

**GLOBAL
ENVIRONMENT
FACILITY**

Sudan

**Community-Based Rangeland Rehabilitation
for Carbon Sequestration and Biodiversity**

Project Document

*This Project Document has been edited to facilitate public dissemination.
The original is on file in the GEF Office at UNDP Headquarters in New York.*



ABBREVIATIONS

ADS	Area development schemes
CAHW	Community animal health workers
CCPP	Contagious caprine pleuro-pneumonia
CTA	Chief Technical Advisor
FAO	Food and Agriculture Organization of the United Nations
FAR	Fellowship for Africa Relief
FINNIDA	Finnish Department of International Development Cooperation
FNC	Forest National Corporation
GCCC	Government cash counterpart contribution
GPS	Global positioning systems (device)
ha	Hectare
NGO	Non-governmental organization
NTA	National Technical Advisor
OPS	Office of Project Services
PCQ	Point center quarter (method)
PPER	Project Performance Evaluation Report
RC	Rural council
RPA	Range and Pasture Administration
UNIFEM	United Nations Development Fund for Women
UNSO	United Nations Sudano-Sahelian Office
WFP	World Food Programme

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UNITED NATIONS DEVELOPMENT PROGRAMME

GLOBAL ENVIRONMENT FACILITY

Project of the Government of Sudan

Title:	Community-Based Rangeland Rehabilitation for Carbon Sequestration and Biodiversity
Number:	SUD/93/G31
Duration:	Five years
Project Site:	Gireigikh Rural Council, North Kordofan
UNDP Sector:	Environment
Subsector:	Land-use planning and development
Implementing Agency:	Range and Pasture Administration
UNDP Approval:	August 1994
Government Inputs:	Sudanese pounds (£S) 28,858,600 (in cash) ¹
GEF Inputs:	US\$ 1.5 million

Brief description:

This project will help reduce global warming by establishing a sustainable, local-level natural resource management system that stores and sequesters carbon. The management system will enhance biodiversity by rehabilitating rangelands and by preventing further land degradation. The project will test a model for community-based natural resource management that uses participatory techniques to promote long-term ecological objectives, and short-term economic objectives. The management model also tests the collaboration of sedentary and mobile populations.

¹ Excludes contribution to be arranged through government cash counterpart contribution (GCCC). The United Nations official exchange rate at the date of last signature of the Project Document was US\$ 1.00 = £S 338.

A. CONTEXT

1. Description of subsector

The Sudan covers about 2.5 million square kilometres. Rainfall increases from north to south, and the agro-ecological zones range from the desert and semi-desert of the extreme north to semi-humid savanna and humid subtropical woodland of the south. Land use in the north is characterized by highly mobile pastoral systems—animals are moved seasonally between the north and the wetter south. The center of the Sudan and much of the south is characterized by a sedentary agropastoral system where only the surplus livestock are moved seasonally. There are also pockets of non-pastoral agriculturalists in the south. Almost all regions have small-scale irrigated farms along riparian areas and mechanized dry farming on Goz (sandy steppes) and clay plains. Large-scale, irrigated farms occur in the center and eastern regions.

The population of the Sudan was estimated at 25 million in 1993, growing at a rate of 3.1 percent per year since 1955. Of the estimated labour force of 7.4 million in 1985, 80 percent are in rural areas, and of that group about 83 percent are engaged in agricultural activities. Rural-urban migration is occurring at a high rate, triggered by the prolonged effects of the droughts, the influx of refugees, and civil strife in the south. Seasonal migrant labour is estimated at 1.5 million people per year, however, many of these people are now choosing to remain permanently in shanty towns around the large irrigated schemes and other sources of seasonal employment.

At the present time, the government of the Sudan is faced with low revenue and increasing government expenditures. Inflation increased from 7.2 percent in 1965-73 to over 100 percent since 1990. Development expenditure is declining as a proportion of GDP. The share of agriculture in government spending dropped from 26.1 percent in 1985-86 to 25 percent in 1987-88. In 1989, the agricultural sector contributed 36.5 percent of the GDP. Of this, 31.6 percent was contributed by the livestock subsector and 13.2 percent by rainfed traditional farming.

The livestock population in the Sudan in 1987 was estimated at 22.4 million cattle, 19 million sheep, 14 million goats, and 3 million camels. This is equivalent to one livestock unit (LSU) for every two people, making the Sudan one of the richest livestock-owning countries in Africa. The majority of these livestock depend on natural rangelands and to a smaller extent on crop residues. Rangelands are estimated to cover about 60 percent of the total area of the country, however, recent estimates are unavailable.

The 1983 census classified 10.5 percent of the total population as "rural nomadic" or pure pastoralists. The number of people that can be classified as agropastoralists (where livestock comprises at least 50 percent of their economic activity) is unknown, but is probably more than 50 percent. All pastoralists, whether pure or agro, can be divided into two groups: cattle-owning (baggara), or camel-owning (abbala). All pastoralists have sheep and goats in addition to the large ruminants. The abbala homeland is generally to the north of a line drawn between El Obeid and El Fasher, while baggara are to the south.

In rural Sudan, land use follows historically derived tribal territories, where each tribe dominates over a specific territory called dar. Within the dar, each clan and subclan has specific

rights to certain areas. Although other people can use someone else's dar, this can only be done after seeking permission from the relevant traditional authority. This system applies both to sedentary communities and to mobile pastoral communities.

The system of Native Administration evolved by the British and later adapted by the government is based on this traditional system of territorial rights and affiliations. This system has a three-tier hierarchy, where the Nazir, or tribal chief, presides over the dar. The dar is divided into several omodiyas, each of which is presided over by an Omda who represents groups of clans. Each omodiya is divided into smaller units presided over by a clan or subclan leader called Sheikh.

The Native Administration was abolished in 1969 and replaced with a centralised system of local government, whose officers were appointed by the government. This system's inadequacy in dealing with local problems in effect resulted in a rural administrative vacuum on the part of the government, although the traditional system continued to function. By 1990, the government decided to reinstate the Native Administration, and passed a law to that effect. The Native Administration is now responsible for judicial matters, tax collection, grassroots execution of development activities, enforcement of laws and ordinances, and the reporting of security matters to local government officials.

The local government system of state governors, provincial commissioners, rural councils and village councils has survived from the pre-1987 era, though in a slightly modified form. A local government appointee heads each council assisted by elected representatives from the local area (leaders in the Native Administration system) and appointed representatives of the new salvation committees. This local government structure is responsible for security, food rationing, marketing activities, local government services, organisation and administration of relief aid, and the enactment of local laws and ordinances.

The local government institutional structure is presently in a high state of flux due to frequent redrawing of provincial and state boundaries, and frequent changes in posting. In contrast, the traditional system at the grassroots level has remained relatively unchanged and is generally more stable politically.

The 1970 Unregistered Land Act of Sudan stated that all unregistered land is state-owned, but the local people have usufruct rights to it. This applies to rangelands and other uncultivated or nonresidential land. However, in practice, the customary system of land tenure defines the use of these communal lands. The traditional system of alliances and reciprocity ensures a fluid, yet well-organised system of exchange of land rights: alliances between tribes are usually established through negotiations between the Nazirs of the tribes. This establishes the right of the respective people to use each other's land without seeking permission every time. It is usually done on the basis of need and carrying capacity of the land. Temporary use of someone else's land, perhaps as a result of an emergency or a drought year, can be negotiated on a yearly or seasonal basis between the Nazirs or Omdas. Unwritten "records" are meticulously kept on favors given and obligations of reciprocity. Finally, rights to use land as a passage during transhumance are generally not regulated. Anyone is free to pass through land and use its resources, but only for the time it takes to pass through.

2. Host country strategy

Although the government's agricultural policies have continuously emphasised the development of irrigated and mechanised rain-fed cultivation, the Comprehensive National Strategy 1992-2000 (CNS), emphasises food security through increased food production. The CNS also seeks to decentralise through a federal system, to promote privatisation, and to reduce state controls. However, the CNS has little provision for encouraging and developing smallholder production systems, even though the government remains concerned with conservation, sustainable production, and the plight of drought-affected people. This is particularly visible at the regional government level. The pastoral sector is seen as an important contributor to the national GDP, and as the basis for employment of a large proportion of the population. Elements of a pastoral development programme are included in the sectoral plans and projects of most line ministries. In particular, the agricultural policy recently drafted by the United Nations Food and Agriculture Organisation (FAO), the proposal for strengthening the institutional setting in the Livestock Development Project (FAO Investment Center/World Bank), and the land use map being developed by the Land Use Department are attempts to cover the complex issue of pastoral development from several angles. However, there is no overall coordination of these various efforts under a comprehensive national pastoral development strategy.

The North Kordofan Regional Ministry for Agriculture has a specific unit to address drought elimination and food security for the area. Its policy at present is to sedentise and destock the northern areas (north of Sodiri) and to establish oasis-type economies in favorable wadis (seasonal rivers) and around boreholes, where crop cultivation and irrigated produce will be emphasised over extensive livestock use of rangelands. This is clearly a response to the drastic impact of the 1984 drought, but the consequences of such a policy, both ecologically and socio-economically, are still unclear.

The CNS's chapter on social development outlines the government's environmental strategy. Among the objectives are: i) protection and development of the environment for sustainable development, particularly in rural areas; ii) poverty alleviation, which is considered as one of the main causes of environmental destruction; iii) rehabilitation and preservation of ecosystems for sustainable and renewable natural resources; and iv) enhancement of environmental awareness among politicians, executives, non-governmental organisations (NGOs) and the public.

The recently established High Council on Environment and Natural Resources has the mandate to coordinate and oversee all projects and programmes concerned with the environment. It will acquire an EIS capability to better monitor projects, including the present one.

3. Prior and ongoing assistance

The concept of the Integrated Resource Management for Desertification Control project, or El Odaya project, is most comparable to this GEF project. It revolves around an integrated land/resource management and planning framework on a participatory basis to achieve sound rangeland management and land rehabilitation. It covers a slightly more humid area than Gireigikh and involves settled agropastoral people—primarily cattle raisers. Although nomadic camel-owning groups moving through the area are to be incorporated in the project, their involvement is not as

clearly defined and consistent as the one envisaged for this GEF project. These two projects, El Odaya and Gireigikh, should be seen as complementary, since they will be testing the same conceptual framework, in two different environmental and socio-economic contexts.

Five other United Nations Sudano-Sahelian Office (UNSO) projects in the Sudan address afforestation, tree production, and fuelwood issues, all of which are indirectly related to this project: Restocking of Gum Belt for Desertification Control (one in North Kordofan and one in Darfur), Fuel Bricket and Cooking Stove Production Phase II in North Kordofan, Afforestation and Reforestation in the Northern Region, and Tree Seed Project. The Afforestation and Reforestation in the Northern Region project has succeeded in promoting women's individual nurseries. Women sell their seedlings in the market or to the government. The Tree Seed Project will provide the tree seeds needed by this project's nursery.

CARE, another NGO, is active in Bara Province with a programme to build or rehabilitate shallow wells. A total of twenty-two new hand-dug wells and fifty rehabilitated wells are planned, with two new and twenty-two rehabilitated wells completed so far. The Gireigikh Rural Council (RC) is involved in the CARE project, but the number of wells is yet undetermined. Discussion with the people is ongoing. The work is contracted out to the National Rural Water Corporation. The local people, organised by a village water committee, provide labour or the cash equivalent, and they choose the type of water-lifting device.

