	29,868	481,868	396,072
38	19,996	21,996							4000	452,000	78,599	29,868	481,868	459,872
-	-0-	2,000							4000	452,000	78,599	29,868	481,868	479,868
-	-0-	2,000							4000	452,000	78,599	29,868	481,868	479,868
38	19,996	21,996							4000	452,000	78,599	29,868	481,868	459,872
25	55,825	57,825							4000	452,000	78,599	29,868	481,868	424,043
75	103,675	105,675							4000	452,000	78,599	29,868	481,868	376,193
00	159,500	161,500							4000	452,000	78,599	29,868	481,868	320,368
00	159,500	161,500							4000	452,000	73,687	28,001	480,001	318,501
52	139,504	141,504							4000	452,000	58,950	22,401	474,401	332,897
38	83,796	85,796							4000	452,000	29,475	11,201	463,201	377,405
	TOTAL COSTS	5,824,657											(10) TOTAL BENEFITS	15,454,765 9,630,108

ction Costs (Labor & Capital)

IRR = 15.9

ECONOMIC ANALYSIS

FOOTNOTES

1) Costs: U.S. dollar figure for local project costs (first five years) calculated at U.S.$ 1 = LS. 1.6 (shadow rate). No inflation factor included in either costs or benefits, since the model assumes the inflation rate will affect foregone output (opportunity) costs and benefits equally. GOS contributions of land and personnel not included in operating costs for first five years, but valued at approximately U.S.$ 200,000 for this period.

2) Shadow rate of U.S.$ 1 = LS. 1.6 used for calculating foregone output costs and all economic benefits.

3) If project land were planted in sorghum, average yield would be 0.35 mt/feddan. Unit farmgate price is LS. 15/80kg or LS. 187,50/mt = U.S.$117/mt. Model assumes sorghum production for five year cycles with five year fallow periods. In reality, land is often not re-usable due to high cost of rehabilitation, so figures are probably high.

4) Operating costs in years 6 and 7 are basically recurrent costs of plantation maintenance (same as years 4 and 5) plus $ 2000 for supervisory and miscellaneous costs. Labor costs are estimated tc be LS. 5 for maintenance and LS. 3 for other operations. Although maintenance of the Shelterbelt/Agroforestry (SB/AS) systems will be provided by leaseholders without cost, this shadow cost has also included in maintenance costs.

5) Harvest costs are estimate at LS. 0.95/m^3 (stumpage) including LS. 0.10 town improvement tax and LS. 0.10 development tax. Shadow harvesting costs for SB/AS systems were included in the analysis. Harvest costs do not include marketing costs as no information available. One might assume that marketing costs might add an additional LS. 1.000 - 2.000/m^3 to the stumpage price.

6) Yields: mean average increment is estimated to be 2.0m^3/feddan/year or a standing volume of approximately 14 m^3/feddan after seven years. This is a conservative figure, since actual yields should be about 18 m^3/feddan, with a mean annual increment of 2.5 m^3/feddan/year.

7) The wholesale price of fuelwood in the Gedaref area is LS. 9-15/m^3. Actual retail price as estimated by the National Energy Administration at 2-3 times the wholesale price. A conservative figure of LS. 30.000 (U.S.$ 19.00/m^3) was taken as an average.

8) Fodder: The Ministry of Agriculture estimates that one feddan of unimproved rangeland in the Gedaref area can produce 0.15 tons of usable forage per year. Improved fodder production using acacia seyal and senegal can

· CONT. -

increase yields to 1.0 - 1.5 tons/feddan/year. A yield of 1 ton/feddan/year or one animal unit was used in the model. Value of one animal unit per year is LS. 180 = U.S.$ 113. No estimates available for cost of harvesting or marketing fodder.

9) Gum Arabic: Benefits for gum arabic were calculated assuming an average of 262 trees/feddan (4 x 4 meter spacing). With 60% of the trees gum producing species, one gum tree yields 125 grams/year from years 5-25. Market value of gum arabic is LS. 27/100lbs or U.S.$ 0.32 per kilogram. No estimate available for costs of harvesting gum arabic.