The Forestry Department has recently reactivated its programme of protecting Forest Reserves. The Shawa Forest Reserve, northeast of Gireigikh Town, is roughly 15,000 acres and contains *Salvadora persica* and *Acacia tortilis* stands. Its boundaries have been marked, but not fenced, and guards are employed by the Forestry Department. The guards act as policemen only, however, and do not attempt to involve the community in the process. Women in the area attribute the failure of their communal irrigated gardens to the forestry guards, who they say punish them for collecting thorn fencing material.

The Swedish-Sudan Friendship project, operating mainly in western Bara, has introduced four solar-powered water pumps. It is also encouraging villagers to grow windbreaks and raise poultry. Although women are encouraged to learn handicrafts, marketing them is a problem because handicrafts are considered luxury items, so demand is low.

The Natural Forest Management project near El Obeid Town (Alein Village), a joint venture between SOS-Sahel and the Forest National Corporation, is promoting community forestry and natural resource management techniques. Other projects of interest include the area development schemes (ADS) of UNDP. The North Kordofan ADS project is primarily interested in fostering development through a participatory planning framework. Funds are made available to all applicants for a diverse range of activities done privately or by groups. The project will use experience gained by other ADS field work, which began in 1990.

FAO, in conjunction with the United Nations Development Programme (UNDP) and United Nations Development Fund for Women (UNIFEM), is conducting a Cereal Bank Project in North Kordofan with plans to install two seventy-five ton cereal banks in Bara Town to service the entire province. The cereal is given on loan.

UNDP's Rural Water Supply to Nomads in the Eastern Region Project (El Butana) provides water points for Shukriya pastoralists by improving three hafirs (water catchment basins) in the dry season areas, and by developing stock routes between the dry season and wet season grazing areas. The water point development does not appear to be linked to any form of local management or local organisation.

FAO's Irrigated Fodder Production in Gash Delta (Kassala) is currently being executed by the Range and Pasture Administration (RPA). This project is conducting trials on a variety of fodder species—both legumes and perennial grasses—such as *Macroptilium* spp., *Stylosanthes* spp., *Cenchrus* spp., and *Panicum* spp. The results of this project are directly replicable to the present project.

The Forestry Department in conjunction with the RPA initiated a range rehabilitation programme in the 1970s in El Beshiri (northwest of Bara Town). It undertook revegetation trials with different tree and perennial grass species, dune stabilisation, and fenced reserves (enclosures) that were managed by the local community. Today, the nursery provides seedlings for revegetation, and local people still control grazing in the enclosures.

The Western Savanna Project, Phase II (Darfur), has long been involved in agropastoral development. It includes both cultivation and livestock improvement activities, as well as rangeland rehabilitation, land use planning (specifically demarcating wet season grazing areas for transhumance), and organisation of rangelands. The project recently conducted a review of the land tenure situation in the Sudan, concluding that rangeland tenure is not at all clearly defined at the national level. They have also recently established communally protected grazing reserves for both settled people and seasonal herders, on the basis of clear tenure rights and no fencing (only marking of boundaries and placing of guards).

The Sudan-FINNIDA Afforestation Project (Tendelti), funded by the Finnish Department of International Development Cooperation (FINNIDA), works to restock the gum-belt, provide shelterbelts around villages, and improve stoves. It runs a central nursery that provides gum seedlings free of charge to farmers and mesquite seedlings for mechanical planting on sand dunes as part of a dune stabilisation and fuelwood programme.

The Fellowship for Africa Relief (FAR) began work in Hamrat el Wuz (north of Gireigikh) in 1985, providing relief aid and planting a shelterbelt of mesquites, eucalyptus, and other species to prevent dune invasion. This work follows on a previous effort by FAO in the same area. The trees are irrigated for the first three years using water from a borehole and an irrigation canal, and the area is fenced. Those participating in the plantation are given food-for-work rations.

Finally, the Ministry for Animal Resources has apparently organised a paravet training programme in Hamrat el Wuz. This programme has resulted in three trained paravets who move with people on transhumance who carry an adequate supply of veterinary drugs.

B. PROJECT JUSTIFICATION

1. Problem to be addressed and the present situation

The project area lies within the Gireigikh Rural Council (RC) of Bara Province, North Kordofan State. The area receives a rainfall of about 250 mm annually. The landscape can be classified into: Acacia-steppe (50-60 percent of area), Goz sand dunes (20-25 percent of area), and loamy depressions (kheiran).

The Acacia steppe (or Acacia desert scrub) can be divided further into light soils and heavy soils. The light soils are dominated by *Acacia nubica* and the heavy soils by *Acacia mellifera*. Other trees and shrubs that occur in this ecosystem are: *Balanites aegyptiaca* (in arabic heglig), *Ziziphus spina-cristi* (sidr or nabaq), *Boscia senegalensis* (mokhet), and *Cadaba farinosa*. *Acacia senegal* or the gum arabic tree is now extremely rare in the area.

The Goz rangelands are dominated by *Leptadenia pyrotechnica*. Other dominant shrubs are *Bouchea marrubiiifolia*, *Melhanian denhamii*, and *Crotalaria thebiaca*. A few other woody species occur rarely: *Commiphora africana*, *Acacia mellifera* and very overbrowsed *Ziziphus spina-cristi*. The understory is dominated by annual forbs, such as *Chrozophora oblongifolia*, *Tragus racemosus*, only some of which are palatable (a few *Blepharis* spp. and *Tephrosia* spp.). Annual grasses do occur, but in lesser abundance, such as *Aristida papposa* and *Cenchrus biflorus* (haskanit). A very few stands of perennial grasses, such as *Panicum turgidum* and *Cenchrus* spp. still survive.

The kheiran are dominated by *Hyphaene thebiaca*, *Acacia tortilis*, *Acacia albida*. Ground cover is very low, due to heavy cultivation, and it is dominated by annual sedges in the wet season.

Ground water resources are very favorable. The area lies on the Bara Basin, Umm Ruwaba aquifer, and subsurface water can be reached at about 20 metres depth. Deeper ground water can be reached at about 65-150 metres by boreholes. There are 54 hand-dug wells and five boreholes in the RC. Most villages are self-sufficient in water, but some require additional wells or rehabilitation of existing wells.

A rapid survey of wildlife in the project area in July 1993 showed a very low diversity in wildlife species in general and the disappearance of certain formerly abundant species such as dorgas gazelle and hyaenas.

Certain wild plant species in the area have potential commercial uses. *Capparis decidua* (tundub) and *Grewia tenax* (gaddeem) have highly valuable fruits. *Salvadora persica*'s (arak) young branches are used as toothbrushes. Certain wild plants are collected for food, such as *Cyperus rotundus* tubers, and *Lactuca* spp. leaves. *Ipomoea cardiospela* and *I. cordofana* are sold as camel feed.

Main environmental issues in the project area

In this area, the major environmental issue is land degradation, which reduces the ecosystem's ability to sequester carbon and maintain its biodiversity. The major causes of land degradation are drought, cultivation, and fuelwood gathering. Drought not only reduces the land's potential, but also its capacity to regenerate spontaneously. Cultivation is occurring in extremely arid conditions where only two out of five years produce a successful crop. The land, left bare for most of the year, is eroded by wind. Overgrazing is not a main problem, since the droughts have greatly reduced the animal population in the area. Therefore, range improvement with drought-adapted species is necessary.

The cultivated areas are subject to wind erosion and sand encroachment, with a few mobile sand dunes. When thorn bushes are cut by people to make fences around the farms, they act as a sand trap sometimes two metres high.

Grazing areas have been adversely affected by the drought, and have deteriorated so that perennial grasses have vanished, annual grasses have increasingly been replaced by annual forbs, and the diversity of browse plants has drastically fallen. The falling range capacity has resulted, during the last drought in 1989, in the death of approximately 80 percent of the animal population.

It should be noted that unlike other parts of the Sudan, bush fires are not a problem in the project area since there is rarely enough ground fuel to carry one. There is, however, a potentially serious problem of fuelwood shortage and deforestation. Data collected during the Preparatory Phase of this project shows that an average household uses 116 kilograms fuelwood per week. At this rate, each household will require six tons per year. Given the estimated woody biomass present in the area, this rate of consumption will require 71 hectares of land per household (if only the net production of biomass is harvested, as it should if it is to be sustainable). In addition, the two bakeries in the area, which require 100 tons of wood per year, will need an additional 1,200 hectares of land to harvest in a sustainable way. Clearly, the land and the forests are not available at these rates. The project will need to concentrate on finding alternative energy sources for households and bakeries.

Environmental management in project area

Apart from the rules regarding protection of the Shawa Forest Reserve, there are no other explicit environmental regulations in the area. However, it is doubtful whether this Forest Department model (employing guards without community participation) would be effective in protecting and managing the reserves over the long term.

At present no other group (government or otherwise) is active in promoting environmental issues in the project area. A lack of technical and managerial capacity to address environmental issues should be remedied by the project. There may be conflicts between the participatory model for natural resource management promoted by the project and the existing Forest Department Model, which will have to be resolved during the implementation phase.

Major environmental impacts

The project will have several intended positive impacts on the natural environment:

- Increased soil cover, reduced soil erosion, and increased carbon sequestration
- Increased biodiversity of plants and, in the long run, fauna
- Sustainable management of natural resources.

These impacts are expected to promote greater productivity of animals and crops and a sustained yield of water resources, both of which will improve the socio-economic profile of the area.

One unintended, but highly probable, negative impact will be the encouragement of populations on transhumance to settle because of the modest investments in water development, credit, animal health, and irrigated gardens. A trend for such settlement already exists, but the project might further encourage it. In the current pattern of settlement, women, children, and elders settle around villages, while keeping the majority of the animals on transhumance. As long as this settlement pattern is maintained, increased settlement will not have a great impact on grazing resources. The increased human population will, however, have an impact on fuelwood and water resources. It will also contribute to increased cultivation, the main cause of land degradation.

If the project and local leaders fail to establish an appropriate natural resource management system, then the impact of increased settlement will be a great blow to the environment and sustainable development of the area.

Alternatives for project design

Since the present project design is seen as a model to be tested in northern Sudan, no specific alternatives are provided at this time. However, the project implementation phase should maintain enough flexibility to respond to suggestions from the local people. The project design should also be modified with changing environmental conditions, such as serious drought or extremely wet years.

Human environment and production systems

North Kordofan State had a population of 3.24 million people in 1983, 260,000 of which lived in Bara Province. The Province is divided into eight RCs. The center of Gireigikh RC is at Gireigikh Village and lies about 1.5 hours' drive north of Bara Town. The RC is inhabited by several groups of people, but the two main ones are the Gawamaa (a clan of the Haamid Tribe) who own the land, and the pastoral Kawahla, originating from Sodiri district. Other ethnic groups are the nomadic Beni Gerrar, Dar Hamid, Kababish, and Hawawir.

The RC has an estimated population of 21,000 Gawamaa agropastoralists who live in 54 villages. The average household size is about eight people. The RC is visited annually by groups on transhumance. The Kawahla have an historically cooperative relationship with the Gawamaa. Since

the 1940s they spend the dry period living in dispersed encampments attached to specific villages, and sometimes in rainy season the Kawahla women, children, and elders stay behind in the Gawamaa villages to cultivate. The pattern of Kawahla mobility is relatively fixed in that the same Kawahla families return to the same Gawamaa villages each time. The Kawahla even obtain their government distributed sugar rations from their satellite villages. The Kawahla population visiting the area is broadly estimated to be about 250 households or about 1,750 people.

The Gawamaa and the Kawahla exchange goods and services. Since Kawahla women specialise in the processing of animal products, Gawamaa women often arrange to provide the raw material (wool or hides from their own animals) and then the Kawahla process it. Similarly, Kawahla men provide veterinary services and Kawahla children are hired as herders, then, in exchange, the Gawamaa give their surplus animals to the Kawahla to take on transhumance. Kawahla in all five RCs of the project area were found to participate fully in all village economic activities, such as construction of public facilities (wells, clinics) and in the communal cultivation parties (naffir).

Socio-political integration of the Kawahla into Gawamaa society depends on length of residence. Older residents (before 1984) are more integrated, share in feast, inter-marry, and engage in reciprocal agreements.

In addition to the Kawahla pastoralists, the area is also a livestock corridor for other pastoralists, such as Kababish and Hawawir, who herd their livestock south during the dry season. In recent years, other pastoral groups, such as the Dar Hamid and Beni Garrar, have started to settle around Gawamaa villages. Settled pastoralists lose contact with their original home areas and choose to be subject to the Nazir in Bara.

Cultivation of millet, sesame, and watermelons is done on the Goz plains, whereas sorghum, millet, and vegetables are cropped on the more fertile, loamy kheiran depressions. Vegetables are produced in small, hand-irrigated plots year-round by only a few farmers. The Goz plains and Acacia steppe are used for grazing. Each village has a 200-300 metre ring around the settlements where traditionally no tree cutting was allowed. This ring is now dominated by a dense stand of mature *Acacia tortillis* and *Acacia albida*, but hardly any tree seedlings or young growth. Beyond this ring is a one kilometre radius that is reserved for cultivation, and livestock are not allowed except in defined access routes. After the cultivation ring comes the grazing area and the area where fuelwood is collected. This traditional form of land use planning seems to be prevalent in the area and will be a strong prerequisite for many of this project's activities.

The agropastoralist Gawamaa raise crops and keep livestock. The pastoral Kawahla and other groups are livestock raisers, with a few cultivating millet but not necessarily every year. Prior to the 1984 drought, the Gawamaa agropastoralists apparently owned large numbers of cattle, goats, sheep, and camels. Gawamaa with large numbers of animals sent their surplus animals on transhumance with members of their own family or were sometimes accompanied by the satellite Kawahla to El Obeid and beyond during the dry season. Their numbers of livestock diminished after 1984 and 1989, and cattle have almost completely vanished from the area. Presently about 80 percent of the Gawamaa households own about five goats and one camel or less per household. The rest consist of a few rich families who still have sizeable numbers of sheep and goats.

The pastoralists, too, were drastically affected by the 1984 drought. Of the three animals they raise, sheep declined considerably, leaving camels (about 10 heads per household) and goats (10-30 heads per household). Sheep are still kept, but by a limited number of households.

A pastoralist's settlement, or semi-settlement, is such that women, children, and elders stay year-round at the village, while men take the majority of livestock on transhumance. Settlement usually occurs near areas where relatives have previously gone. Pastoral camps are usually internally homogeneous, even though they have lost contact with higher leaders.

Each Gawamaa household has a right to about 15 mukhammas or about 8.5 hectares of cultivated Goz land, which is fenced with clear boundaries. Only about a fourth of this land is cultivated each year, and the rest is left fallow for seven to ten years. This land is treated as private property with full rights to rent or share-crop, or to pass on as inheritance.

Kawahla families or other newcomers obtain farm land through two different arrangements: i) a direct negotiation with individual farmers on a share-cropping/renting basis (renting is either temporary, kul goom, or a longer term lease, tugundi), or ii) by requesting the village Sheikh to allocate land from an area reserved for this purpose. Land obtain by the second arrangement, however, is usually less fertile than land for rent.

The kheiran or depression lands, being fertile and of limited extent, are highly valued, and not everyone has a right to use them. Some parts have been fenced off by individuals, and in at least one case there is a diesel operated, large-diameter well that supplies an individually owned, irrigated vegetable garden. There is ample precedence for this type of irrigated garden in the region, such as in Bara Town and at Khor el Tinna. In Bara Town, fodder (alfalfa mainly) is produced and sold in the market, along with hay collected in outlying kheiran.

The Gawamaa, the Kawahla, and other pastoralists attribute high value to livestock as a major contributor to their livelihood. Although the drought has forced them to rely more on crop cultivation than usual, they repeatedly maintained that, given a chance, they would like to rebuild their herds, starting with goats.

The most serious animal health problems in the area are contagious ones such as foot and mouth disease and contagious caprine pleuro-pneumonia (CCPP). The nearest animal health officer is located in Bara Town. Veterinary drugs are rarely available outside the highly priced black market.

The only forms of fodder conservation are the use of crop residues immediately after harvest and the collection of browse fodder and hay by women for young or sick animals or for special milking animals. Some agropastoralists engage in supplemental feeding of their special animals using sorghum/millet meal and cotton seed cakes purchased on the market, but the practice is restricted to the rich people. Most people complain about the critical period at the end of the dry season and the beginning of the rainy season, when natural rangelands are at their least productive level.

Due to the two years of crop failure in 1989-1990, the Gawamaa population of Gireigikh RC received relief aid, which was then reduced in 1992, forcing high male out-migration. The

immigrants head to Dongola Province and to Khartoum. Incomes raised from employment, often on the order of £S 2000-3000 per year per individual, are used to support families. Most immigrants return home at the onset of the rains to raise crops, then move out again after crop are sown or after harvest.

Women contribute to the local economy primarily through crop cultivation. They are also responsible for raising young livestock and other domestic tasks. With the increasing out-migration of the men, women are taking on more livestock duties. They also engage in income-generating activities such as crafts (using doum palm leaves and other plants or hides). Credit is not available at the local level outside of the traditional shale system. Local people have clearly expressed the need for a credit system, either in cash or in kind.

Local affairs are run by two systems of administration: Native Administration and local government. The former is comprised of Sheikhs at the village level, Omdas at the RC level, and Nazir at the district level. The Chief of the Gireigikh RC has been actively participating in the formulation of this project and is a strong supporter of its methods and objectives. Local government operates through village councils (one to four villages under a council) with representation of each village council at the RC. The Kawahla pastoralists, not belonging administratively to the area, have no formal representation in the above institutions; however, through their Sheikhs, they cooperate on relevant matters.

Local government services in Gireigikh RC include the following: nineteen primary schools (four for boys, four for girls, and eleven co-ed), one intermediate school for boys, one dispensary, ten primary health care units, one environmental health officer, fourteen midwives, a police station, and a local court. Technical services, especially agriculture, livestock, and forestry, are also provided, but their effectiveness and grassroots contact is limited due to lack of experience and material support.

The market at Gireigikh Village holds crop and livestock auctions organised by the local government and has many shops and restaurants frequented by travellers going towards Hamrat el Wuz and other northern destinations. There is a weekly market and frequent visits by lorries from El Obeid.

The peak marketing time for crops is in November and December. For livestock, peak sheep transactions are also in November and December, when they have attained maximum production. This is more or less a local trade. However, the camel trade, primarily aimed at export to Egypt, peaks in July, after which the traders take advantage of the rainy season to trek them north.

Bara and adjoining villages have historically benefitted from the truck trade between Khartoum and El Obeid, passing through the desert. But since the construction of a highway between Khartoum and El Obeid that by-passes the area, the importance of Bara has diminished. Local traders are keen to embark on alternative activities, and livestock fattening through fodder produced in the kheiran is frequently discussed.

The local medical assistant is very active and has organised the women of the Gireigikh Village Council to start group gardens irrigated from wells. Usually a group of ten women in a

village get together, put up a fence, and with seed supplied by the medical assistant (who incidently has difficulties getting adequate supplies and appropriate species), plant about a quarter of a hectare of land near the village. They irrigate it by hand using water from the communal shallow wells that are often located 400 to 800 metres away. Their interest and enthusiasm is remarkable, but they need assistance in the form of technical expertise and reliable sources of water.

Very little accurate information exists on the socio-economic profile of the project area, nor on livestock husbandry and disease. In 1990, a vegetation classification of the entire North Kordofan State was done using satellite imagery by the RPA, but its scale was too small for project planning and implementation.

Priority problems to be addressed by project

One of the major problems in the Sudano-Sahelian Region, and the Sudan in particular, is the deterioration of rangelands by soil degradation and declining livestock and crop production. Specific causes include the following i) a relentless series of droughts—culminating in the devastating 1983 to 1985 drought—reduced the ecological capacity for production as well as regeneration; ii) expansion of cultivation into rangelands decreased land for grazing, cut off livestock access routes, and took over the higher quality rangelands; iii) the system of cultivation left the land bare for nine months and vulnerable to wind erosion; iv) the population has increased; v) traditional land tenure systems and social control over the use of land has broken down; and vi) the government has not effectively replaced the traditional system of land management on the grassroots level. Past attempts at solving these problems have been unsuccessful or, at worst, have aggravated the situation.

The falling rangeland capacity caused the death of approximately 80 percent of the livestock herds in Gireigikh RC. Agricultural expansion is a present danger, and potentially a greater problem, because of the increasing in-migration of pastoralists from the north.

The conventional view that all land degradation is due to overgrazing should be discarded in this context, because:

- Drought has desiccated the environment and therefore decreased range productivity
- Livestock populations have dramatically dropped to a level well below survival needs due to recurrent droughts
- Land degradation is due more to deforestation, expanding cultivation, and over-cultivation than to overgrazing.

Land degradation not only reduces the area's biodiversity, but the land loses its capacity to sequester and absorb carbon, a major factor in preventing the greenhouse effect. Moreover, the balance shifts to carbon emission, because the methane produced by animals outweighs the carbon absorbed by plants and soils.

Another development problem is the lack of an overall national pastoral development policy. Most Regional Ministries have their own pastoral policies embedded within a rural development

policy; however, there is little coordination among regions. In addition, most of the budget allocated to the agricultural sector is channelled to the farming subsector.

The development of a National Transhumance Master Plan that takes into account communal rangeland tenure arrangements, livestock corridors, and inter-tribal and inter-regional cooperation is beyond the terms of reference of this project, but may be important for the success of any pilot project in the area.

Another development problem is that of land tenure. Proper, long-term management of natural resources by the local people cannot be expected unless they have secure communal rights to the land and resources. Some of the rangeland tenure issues are the concern of the local government and traditional authority (such as communal management of resources in the dar or homeland), whereas other issues require coordination and review at the regional or even national levels (such as transhumance to distant areas for dry season grazing).

In the traditional system, customary land tenure is still viable and enforced in the traditional way. However, it has not yet been legally recognised within the local government. It is also not recognised as a component of the 1987 directive to reinstate the Native Administration. Legal recognition, at least at the local level, is crucial to the success of the land management activities of this project, but it is in danger of being disrupted due to the influx of northern pastoralists. Therefore, national-level recognition of customary and communal tenure is a priority issue.

In the past, the conventional techniques used in range management and livestock development projects, such as fencing and block rotation, have not worked. There is now a need to test non-conventional approaches, such as relying on and upgrading traditional systems of rangeland use and control.

The importance of involving local people directly in the management of their own resources is being increasingly appreciated both within the Sudano-Sahel Region and in the Sudan. Experience with this approach is limited, but encouraging. To advance this appreciation, an appropriate institutional framework must be organised and project staff and the local people must be trained in this approach.