10) Apart from the measurable benefits, those which are unquantifiable include reduced soil erosion, increased crop yields, production of thorns for fencing, production of construction poles, improvement in the environment of the villages and refugee settlement, and income generation among the refugees.

FINANCIAL ANALYSIS

(In Sudanese Pounds)

FORESTRY DEPARTMENT

ASSUMES GUM ARABIC & CHARCOAL PRODUCTION FOR 28 YEARS

YEAR	COSTS			FEDDANS		BENEFITS							NET
	OPERATING COSTS (1)	LAND VALUE (2)	TOTAL	ANNUAL	CUMULATIVE	FODDER ANIMAL UNITS (3)	FODDER VALUE	CHARCOAL BAGS (4)	CHARCOAL VALUE	GUM ARABIC KILOS (5)	GUM ARABIC VALUE	TOTAL BENEFITS	
1	14.274		14.274										- 14.279
2	23.946	3.000	26.946	1000	1000								- 26.946
3	23.946	7.500	31.446	1500	2500								- 31.446
4	23.946	12.000	35.946	1500	4000	1000	18.000					18.000	- 17.946
5	23.946	18.000	41.946	2000	6000	2500	45.000					45.000	3.054
6	21.528	18.000	39.528		6000	4000	72.000			19.650	2.358	74.358	34.830
7	3.300	18.000	21.300		6000	6000	108.000			49.125	5.895	113.895	92.595
8	3.300	18.000	21.300		6000	6000	108.000			78.600	9.432	117.432	96.132
9	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
10	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
11	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
12	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
13	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
14	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
15	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
16	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
17	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
18	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
19	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
20	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
21	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
22	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
23	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
24	3.300	18.000	21.300		6000	6000	108.000			117.900	14.148	122.148	100.848
25	3.300	18.000	21.300		5000	5000	90.000	85.000	51.000	98.250	11.790	152.790	131.490
26	3.300	15.000	18.300		3500	3500	63.000	127.500	76.500	68.775	8.253	147.753	129.453
27	3.300	10.000	13.800		2000	2000	36.000	127.500	76.500	39.300	4.716	117.216	103.416
28	3.300	6.000	9.300		-	-	-	170.000	102.000	-	-	102.000	92.700
		TOTAL COSTS	636,186						TOTAL BENEFITS			2842,812	2206,626

IRR = 38.7

FINANCIAL ANALYSIS

Footnotes (Forestry Department; Charcoal Model)

1) Operating cost: assumes nursery ceases to operate after year five. In actuality, nurseries will contenue to function for agroforestry program.

2) Land value: Present lease value of Land set at LS. 3.000 per feddan.

3) Fodder: value calculated at LS. 180 per feddan per year, or equivalent of one animal unit. Assumes 10% of value will accrue to the Forestry Department for grazing and /or harvesting rights.

4) Charcoal: market price is LS. 3.50 per bag (100 lbs). Production calculated at 85 bags per feddan. Assumes LS. 0.600 per bag accrues to Forestry Department for harvesting rights and royalties. (average tender price)

5) Gum arabic: present market value LS. 0.600/kilo. Assumes 20% of market value accrues to Forestry Department for harvesting rights.

FINANCIAL ANALYSIS

(In Sudanese Pounds)

FORESTRY DEPARTMENT

ASSUMES CLEAR FELLING OF BLOCKS FOR FUELWOOD

YEAR	COSTS				BENEFITS (NET)					
	OPERATING COSTS (1)	LAND VALUE (2)	TOTAL	FEDDANS PLANTED (BLOCK)	FUELWOOD m^3 (3)	YIELD LS. 6 /m^3	FODDER ANIMAL UNITS (4)	LS 18/UNIT	TOTAL	NET
1	14,274	-	14.274							- 14,274
2	23,946	3,000	26,946	1000						- 26,946
3	23,946	7,500	31,446	1500						- 31,446
4	23,946	12,000	35,946	1500			1000	18,000	18,000	- 17,946
5	23,946	18,000	41,946	2000			2500	45,000	45,000	3,054
6	21,528	18,000	39,528				4000	72,000	72,000	32,472
7	21,528	18,000	39,528				6000	108,000	108,000	68,472
8	3,300	18,000	21,300		14,000	89,000	5000	90,000	174,000	152,700
9	3,300	15,000	18,300		21,000	126,000	3500	63,000	189,000	170,700
10	3,300	10,500	13,800		21,000	126,000	2000	36,000	162,000	148,200
11	3,300	6,000	9,300		28,000	168,000			168,000	158,700
		TOTAL COSTS	292,314						936,000	643,686