Although successes in this project area are not expected to significantly affect global warming and biodiversity, it is expected that replication of the successful methodology will.

Short-term problems

A project with a finite term cannot expect to accomplish its goals if the people are faced with a food shortage. The project will address several of the people's immediate problems: water, animal and human health, and vegetable and fodder production.

The ever-present danger of droughts and the high risk of production failure in this semi-desert introduce the possibilities of famine and population instability. The Gireigikh RC population depends on food aid (at least three years out of five) and remittances from relatives who have migrated to urban areas or to large, irrigated farms. Drought contingency plans, such as credit schemes,

restocking mechanisms, grain credit, and economic diversification, are needed to make the agropastoral and pastoral systems more resilient and sustainable in the long term.

2. Expected end-of-the-project situation

Carbon sequestration, a primary output of the project, can be quantified two ways: the direct carbon storage associated with this pilot project and the indirect carbon storage resulting from replication of the project to neighbouring areas. The following calculations are based on data collected on herbaceous and woody biomass, cover, and density during the Preparatory Phase of the project. The vegetation was classified into three ecozones: *Leptadenia* dunes, Acacia-complex steppes, and kheiran depressions. Vegetation biomass increases across these three ecozones. Average rangeland biomass is calculated to be 7 t DM/ha. This data should also be used when conducting the baseline vegetation study for the project.

Direct carbon sequestration

Through the development and implementation of land use and rangeland management master plans, each community will develop conservation rules for the sustainable management of the natural resources in approximately 60,000 hectares of land. In twenty years, the carbon sequestered in the vegetative biomass (above and below ground) is assumed to increase from its present levels (estimated 6 t C/ha) to about 10 t C/ha. This represents a net benefit of 4 t carbon sequestered per hectare or a total of 240,000 t C.

Rangeland improvement

At least 100 hectares of rangeland will be improved by the village councils through the use of native perennial grasses, browse species, and the planting of about 100 native trees per hectare. The biomass of the improved plots is expected to increase to slightly above that which could be achieved with natural regeneration (to a maximum of 12 t C/ha). This represents a net gain of 6 t C/ha above the present degraded condition, resulting in a total gain of 3,000 t C across the five village councils.

Stabilisation of sand dunes

The stabilisation of sand dunes represents a dual benefit: revegetation of the dunes themselves, which increases carbon sequestration, and prevention of dune mobility, which prevents further land degradation and carbon loss. During the project life, a total of five kilometres of dunes will be stabilised with a combination of trees/shrubs and grasses. Assuming an average dune width of 20 metres, five rows of trees across the width, with trees spaced two metres apart within rows, and six rows of grasses between the tree rows, there will be a total of 12,500 trees and 60 tons of grass planted. In such dry conditions, the trees and shrubs are assumed to achieve a maximum of 30 kilograms above and below ground biomass per tree, equivalent to about 15 kilograms C/tree. The grasses will have about 50 percent C by weight. Thus, the total carbon sequestered on the five kilometre stabilised dunes is 210 t C.

The revegetated dunes will prevent their mobility, which is otherwise projected at a rate of 15 metres per year. Over twenty years, that represents a total movement of 300 metres. Without revegetation, the five kilometres of dunes would have engulfed a total of 150 hectares of land. After twenty years, there would have normally been some natural regeneration of the land vacated by the moving dunes, but it would likely be very slow. If one assumes that only 10 percent of the land will have regained its former biomass levels, and the rest would be in various stages of land degradation with an average of about 5 t C/ha (as opposed to a "normal" 8 t C). The additional carbon benefit amounts to 675 t C.

Creation of windbreaks

A total of 195 kilometres of windbreaks will be established during the project. Trees will be planted on the boundaries of farms in two rows, two metres by two metres, totalling 195,000 trees. Assuming the same rate of carbon content as above, this is equivalent to a gain of 2,925 t C. Upon maturity, about half of the biomass of the trees will probably be cropped for fuel and browse, but over twenty years this is equivalent to 0.75 percent of the total carbon (half of the biomass will always be there, and half of the "half harvested" biomass). Carbon credits for 2,190 t C are therefore claimed.

The windbreaks will be planted with trees that achieve a maximum height of 6-8 metres, which will reduce wind velocity in an approximate width of 25 metres in the prevailing wind direction, protecting that land and conserving the vegetation. This represents a total of 490 hectares of protected land. Assuming a net gain of 5 t C/ha between a degraded *Leptadenia* ecozone (3 t c/ha) and good condition land (8 t C/ha), the net benefit will be 2,450 t C.

The total carbon sequestered by windbreaks: 4,640 t C.

Indirect carbon sequestration

It is assumed that rangeland management activities demonstrated during the course of the five year project will be continued and expanded after being proven successful, resulting in the implementation of the Land Use Master Plans by all of the 19 village councils within 20 years. Based on the same calculations used above, this would result in the additional management of 165,000 hectares of rangeland and additional carbon storage of 660,000 t C. It is estimated that 50 percent of this future carbon benefit should be counted for purposes of assessing the value of this pilot project.

The range improvement activities implemented by the remainder of the village councils will give a total carbon benefit of approximately 8,000 t C, 50 percent of which should be counted for purposes of assessing the value of this project. Likewise, the 50 percent benefit attributed to the project for stabilisation of 130 kilometres of sand dunes will be 11,505 t C, and for 750 kilometres of windbreaks over 20 years it will be 7,980 t C.

Total carbon sequestered (in t C) as a result of all above activities:

	Direct	Indirect
Rangeland management	240,000	330,000
Rangeland improvement	3,000	4,000
Stabilisation of sand dunes	885	11,505
Creation of windbreaks	4,640	7,980
Total	248,525	353,485

Based on the total project cost (US\$ 1.5 million), and assuming that all carbon benefits accumulate linearly over the next thirty years, the cost of direct carbon storage and sequestration is approximately US\$ 12 per ton, while that of direct plus indirect carbon storage and sequestration is approximately US\$ 4 per ton (using a 4 percent discount rate).

Biodiversity

The ecosystem of the project area, typical of other arid to semi-arid lands in the sub-Saharan belt, is potentially capable of supporting a wide range of species. Some of these species are known to be endangered or threatened, such as four species of gazelle (Dama, Dorcas, Rhim and Red-fronted), the Nubian Ibex, the Scimitar Oryx, and the Barbary Sheep all have similar habitats. According to oral reports, the Dorcas gazelle used to inhabit the project area as recently as fifteen years ago. The project's contributions to the preservation and improvement of the ecosystem will improve the habitat for these endangered species and may lead to their re-introduction in the area.

Certain plant species are also threatened by continued degradation. Special attention will be paid to propagating these species, primarily in range improvement and dune stabilisation activities.

Ecological and genetic diversity

By helping to improve the condition of the rangelands, the project will contribute to the improvement and conservation of the ecosystem. A healthy ecosystem in the majority of cases also results in increased species diversity (species richness x species density) and genetic diversity. Both aspects are important in preserving the future potential of plant species and ensuring long term biodiversity.

Cultural diversity

The project will incorporate the traditional knowledge and techniques of local people in the management and preservation of the ecosystem and will help strengthen that capacity with its own methods. This combined knowledge is essential not only for managing local resources, but also for providing viable, replicable techniques and information to managers of similar ecosystems and species elsewhere in the sub-Saharan region.

Atmospheric particulates

An indirect benefit of the project's activities, particularly all revegetation and rangeland management activities, is the reduction of dust and sand in the atmosphere. The *haboub* of the Sudan—and similar dust storms across the arid belt of the Sahel—contribute to an unknown, but unquestionably large, amount of dust in the atmosphere over Africa. Prevailing winds shift these particulates to other regions: particles of Saharan-Sahelian origin have been found in Brazil and the northern Mediterranean zone. The contribution of the project to a reduction in this dust is small over five years; however, the innovative, community-based methodology tested by the project should guide similar efforts across the Sahelian zone and may eventually contribute to a substantial reduction in atmospheric dust.

Development benefits

At the end of the project period, it is expected that the project staff, RPA, and UNSO will have assessed the replicability of this unconventional approach to pastoral development. Specifically, rangeland management, irrigated fodder production, range rehabilitation and improvement in a semi-desert, paravet training, and fodder conservation will all have proven themselves one way or the other by the end of the project. In addition, the value of land use planning and land tenure formalisation as a condition for land resource management will be made clear to all concerned.

There may also be physical improvements in terms of new and rehabilitated shallow wells, women's irrigated gardens, and village council cereal banks. Finally, steps will have been taken to reduce the risks of production through a revolving credit programme that disburses cash, cereals, and livestock.

External support may be needed at the end of the project to extend either the experiments or to replicate the successful results of the project.

3. Target beneficiaries

The development problem was initially identified during a review of pastoral development projects sponsored by UNSO. The problem was further elaborated and refined, through discussions with UNDP and RPA in Khartoum, and during the participatory identification and formulation missions at the villages.

The project will be targeting livestock producers (both agropastoral and pastoral). It will reach a wide segment of this group, especially the poor who rely on communal rangelands, but also those who are interested in fodder production and conservation. It will reach those who cultivate dune revegetation and windbreaks. It will also reach the women who are interested in creating irrigated gardens. In general, the poorer target beneficiaries, either men or women, will also be able to take advantage of the three types of credit to be extended by the project.

The project area will comprise five village councils, totalling seventeen villages. This is estimated to be populated by about 5,500 Gawamaa and 600 Kawahla. Table 2 gives the list of villages chosen by the RC elders and leaders during the formulation mission.

Table 2: Villages and village councils

Village Council	Villages	Gawamaa pop.	Kawahla VC pop.
Gireigikh	Gireigikh	900	80
	Nimir	200	
	El Kawa	250	
Mereikha	Mereikha	400	78
	Iyal Ali	168	
	Iyal Tomsah	140	
El Sarariya	El Daw	200	50
	El Zaki	250	
	Makari	190	
	Umm Begheila	510	
Kajebi	Kajebi	250	300
	El Kararik	350	
	Umm Sireiha	300	
	Ed Dom	400	
Umm Dayogha el Tilib	El Tilib	450	100
	El Sanousi	300	
	El Goz	250	
Total = 5	17 villages	5508	608

The activities concerned with rangeland improvement, water development, and paravet training and veterinary supplies will directly benefit everyone in the project area. Other experimental activities, such as fodder conservation, irrigated fodder production, and windbreak establishment will directly benefit only those who choose to partake in the activity, estimated at 20-30 percent of the households. The women's irrigated gardens may reach about 20 percent of the adult women. The three credit programmes, designed for the needier population, will reach about 80 percent of the population.

The project's survey component will train ten to fifteen local people as assistant researchers. The project's training programme will reach local leaders and all project staff.

4. Project strategy and institutional arrangements

The project's central issue is the rehabilitation of the desiccated environment to increase carbon sequestration and conserve biodiversity. Its central hypothesis is that community participation in rangeland management, coupled with secure land tenure and a favorable socio-political situation, will improve and sustain range management and livestock production without fencing in an environment used by a settled agropastoral community and a satellite purely pastoral community.

This project is based on the assumption that long-term goals for natural resource management and the reduction of global warming can only be achieved through community-based actions that do not neglect the short-term survival and production needs of the community. Thus, although the main thrust of the project is on natural resource management and environmental rehabilitation, the project will also engage in water development, income diversification, and drought contingency measures.

The project will rely on traditional mechanisms of leadership, social discipline, alliances, and reciprocity between tribes using the same area, with minimum external assistance. The approach concentrates project activities in "focal points" or places that are more frequently used by pastoralists (such as villages, water points, and salt licks), while it confirms the territorial rights to the larger rangelands. In this case, the focal points are the Gawamaa villages and the satellite Kawahla camps, and the larger territory is all the lands claimed by the villages.

In addition to range, pasture, and fodder management, the project will undertake other activities to meet the needs of the people that were identified during the mission's field visits. Some of these activities are directly related to the range/pasture activities, such as fodder production and conservation. Others fall within a programme of drought contingency planning and risk reduction, including water development, livestock restocking, cereal and cash credit, veterinary supplies, and irrigated gardens.

The project will conduct all activities for both the settled Gawamaa and the mobile Kawahla (and other pastoral groups if present) under a framework that brings the groups together. Activities will rely heavily on sensitisation, dialogue, and extension of technical innovations and environmental education to ensure the sustainability of project activities beyond five years.

The project will, at all times, maintain a flexible approach that promotes participatory planning and local-level activities. One of the first tasks will be to formalise and verify the security of rangeland tenure. Gireigik's communal protection of woodland and cultivation prevention in grazing areas needs to be formalised (accepted publicly), institutionalised (within the local setting through public proclamations) and expanded (in the form of a land use master plan) to cover other issues of land management in the entire project area. Thereafter, the workplan for the other activities of the project can be developed and implemented with the people.

The local community, represented by the village council and the Sheikhs of each village in the council, will be directly involved in choosing the project's direct recipients and the location of interventions. The people will also be required to contribute to the activities by participating in decision-making, labour, in-kind or cash return of loans, and communal discipline. The project will provide a minimum subsidy on other inputs, such as water development, seeds and seedlings, veterinary drugs, and so on. The government will contribute national personnel, buildings, and some operating costs.

Once the project has tested the approach and concluded that it is successful, the results will be conveyed to other development practitioners in the Sudan and beyond.

Institutional framework

The project will involve the UNDP/GEF, government, RPA, the local communities represented by the village councils and the Sheikhs of each village, UNSO, UNDP's Office of Project Services (OPS), and the UNDP Khartoum Country Office.

Their respective roles are as follows:

- The government, represented by the Ministry of Agriculture, Natural and Animal Resources, will be responsible for the execution of the project.
- The RPA will be responsible for implementation. The RPA will appoint a national director and national staff to run the project, as well as provide buildings.
- UNSO and UNDP/GEF will assume overall technical responsibility for backstopping and monitoring of the project.
- OPS will be responsible for contracting the long-term experts financed by the external contribution of the project (contracts longer than 6 months).
- The UNDP Resident Representative's Office in the Sudan will be responsible for appointing the national technical advisor (NTA). It will also provide overall supervision of the project and support services.

According to this arrangement, UNDP will provide goods and services at the request of and in full consultation with the government, including short-term consultants and procurement of equipment. UNSO and GEF technical advisors will assist with technical and substantive expertise for procurement of these goods and services. UNDP will take appropriate action, as and when necessary, on behalf of UNSO, GEF, and OPS, to ensure the smooth operation and progress of the project.

The project will be managed by an autonomous body under the National Director. Linkages with other Ministries, research institutions, and technical personnel in El Obeid and Khartoum will be developed by the project through surveys, consultancies, and backstopping. In particular, relevant staff will be seconded by RPA from the Ministry of Agriculture, Natural and Animal Resources, and the National Forestry Corporation.

The North Kordofan State RPA will ensure the facilitation of administrative matters and provide technical monitoring to the project. The North Kordofan State RPA will assist in the tendering of subcontracts in El Obeid and will facilitate the disbursement of counterpart funds. North Kordofan State RPA staff will join the project for induction training and other relevant workshops.

The National Director and the Chief Technical Advisor (CTA) will have the responsibility of establishing the project, in both technical and administrative terms. The CTA will join the project initially on a one-month consultancy, as soon as the National Director is appointed, to initiate personnel and equipment procurement. Thereafter, the CTA will return on a eleven-month

consultancy as soon as the procurement process is completed and equipment and personnel have been delivered to the project. The NTA will be assistant to the CTA in the first year. The CTA will hand over his/her responsibilities to the NTA upon completion of assignment. If needed, a national consultant on project management will be requested to backstop the project's administrative/financial matters, to be funded through UNDP's TSS-2 funds. Additional technical consultants using expertise from other special UN agencies can be brought to the project when required using the TSS-2.

The project will have a national advisory committee for coordinating and overseeing the project. The composition of the committee will be decided at the time of implementation by UNDP/UNSO and RPA, but it is proposed that it consist of the National and North Kordofan State Directors of the RPA, the representative of the National and State Ministry of Planning, the State Director of the Forest National Corporation (FNC), the Director of the High Council on Environment and Natural Resources, the Nazir of Dar Hamid, the two Omdas, the Director of the Agricultural Bank in Bara, and the project's National Director, CTA, and NTA.

The national advisory committee should meet once a year in Bara to review project progress. The project's National Director will prepare and present an annual report to this meeting. The National Director will have overall responsibility and authority for the implementation of the project, but will draw upon the resources of the national advisory committee. The committee's terms of reference, to be finalised upon creation, will include:

- Review of project activities and progress and consideration of implementation arrangements and problems
- Evaluation of project and recommendations for revisions, if required, to be approved by the project's community-based organisations
- Follow-up on government contribution
- Review of audit reports, especially on the credit component
- Consideration of the need for national-level actions to facilitate project activities (better government coordination and legislative framework).

Enhancement of local institutions so that they include women and mobile pastoralists and better perform resource management will be considered.

It is recommended that a central coordinating body be established, composed of project senior staff and representatives of the local leadership. This central coordinating body has been called Legnat al Tansigh by the local community, meaning coordinating committee. It will congregate project leadership with representatives from each village council, as well as the chief of the RC and the RC's judge. The latter two will be pivotal in ensuring formal acceptance of project activities, particularly the land use master plans. The RC judge will have a direct role in adjudication and conflict resolution on land matters.

Legnat al Tansigh will create three higher subcommittees responsible for technical matters: the resource management subcommittee, the drought subcommittee, and the women's subcommittee. The subcommittees will be composed of project technical staff and local people. Links with the Native Administration (especially Nazir of Dar Haamid), local government in the RC and Bara commissionate also need to be developed. Yearly meetings in Bara between the Legnat al Tansigh, the Nazir, and Bara local government officials will be held to review activities.

Legnat al Tansigh would be linked to each village council by an executing committee composed of people's representatives and local leaders. This has been called the Legnat al Tanfeez or implementing committee by the villagers. Legnat al Tanfeez will also have six technical subcommittees: resource management subcommittee, water subcommittee, credit subcommittees (one for men, one for women), women's irrigated gardens subcommittee, and pastoral women's subcommittee. Legnat al Tanfeez will have a maximum of seventeen members.

5. Reasons for assistance from UNDP

This pilot project aims to create a favorable environment for the grassroots communities in the Gireigikh Rural Council of Bara Province, North Kordofan State. Enhanced land use systems can be improved for utilisation of productive natural resources on marginal lands. GEF support for this project is appropriate on the following grounds:

- The project addresses the cross-cutting area of climate change/desertification within the GEF, providing an original contribution to the GEF project portfolio
- The project uses a community-based approach to reducing global warming through carbon sequestration
- It combines a reduction of global warming with increased biodiversity, while improving the welfare of the local pastoral and agropastoral communities living in the project area
- If proven successful, the results will be replicated in similar projects all over the world
- The country lacks funds for development efforts
- It is participatory in nature, involving close collaboration with local communities.

6. Special considerations

Of special concern is the environmental vulnerability of the area and its recent decline in productivity due to drought and other factors. This vulnerability has led to the adoption of several local-level activities aimed at rangeland rehabilitation and improvement and land use planning and management. Past failures at dealing with this problem through centralised approaches has also influenced the choice of an unconventional, grassroots-level approach to rangeland development.

Poor segments of society

The vulnerability of the production system and its impact on the poor has influenced such activities as water development, credit (in several forms), irrigated fodder production, irrigated vegetable production, fodder conservation, and paravet training.

Women

The increasing demands on women, including their increased role in livestock production due to seasonal migrant labour, is a concern that has influenced activities aimed at generating income and decreasing production risks, such as the irrigated gardens and the cash revolving fund.

Mobile pastoralists

Mobile and semi-mobile people practising transhumance have long been left out of mainstream development efforts, primarily because there was no model for their participation. It will take considerable modification of the attitudes of both pastoralists and government personnel before this group can become an effective partner in development.

7. Coordination arrangements

As mentioned previously, the project will stand to benefit from experiences learned in a few other ongoing projects in the Sudan. Close contacts through visits, exchange of reports, and shared data will be maintained with these projects, including: UNSO's El Odaya project, the NMF project, CARE in Bara, and ADS of North Kordofan.

8. Counterpart support capacity

The RPA is in a position to provide all national staff required by the project—either from its current staff or through secondment from other Ministries and Departments—and their salaries and field allowances. Some of the staff will require additional training before being assigned to the field. The RPA is expected to maintain the appropriate level of staffing for the duration of the project and to minimise staff turnover. The RPA is expected to be able to sustain the results of the project after its completion. The government is also in a position to procure (rent) existing building sites in Bara Town, but the project will assist in rehabilitating the buildings to suit its needs.

C. DEVELOPMENT OBJECTIVES

The project's overall development objectives are to achieve a sustainable, local-level natural resource management system that prevents degradation, rehabilitates or improves rangelands, reduces global warming through carbon sequestration, preserves biodiversity, and reduces atmospheric dust in the region. The project also aims to reduce the risks of production failure and increase the number of alternatives for sustainable production, so that out-migration will decrease and the population will stabilise.

These development objectives follow the Fourth UNDP Country Programme's (1993-1996) three areas of concentration: i) sustainable rural development, (ii) promotion of food security, and (iii) strengthening of national capacity to manage development.

D. IMMEDIATE OBJECTIVES, OUTPUTS, AND ACTIVITIES

The aim of the project is to encourage local people to commit to the communal management of their land and resource base in ways that reduce global warming and increase biodiversity. At the same time, the project aims to reduce day-to-day uncertainty and the effects of drought in these arid environments by providing alternatives for improved production systems and greater availability of basic inputs (water, credit, animals, seed, and grain).

IMMEDIATE OBJECTIVE 1

To enhance the ability of local people to manage their natural resources at a sustainable level to prevent land degradation and to rehabilitate or improve rangelands.

Output 1.1

Appropriate field base-line data collected.

Activities for Output 1.1

- 1.1.1 To create five land boundary maps and five land use maps, one for each village council. The work will be done in a participatory manner by walking around all village boundaries with local leaders and recording the exact geo-position on a base map using a Global Positioning Systems device (GPS). Mapping land uses will be done with the aid of a 1:100,000 satellite image and by verifying satellite information through ground surveys.
- 1.1.2 To create a transhumance map covering the livestock movements of the Kawahla, Gawamaa, and other pastoralists within the project area and outside it.
- 1.1.3 To conduct a rapid rural appraisal of people's indigenous technical knowledge and assessments of natural resources (present and future), including drought prediction and any coping mechanisms. It will also involve a socio-economic survey of transhumance and settled populations, covering production systems and yields, areas cultivated, grain needs, women's participation, prospects for income-generating activities, livestock productivity (especially milk), income saving and expenditure, labour out-migration, and alternative employment.

Output 1.2

An institutional structure established for community-based management of natural resources and development.