IRR = 39.4

FINANCIAL ANALYSIS

Footnotes (Forestry Department; Fuelwood Model)

The model assumes clear felling of all block fuelwood plantations by year 10.

1) Operating costs: assumes for purposes of this analysis that nurseries cease to operate after year five. In actuality, nurseries will continue to operate to provide seedlings for agroforestry program.

2) Land value: present lease value of land set at LS. 3.000 per feddan.

3) Fuelwood: assumes yields of 14 m^3 per feddan. Estimates that 20% of market value will accrue to Forestry Department for clearing rights, etc.

4) Fodder: value calculated at LS. 180 per feddan per year, or equivalent of one animal unit. Assumes 10% of value will accrue to Forestry Department for grazing and/or harvesting rights.

FINANCIAL ANALYSIS

(In Sudanese Pounds Per Feddan)

INDIVIDUAL FARMER

	WITHOUT PROJECT						WITH PROJECT					
YEAR	CAPITAL & LABOR COSTS	LAND COSTS	NET PROFIT FOREGONE OUTPUT (OPPORTUNITY)	GROSS TOTAL	NO. FEDDANS YR	SB/AS CUM	FODDER (1)	CHARCOAL (2)	GUM ARABIC (3)	SORGHUM	TOTAL	NET
2	22.000	3.000	25.400	50.400	250	250				47.380	47.380	- 3.020
3	22.000	3.000	25.400	50.400	750	1000				47.380	47.380	- 3.020
4	22.000	3.000	25.400	50.400	1500	2500	9.790			47.380	57.170	6.770
5	22.000	3.000	25.400	50.400	7500	4000	9.790			47.380	57.170	6.770
6	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
7						4000	9.790		0.350		10.140	10.140
8						4000	9.790		0.350		10.140	10.140
9						4000	9.790		0.350		10.140	10.140
10						4000	9.790		0.350		10.140	10.140
11						4000	9.790		0.350		10.140	10.140
12	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
13	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
14	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
15	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
16	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
17						4000	9.790		0.350		10.140	10.140
18						4000	9.790		0.350		10.140	10.140
19						4000	9.790		0.350		10.140	10.140
20						4000	9.790		0.350		10.140	10.140
21						4000	9.790		0.350		10.140	10.140
22	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
23	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
24	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
25	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
26	22.000	3.000	25.400	50.400		4000	9.790		0.350	47.380	57.520	7.120
27						4000	9.790		0.350		10.140	10.140
28						4000		8.930			8.930	8.930
			TOTAL COSTS	756.000					TOTAL BENEFITS		962.290	206.290

IRR = 24.9

FINANCIAL ANALYSIS

Footnotes (Individual Farmer; Agroforestry)