Activities for Output 1.2

- 1.2.1 Executing committees and Legnat al Tanfeez will be created in each village council and will in turn appoint six subcommittees: grazing management, water management, women's gardens, pastoral women, men's credit, and women's credit.
- 1.2.2 Legnat al Tansigh will consist of senior project staff, one representative from each executing committee (five total), and the chief and judge of the RC. In this committee, at least two members will be women and two will be representatives of pastoral groups. The North Kordofan state director of RPA will attend the Tansigh committee's yearly meetings.

Output 1.3

Five land use master plans, one for each village council, developed with full participation of the people, formalised within the local government structure, communicated to the entire project population, and used as the basis of future action.

Activities for Output 1.3

- 1.3.1 To create land use master plans to resolve any village boundary disputes and to clearly identify the rights of the Kawahla and other pastoralists (grazing areas).
- 1.3.2 The Tansigh committee will obtain local government and Native Administration acceptance of the land use master plans, including their formal recognition of the territorial rights, public proclamations (radio, posters), and incorporation of the plans into the development programme of the RC.
- 1.3.3 The Tansigh and Tanfeez committees will arrange to formally mark the boundaries of villages and village councils using paint, rocks, or other locally available materials. They will revise the land boundary maps, if necessary.
- 1.3.4 The Tanfeez and Tansigh committees will install a mechanism for public supervision and control to ensure compliance with the land use master plans and other forthcoming activities of the project. In the first three years, the project will finance guards if necessary; however, compliance to rules should result from communal supervision of lands and increased dialogue between leaders and the people.
- 1.3.5 The project's community mobilisation teams will transform the master plans into products readily suited to local people, through general meetings, market gatherings, and schoolroom presentations.
- 1.3.6 The Tanfeez and Tansigh committees will periodically review the master plans and modify them if needed, after approval through a general assembly.

Output 1.4

A detailed project workplan developed by the Tanfeez and Tansigh committees that specifies the schedule of project activities, the potential direct recipients, and the location of activities based on the land boundary and land use maps.

Activities for Output 1.4

- 1.4.1 To conduct a socio-economic survey of the settled and mobile communities in the area (see Activity 1.1.3).
- 1.4.2 To conduct a soil and vegetation baseline survey of the entire RC at the 1:100,000 scale in the first six months of the project. This survey will be done using satellite imagery and ground surveys by the project's range management officer and assistants, some of whom will be recruited locally and paid by the project. The purpose of the baseline studies is not to do detailed inventories, but to collect enough data to allow monitoring of indicators.
- 1.4.3 The Tanfeez and Tansigh committees, using the information generated previously, will create a project workplan that specifically identifies sites and timetables for the immediate execution of the other project activities. Through this process, the local leaders will be encouraged to review the content of the activities and to suggest revisions if necessary.
- 1.4.4 The Tanfeez and Tansigh committees will review the project workplan every year and revise it if necessary. The project's mid-term and final evaluation should take these revisions into account.

Output 1.5

Enhanced capability of the local leaders and project staff to carry out their mandate.

Activities for Output 1.5

- 1.5.1 Members of the Tansigh and Tanfeez committees and all subcommittees will be given induction training and specialised training for their tasks (management of projects, accountancy, secretarial work, technical training on water or range management).
- 1.5.2 Members of the Tansigh and Tanfeez committees and some subcommittee members will visit other related projects in the Sudan.
- 1.5.3 The community mobilisation team, consisting of the sociologist, assistant sociologist, five project community mobilisers, ten local community mobilisers, and two project extension agents, will be trained in popular participatory techniques used in community management of natural resources.

- 1.5.4 Training of the fodder production specialist through a study tour of fodder production projects in the Sudan and other African countries.
- 1.5.5 Visit of project accountant to the ADS project in El Obeid to review its experience with the Sandug programme.
- 1.5.6 Induction training of all project staff and local leaders by the international consultants and National Director on the project's approach, philosophy, strategies, and methodology. Visits to El Odaya and other relevant projects will be arranged for all project staff. There will be regular project seminars to motivate and upgrade the staff and local leaders and representatives.
- 1.5.7 Two range officers (NTA and grazing management) will be trained in the use of the GPS device at the Land Survey Department in Khartoum.
- 1.5.8 All project consultants will conduct on-the-job training for the staff. The project staff will also be responsible for developing information manuals on each of their responsibilities to be used for extension purposes and for other interested people and projects.
- 1.5.9 The North Kordofan State RPA will assist the project with administrative matters that are to be handled in El Obeid, at the request of the National Director. In addition, North Kordofan state RPA staff will attend the induction training and other relevant workshops offered by the project, using the vehicle allocated to RPA from project funds.
- 1.5.10 Towards the end of the project, and assuming the pilot tests have been successful, the project will conduct workshops to disseminate its experiences to other projects, NGOs, government organs, and interested people.

Output 1.6

Five community mobilisation teams established and trained to carry out extension work on environmental education and technical innovations. Half of the community mobilisers will be women.

Activities for Output 1.6

- 1.1.6 A mobilisation coordination team will be created whereby a local representative of the Tansigh committee works jointly with the project's sociologist/community mobilising specialist to coordinate activities with the technical divisions of the project. They would develop the content and method of communication with the people.
- 1.6.2 In each village council of the project area the mobilisation team will consist of one project community mobiliser (man or woman), and one local man and woman

identified as well-respected, knowledgeable opinion-leaders. Project funds will be used to pay part-time salary to the local mobilisers for the first three years.

- 1.6.3 The mobilisation teams will be trained by the coordinating team to make full use of all communications equipment (demonstrations, lectures, films, school lectures, and traditional gatherings) for environmental education and the dissemination of project results.
- 1.6.4 The Tansigh committee will consider, by year three, the future role and need for the mobiliser teams.
- 1.6.5 The mobilisation coordination team will arrange inter-project visits for local people.

IMMEDIATE OBJECTIVE 2

An enhanced ecological capacity for rangeland regeneration after drought and an initiation of the rehabilitation of a portion of the degraded areas through physical interventions and people's participation.

Output 2.1

Revegetation of up to five kilometres of denuded sand dunes threatening economically sensitive areas or project activities.

Activities for Output 2.1

- 2.1.1 To use the soil and vegetation survey (see Activity 1.4.2) to identify potential sites for revegetation.
- 2.1.2 To procure seedlings of mesquite, *Leptadenia* spp., or other appropriate woody species, such as *Grewia tenax*, *Ziziphus spina-cristi*, and *Capparis decidua* for wetter areas from the project's central nursery (or later from the nurseries established in people's homes or in the women's irrigated gardens).
- 2.1.3 To procure and scarify tree seeds for direct seeding trials.
- 2.1.4 To procure perennial grass cuttings or pelleted seeds for revegetation.
- 2.1.5 To organise local volunteers to do the work (planting and giving food and water to planters).
- 2.1.6 To transport materials to site and revegetate up to one kilometre per year.

Output 2.2

Up to 130 farms (195 kilometres) provided with windbreaks.

Activities for Output 2.2

- 2.2.1 Compare the land use maps showing farm density (see Activity 1.1.1) with the soil-vegetation maps (Activity 2.1.1) to identify areas of greatest degradation and sand encroachment.
- 2.2.2 The project's community mobilisation team will produce and communicate extension material related to windbreak production to the local people, making sure that women's voices are also heard.
- 2.2.3 The grazing subcommittees will choose volunteers from up to ten households per village who would plant windbreaks without direct payment from the project. The Kawahla and other pastoralists should be encouraged to join and given long-term rights to the lands they currently farm.
- 2.2.4 Procure seedlings or direct seeds from the project's central nursery and distribute to farms.
- 2.2.5 Starting in year two, plant up to 300 metres per household per year and establish an estimated 1,500 metres of windbreak per household in four years.

Output 2.3

At least 100 hectares of rangeland improved and properly managed.

Activities for Output 2.3

- 2.3.1 Using the Land Use Master Plans, the Tanfeez and Tansigh committees will choose not more than 10 percent of the area (minimum 10 hectares) of each village council as the site for rangeland rehabilitation. This block will be put under complete protection from all uses, including grazing and fuelwood collection, excepting medicinal uses.
- 2.3.2 The community mobilisation team will develop material to explain the reasons for these blocks, plans for their improvement, and plans for their eventual opening to controlled use by the people.
- 2.3.3 Trials will be conducted on several rehabilitation techniques, such as the re-introduction of native perennial grasses through seed pelleting or cuttings. Trials will also re-introduce native browse species, such as *Ziziphus* spp. Establishment of trees and shrubs will be done by testing a combination of direct seeding and seedling transplanting.
- 2.3.4 The grazing management subcommittee will proclaim the block as a reserve for at least two years or until the introduced vegetation has effectively been established. The committee may decide to place guards on the boundaries of the block for the

duration. It will then be opened to controlled grazing, the details of which will be developed by the grazing management committee. Considerations should be given to establishing a grazing fee on the rehabilitated block to generate funds for replication of the work in other parts of the rangeland.

- 2.3.5 If enough time remains in the project, a second block will be reserved and rehabilitated in the same manner, using the more successful techniques. In the project lifetime, it is expected that up to 20 hectares will be rehabilitated in each village council.

Output 2.4

An environmental monitoring and evaluation unit will be established.

Activities for Output 2.4

- 2.4.1 The environmental monitoring unit will consist of members of the grazing management subcommittees, plus technical experts of the project, backstopped by the international consultant on carbon-sequestration. This consultant will design the monitoring methodology and train project staff. Local people will be asked to do the actual data collection. Results will be evaluated at mid-term and end of project.
- 2.4.2 A national consultant will conduct periodic wildlife surveys to monitor impacts of the project on wildlife.
- 2.4.3 The results of the environmental monitoring unit will be reported to the scientific and international community at large and will be used in project workshops.
- 2.4.4 The monitoring/evaluation missions will include a consultant on carbon-sequestration and environmental monitoring.

IMMEDIATE OBJECTIVE 3

A diversification and improvement of the local production system through environmental education and the introduction of technological innovations.

Output 3.1

Up to five new shallow, hand-dug wells and ten rehabilitated shallow wells in the project area.

Activities for Output 3.1

- 3.1.1 The Tansigh committee will select the villages requiring intervention, in coordination with the activities of CARE and UNICEF, and following the land use master plans and the preparatory phase water development feasibility study.

- 3.1.2 The National Rural Water Corporation or another contractor will be contracted to construct the wells, using local people's inputs in decision-making and local labour.

Output 3.2

A water management subcommittee in each village council to manage the public access wells, paying close attention to the methods used by CARE and UNICEF in North Kordofan.

Activities for Output 3.2

- 3.2.1 The Tanfeez committee will appoint a water management subcommittee that includes Gawamaa, Kawahla, and other pastoralists.
- 3.2.2 The community mobilisation team will discuss with the people issues of public access to wells and their management in terms of hygiene, maintenance, and proper use, including access by livestock. Links will be established with UNICEF and CARE in Bara and El Obeid to coordinate messages and maintenance procedures for the wells.
- 3.2.3 The water management subcommittee will establish a management plan, including responsibilities of citizens and fees for maintenance.

Output 3.3

A project experimental substation established and operational with fodder trials and nursery to be used for demonstrations and extension of project innovations.

Activities for Output 3.3

- 3.3.1 The RC or Tansigh committee will select an area of about one hectare as the site for the project's experimental substation in Gireigikh Village, and it will pay the people to construct sheds and other low-scale buildings needed for operation.
- 3.3.2 The project will construct for the substation one large- diameter well supplied with a diesel pump and irrigation canals made from locally available material.
- 3.3.3 The project fodder production specialist and assistants will conduct trials on promising forage species under irrigation and will evaluate and disseminate results through manuals and other communication methods, such as monthly demonstrations or bi-annual agricultural shows.
- 3.3.4 The horticulturalist, with assistance from the arid land agronomist consultant will test drought-adapted crops under rainfed conditions in the substation, including short-duration millet and watermelons. Results will be communicated to the women's groups.

- 3.3.5 The range improvement officer will test the germination and initial performance of new drought-adapted grass and shrub species and verify the results of the seed-pelleting studies during the first year, so that results are ready for range rehabilitation during the second year.
- 3.3.6 The project forester and local assistants will establish a central nursery in the substation to test the adaptability of drought tolerant species and to provide seedlings, seeds, and cuttings for the other activities of the project. The central nursery should have a minimum capacity of 40,000 tree seedlings, 10,000 grass cuttings, and 10 to 20 kilograms of various seeds. The nursery will be constructed so that it can be expanded to fully meet all project demands.
- 3.3.7 The project forester and local assistants will initiate decentralised nurseries starting in year two, either in volunteer households, or in the women's irrigated gardens at each village council.
- 3.3.8 The Tansigh committee will consider the future of the substation after project completion and will develop plans for its use.

Output 3.4

Five women's irrigated gardens with five new shallow wells established.

Activities for Output 3.4

- 3.4.1 Centered around existing women's groups and existing gardens, this programme will provide technical and financial assistance to women.
- 3.4.2 Existing or new gardens of each village council will be grouped together and a hand-dug shallow well provided in the center, with irrigation canals made of locally available material to reach each group's garden.
- 3.4.3 The women will make decisions within the gardens and provide the fence and all labour necessary for planting, weeding, and harvesting.
- 3.4.4 Any species of interest to the women will be planted, including fodder, vegetables, and fruits, but emphasis will be placed on increasing milk production and better feed for goats.
- 3.4.5 Women's groups involved in irrigated gardens will be given priority access to credit from the revolving fund (Outputs 4.1 and 4.2).

Output 3.5

Five pastoral women's groups will receive assistance in goat production, sheep fattening, dairy production, and marketing.

Activities for Output 3.5

- 3.5.1 In each village council, at least one group of pastoral women will be established with interests in dairy production and marketing. The mobilisation teams will be in charge of organising this activity. Women will be given training in project management and project feasibility analysis.
- 3.5.2 The pastoral women's groups will be trained to identify bottlenecks and propose solutions for increased dairy production, sheep fattening, and better marketing of milk products and sheep. Close cooperation with women's irrigated gardens should be maintained for fodder. This could be either through trade between the respective women's groups, or the two groups could work together on fodder production.
- 3.5.3 At least one woman from each pastoral women's group will be trained and equipped as an animal health worker (Output 3.6).
- 3.5.4 The pastoral women's groups will be given priority access to credit from the revolving fund and from the restocking programme (Output 4.3).

Output 3.6

Fifteen community animal health workers (CAHW) trained and working in the project area.

Activities for Output 3.6

- 3.6.1 The project will conduct a survey of the animal disease profile in the project area.
- 3.6.2 The Tanfeez and Tansigh committees will select fifteen people known for their medical or livestock raising skills for this programme.
- 3.6.3 The programme will consist of training two people per village council (one for settled villages and one for the mobile camps). The CAHW will be trained by the project's veterinarian, backstopped by the international paravet consultant, and assisted by the local medical officer in conducting elementary diagnosis and treatment as well as data collection.
- 3.6.4 The paravets will be provided with an initial free package of medicines. They will be expected to sell the drugs to the people and from the proceeds to purchase more drugs.
- 3.6.5 The project will provide a 50 percent matching grant to allow the Tansigh committee to construct and maintain a pharmacy in Gireigikh, which will be managed by a local person nominated by the Tansigh committee. The Tansigh committee will be responsible for raising their 50 percent share before the project hands over its share.

- 3.6.6 The nominee for pharmacy manager will be trained in accounting, pharmacology (human and animal), and storekeeping.
- 3.6.7 The project will stock the pharmacy with medicines based on the estimated needs identified through the animal disease survey, and on the human side, through recommendations of the medical officer.
- 3.6.8 Operations of the pharmacy will be handed over to the Tansigh committee as soon as possible. The Tansigh committee will be able to use the funds generated by the pharmacy to purchase new drugs every year.
- 3.6.9 The project will work closely with the local animal health officer to supervise the CAHW and will handover information generated by the CAHW to the Ministry. After project completion, the animal health officer of the regional office in El Obeid will be expected to take over CAHW supervision and training.

Output 3.7

Trials with fodder conservation technologies conducted with successful methods passed on to local people.

Activities for Output 3.7

- 3.7.1 The project's fodder production staff will experiment with improved designs for fodder storage aimed at preserving the quantity and quality of forage until the end of the dry season. The fodder will consist of crop residues, hay collection, kitchen wastes, and collection of mesquite pods (from revegetated areas).
- 3.7.2 The community mobilisation team, with assistance from the fodder production specialist, will extend the results of these trials.

Output 3.8

Alternative energy trials and extension.

Activities for Output 3.8

- 3.8.1 The community mobilisation team will survey existing alternative energy experiments aimed at reducing the area's dependence on fuelwood. Several techniques are currently being tried out and extended in other parts of Sudan, and models could be brought to the project and evaluated by the unit.
- 3.8.2 The community mobilisation team will extend the most appropriate designs to women's groups working with the project, and later to all other interested seekers. Although the first trials can be free of charge, once a prototype is successfully tested, it should be promoted as a fuel/time saving device and sold to interested women.

Output 3.9

A monitoring and evaluation unit made up of representatives of relevant subcommittees, committees, and project staff.

Activities for Output 3.9

The unit will monitor the economic and social aspects of project interventions, both in terms of development and drought contingency measures (Immediate Objective 4). Monitoring will focus particularly on whether the activities are adopted and if they succeeded in raising the people's standard of living.

IMMEDIATE OBJECTIVE 4

Drought contingency measures in place to reduce the adverse effects of droughts and to assist the local people in revitalising their household economies.

Output 4.1

A drought subcommittee created within Legnat al Tansigh.

Activities for Output 4.1

- 4.1.1 The Tansigh committee will appoint this committee made up of representatives from credit subcommittees of Legnat al Tanfeez and from the Tansigh committee. The committee will have a total membership of ten, including at least two women and two pastoralists.
- 4.1.2 The drought subcommittee will develop a drought contingency plan that will include major components of credit, restocking, and drought-adapted production. The subcommittee will guide the overall planning of the Tansigh committee.
- 4.1.3 The drought subcommittee will set in place a local early warning system by tapping into the project's monitoring efforts, national meteorological information, and using the traditional system of climate and crop prediction. It will use this information to plan for food aid in the event of extreme drought.
- 4.1.4 The drought subcommittee will oversee the Tanfeez credit subcommittees, assisting them with coordination of rules and regulation. It will also liaise with the Agriculture Bank of Sudan.

Output 4.2

Two credit subcommittees, one for women and one for men.

Activities for Output 4.2

- 4.2.1 The Tanfeez committee will appoint two credit subcommittees to administer three lines of credit given by the project. Each subcommittee will consist of at least six members, with one from each village and three pastoral representatives. One subcommittee will manage loans for men, the other for women.
- 4.2.2 The credit subcommittees will appoint local accountants (one treasurer and two assistants per subcommittee) who will be given training by the project's accountant and credit consultant on credit operations and management. The accountants will be given a salary by the project in the first three years until the operation is handed over to the local community.
- 4.2.3 The project's community mobilisation teams will work closely with the credit subcommittee to communicate the philosophy and content of the credit schemes to the people.

Output 4.3

Two small revolving funds to supply cash credit to suitable applicants (individual or groups) who wish to implement income-generating activities.

Activities for Output 4.3

- 4.3.1 The credit subcommittees, with assistance from the project's accountant and credit specialist, will establish procedures to assess the income-generating activities of the area and will select the minimum size of loans, groups eligible, and repayment conditions. Different rules may need to be developed for loans to men and women.
- 4.3.2 Establish bank accounts for each revolving fund in Bara's Agricultural Bank of Sudan. Yearly audits of each revolving fund by the bank will be paid by the project in the first three years and later be taken over by the credit subcommittees. The revolving funds will establish an appropriate fee to be charged to all borrowers to finance the running of the revolving funds.
- 4.3.3 Loans on an average of £S 30,000.00 per person (or group) will be provided, with repayment expected not more than one year later. Repayment terms should take into account the high rate of inflation, otherwise the revolving fund will not be sustainable.
- 4.3.4 Returned loans will be put back into the revolving funds for further loans. New loans should be made contingent upon repayment of old loans, even if by different people, as a way of ensuring repayment within the community.

Output 4.4

A livestock restocking programme that restocks the herds of up to 80 percent of the poorer population whose herds have lost reproductive potential. Restocking will be done gradually—in pace with the rehabilitation of rangelands, water development, and the fodder production activities—to prevent overgrazing.

Activities for Output 4.4

- 4.4.1 Successful applicants screened by the credit subcommittee will be provided with two mature goats. They will be required to return the loan, in kind or cash, equivalent to two kids after 1.5 years.
- 4.4.2 Returned kids/cash will be recycled into the programme or put into other project activities. The subsidy rate of this programme is estimated at 70 percent because the value of the kids is far less than the mature goats. The success of the programme will be judged according to the rate of loan default and the increase in the overall size of livestock holdings.
- 4.4.3 The credit subcommittee will be encouraged to continue the programme after the completion of the project by fattening the returned kids (on irrigated fodder from the experimental substation) and selling them at profit. Two feedlot attendants will be paid by the project until the operation becomes profitable, or until the third year. Thereafter, the Tansigh committee will consider the future of the operation.
- 4.4.4 The project's range officer (grazing management), veterinary officer, and accountant will supervise the livestock restocking programme and monitor its effects.

Output 4.5

A grain storage and credit programme (for seed not relief aid) established and operational, giving grain credit to a maximum of 80 percent of the project population.

Activities for Output 4.5

- 4.5.1 The credit subcommittee, with assistance from the project's horticulture officer, will create five grain credit units, one in each of the village councils.
- 4.5.2 The credit subcommittee and the grain credit units will be responsible for constructing grain stores with local labour and from local materials, with a storage capacity of approximately 1,200 sacks.
- 4.5.3 The project will secure the supply of 12,000 sacks of grain from the World Food Programme (WFP) over the project's operation, divided into two shipments.

- 4.5.4 The credit subcommittee will monitor harvest and grain needs, coordinate with the FAO/UNDP/UNIFEM project in Bara, and, with the help of the grain credit units, select households in need of support.
- 4.5.5 The grain credit units will supervise the operation of disbursement and take responsibility for ensuring loan repayment over a schedule agreed upon between the committee and the applicants.
- 4.5.6 In the event of a drought, WFP food for relief aid will be brought and stored in the grain store for distribution. The project will fund the transport costs.
- 4.5.7 The Tansigh committee will consider the future of the programme, especially how to ensure a sustainable grain supply. It may consider alternatives such as communal seed production in irrigated gardens, or trade arrangements with neighbouring regions.