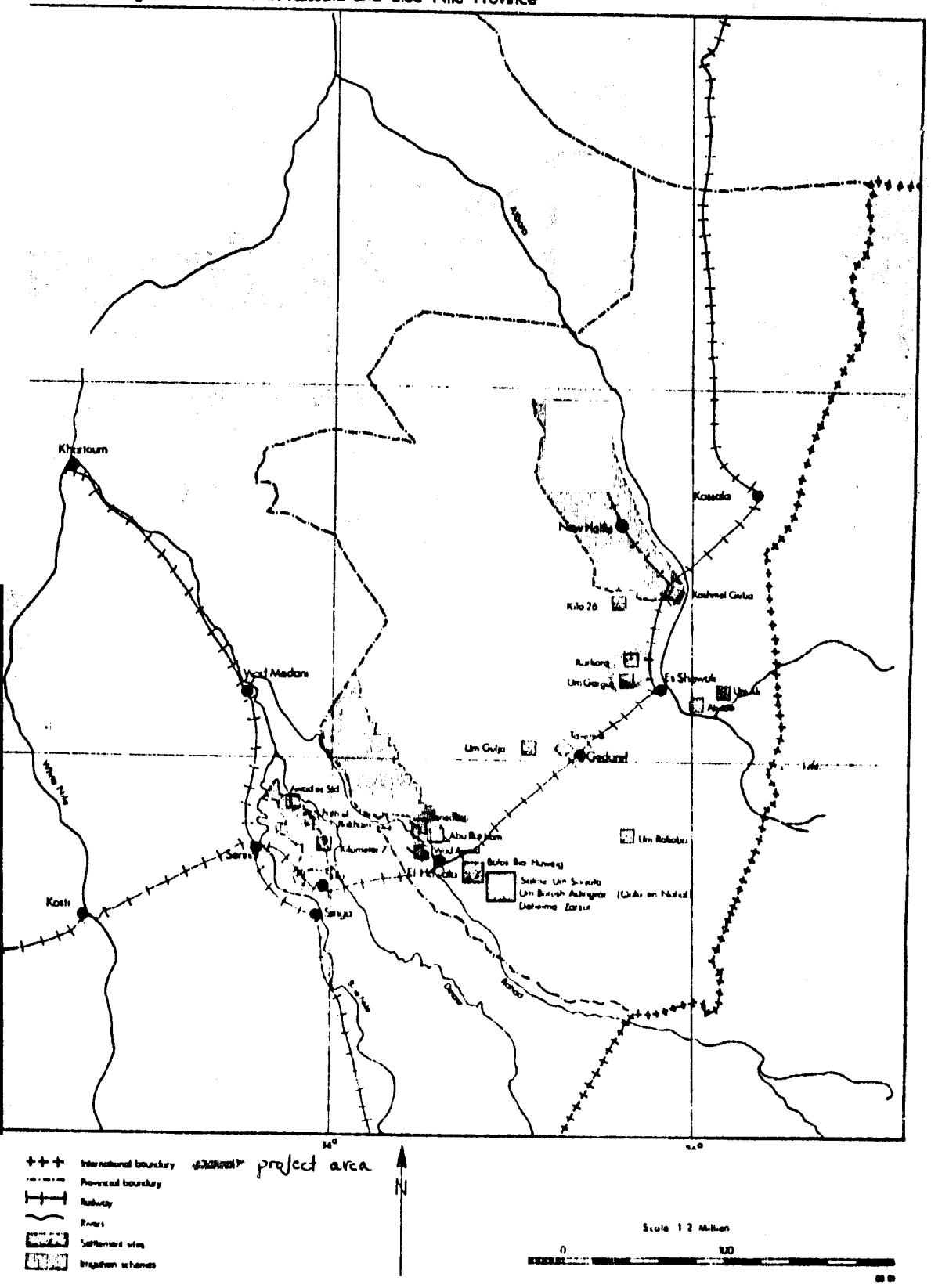
1) Fodder: yield calculated at one ton per feddan per year equal to one animal unit. Value calculated at LS. 180 per ton x 6% of land used for agroforestry = LS. 10.80. Harvesting costs calculated at 5.6 man days per feddan x LS. 3 per man day x 6% = LS. 1.010 labor costs for net value of LS. 9.790.

2) Charcoal: assumes farmer will receive 50% of market price of LS. 3.500 per bag. Assumes yield of 85 bags per feddan x 6% = 5.10 bags per feddan x LS. 1.750 per bag = LS. 8.930.

3) Gum arabic: yield is calculated at 19.65 kilos per feddan x 6% = 1.18 kilos. Assumes 50% of market price of LS. 0.600 kg. accrues to farmer or 1.18 x 0.300 = LS. 0.350 per feddan.

4) Dura: assumes 6% reduction in output. No provision for increased yields as result of agroforestry efforts.

rganised refugee settlements in Kassala and Blue Nile Province



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