E. INPUTS

1. Government

The government will assign or transfer to the project the staff listed below. Such staff will be suitably qualified and experienced. The government will be responsible for financing the payment of salaries and allowances commensurate with current policies and future policies which may from time to time be decided by the government. The government is also responsible for providing the housing and offices, including utilities, for the staff in Bara Town.

Personnel

All staff listed below will be assigned full time to the project. Positions are expressed in man-years to the right.

National Director	5
Range Officers (3)	15
Horticulture Officer	5
Forestry Officer	5
Veterinary Officer	5
Sociologist	5
Small Animal Officer*	5
Range Assistants (4)	20
Veterinary Assistant	5
Sociologist Assistant*	5
RC Medical Officer	5
Community Mobilisation Assistants* (5)	25
Extension Agents (2)	10
Admin. Asst/Accountant	5

Mechanics (2)	10
Secretary	5
Drivers (6)	30

- * The small animal specialist and the assistant sociologist will be women. Not less than two of the community mobilisation assistants will be women.

The project will have its headquarters in Bara, with a substation in Gireigikh Village. The experimental plot, the four range assistants, the two extension agents, the veterinary pharmacy, a mechanic, and one community mobiliser will be based in the substation. All other community mobilisers and the grain storage programme will be based in the center of each village council. All other staff will be in Bara: National Director, NTA, range managers, horticulturalist, small animal production specialist, forester, veterinarian, sociologists, administrative assistant/accountant, all consultants, secretary, drivers, and one mechanic.

The National Director will be a range manager with experience in land use planning and community participation. The three range managers will be experts in fodder production, range improvement, and grazing management/ecology. The forestry officer will be expert in agroforestry. The horticulture officer will have experience with both irrigated crops as well as rainfed drought-resistant crops. The veterinarian will have experience with traditional knowledge and community-based approaches. The sociologist will have experience with community participation approaches. Of the two extension agents, at least one will be a woman with experience with women's groups and improved stoves.

Buildings

The government will be responsible for providing the housing and office space required for the project staff in Bara Town. The equivalent of five large houses, to house all staff including a guest house and one large house to be used as office, will be rented by the government in Bara. The cash contribution of the government representing this rent, to be paid in local currency, is estimated to be £S 15,000,000 (at prevalent rates).

It is estimated that the cost of utilities for five years for the offices and buildings, including electricity, water, and telephone charges, will be £S 1,300,000.

The government will ensure that the funds agreed upon under a government cash counterpart contribution (GCCC) arrangement for staff motivation and local equipment procurement would be released immediately upon signature of the project document to UNDP's bank account in Khartoum. The funds, to be calculated in US dollars would be disbursed in local currency, using the exchange rate prevalent at time of disbursement.

The total cash contribution of the government, excluding the amount to be agreed through the GCCC, will be £S 28,858,600.

2. GEF

The remaining requirements of the project, not covered by the government contribution will be provided under GEF financing. These will include personnel, subcontracts, equipment, training, and operation and maintenance of vehicles and equipment. Of a total budget of US\$ 1.5 million, about 20 percent goes directly (as in-kind or cash) to the local people (by way of credit, production inputs, costs of local buildings and wells, and local hire).

Personnel

The standard rates recommended by UNDP are here converted into US dollars for the sake of budgeting only. The national personnel of the project hired under external financing will be paid in Sudanese pounds.

	Total cost US \$
CTA (12 m-m)	140,000
International Consultants	
Range Manager/Pastoralist (3 m-m over 4 yrs)	36,000
Veterinarian (paravet) (2 m-m)	24,000
Carbon-sequestration expert (1.5 m-m)	19,250
National Professional Project Personnel	
National Technical Advisor (5 m-y)	100,000
National Consultants	
Land use/regional planner (3 m-m)	5,280
Range improvement expert (3 m-m)	5,280
Credit specialist (3 m-m)	5,280
Wildlife specialist (5 m-m)	8,800
Sociologist (2 m-m)	3,520
Arid agronomist (2 m-m)	3,520
Local Hire	
Locally hired people will be drawn from both settled and mobile communities. Salaries are based on £S 3000/month. The guards will be hired only if absolutely required.	
20 Guards (60 man-years)	15,600
4 Soil/vegetation survey assistants (24 m-m)	530
Experimental station construction (30 m-m)	640
6 Experimental station operation assts. (30 m-y)	7,800

50 Range improvement trial workers (25 m-y)	6,500
10 Community mobilisers, half-time (15 m-y)	3,900
2 Senior treasurers (6 m-y)	1,560
4 Assistant treasurers (12 m-y)	3,120
Accountant (3 m-y)	780
2 Assistant accountants (6 m-y)	1,560
Pharmacist (3 m-y)	780
2 Feedlot attendants (6 m-y)	1,560
Total local hire	44,330

Duty Travel

Duty travel includes travel of the National Director of RPA to the project (two trips) and also of the Regional Director of RPA (six trips). It also includes official travel by project staff to Khartoum and El Obeid, and travel in connection with meetings of the National Advisory committee. Finally, it includes a "night field allowance" given to project staff if they stay anywhere within the project area not their duty station. A rate of £S 200/night has been calculated. This night allowance has been provisionally agreed to by UNDP/Khartoum.

Official travel	7,000
Night Allowance	18,000
In-country travel	10,000

Evaluation Mission

Evaluation mission	35,000
HQ technical monitoring mission (UNSO/GEF)	17,619

Subtotal personnel **519,532**

Subcontracts

New shallow wells (5)	21,500
New shallow wells with irrigation canals (5)	32,250
Large diameter well, irrigation canals	46,875
Rehabilitated wells (10)	10,000
Overhead charges	8,000

Subtotal water development **118,625**

Laboratory soil analysis	2,000
Rehabilitation of project offices and houses	5,000
Local construction of pharmacy and grain store	10,000
Local construction of feedlot	1,000
Rental of 40 T lorries, Khartoum-Bara (4 times)	6,000

Subtotal subcontracts	142,625
Training and visits	
Community mobilisation team (18 persons, 2 mo)	4,000
Fodder specialist tour (1 mo)	1,500
Local pharmacist trained in El Obeid	800
Staff visits to other projects	6,000
Local people visits to project sites and other projects	12,000
End-project workshops to disseminate results	10,000
In-service training	5,000
Subtotal training and visits	39,300
Procurement of equipment	
<p>The equipment under this project will be procured according to UNDP rules and will be essential to the achievement of the project objectives, in particular the transfer of knowledge and skills to the national staff. A project like this that deals with people in remote communities, as well as with mobile populations, requires adequate mobility of project staff, hence the heavy expenditure on vehicles.</p>	
Expendable equipment	
Local purchase:	
Goats for restocking	11,400
Material for making land use maps and marking boundaries	1,000
Stationery and office supplies	7,000
Extension and communications materials	2,000
Seeds, seedlings, polypots	3,000
Fodder storage prototype construction	1,500
Alternative energy prototype and dissemination	1,500
External purchase:	
CAHW starter kits and training material	3,150
Pharmacy initial stock	5,000
Photocopier and computer papers and ink	5,000
Subtotal expendable equipment	40,550
Non-expendable equipment	
Local purchase:	
Camping equipment (3 sets, each for 6 people)	9,000
Office furniture	9,000
Housing furniture	57,000

External purchase:

Global positioning systems device and installation	4,000
Satellite imagery	2,000
Laptop computers and accessories (3 + modem)	18,000
Extension and communication equipment	5,100
Soil and vegetation survey equipment	3,000
CAHW training equipment and animal survey tools	1,450
Fencing for experimental substation	2,000
Photocopier	2,000
Radios and generator	29,000
Vehicles (7)	119,000

Subtotal non-expendable equipment 260,550

Subtotal equipment 303,100

Revolving Fund

The capital assigned to each fund at this time is only indicative, based on the suggestions of the people during the participatory formulation mission. Final allocation of funds is at the discretion of the Tansigh committee. Experiences of the ADS Sandug should be considered in designing the component.

Revolving fund for women	15,000
Revolving fund for men	25,000

Subtotal Revolving Funds 40,000

Direct Cost: Reimbursement to field offices for services provided in relation to GEF projects.

Experience indicates that field offices are incurring significant workload in relation to the identification, formulation, processing, support, and monitoring of GEF projects. In line with UNDP's financial regulations such support must be reimbursed and should be charged to the project budget.

Therefore, the field office requests reimbursement for the following services provided during the implementation of this project:

- Locally recruited programme assistant, based at the UNDP field office, to assist the executing agency in the management of the project on a daily basis for three years. Given the relatively small budget of this project, such assistance cannot be given for the entire five years. It is hoped that another GEF project will come on line to take over the additional costs.

30,000

●	Monitoring/field travel of office programme staff	
	DSA	6,000
	Fuel for vehicles	3,000
●	Communications, office supplies and sundries	2,000
●	Contingency	2,225
	Subtotal Direct Costs	43,225
Operation and Maintenance		
<p>In normal circumstances, the government would be responsible for the operation and maintenance of vehicles and all equipment. However, recent economic difficulties in the country, particularly the need to ration fuel, has prompted the Implementing Agency to request assistance from UNDP for this component. Added justification comes from the fact that the project is located in a remote area, so transport and telecommunications are vital to its success.</p>		
	Operation and maintenance	277,618
Other		
	Reporting Costs	5,000
	Sundries	10,000
	Contingency	100,644
	Subtotal miscellaneous	504,715
	Total GEF contribution	1,500,000

F. RISKS

Probably the greatest project risk is drought. On average, it is now expected that two out of every five years will dry; however, it could be more. In such a case, the estimated benefit of the project in terms of carbon sequestration, as calculated in this project document, and benefits to the local people may not be achieved. The evaluation mission in mid-term will take this into account and propose necessary re-directions to the project design.

The time period of five years may, in any case, be too short to show significant results from the rangeland rehabilitation and improvement component. This factor must be taken into account during the final evaluation of the project and allowances must be made to allow the project's duration to be prolonged using the same funds.

Another risk is the possibility of difficulties in procuring materials and personnel needed by the project. Without adequate staff motivation (particularly the cash contribution by the government

through the GCCC arrangement to supplement their government salaries as discussed during the project appraisal committee meetings), it is highly unlikely that appropriate staff will be found to work consistently on the project. The project workplan should start off with at least a three month period devoted only to procurement and personnel assignment, after which the surveys and other activities can start. Any delays in procurement beyond this period may seriously jeopardise the project. In addition, fuel shortages are currently hampering most other project operations. The fuel supply for this project, lubricants, and spare parts should be provided on a timely basis by UNDP.

The risk of loan default in the credit programme is high, judging from experiences elsewhere (the ADS rate of default is 40 percent). The project should set realistic guidelines for evaluating the success of this component, and should learn from the experiences of other more successful loan programmes, such as OXFAM's in Kenya.

It is possible that, if the range improvement component does not produce successful results and the rainfall patterns remain depressed, the rangelands will continue to exist in a deteriorated form or may become more deteriorated as a result of the project's activities in restocking and veterinary services. It is expected that the land use planning efforts will be able to prevent serious overgrazing and that the fodder production activities will result in a partial intensification of the livestock system, thus partially reducing demand on the rangelands.

If the project's institutional set-up is not entirely representative and accountable to the people, the interests of women and the poor may be subordinated. Thus, the design and implementation of the project must have an appropriate institutional structure.

It is possible that if the project's institutional set-up does not adequately integrate the pastoral community with the agropastoral one, the presence of the project and its activities could result in conflicts between the two groups. The formulation mission should account for these possible negative impacts in the final project design.

G. PRIOR OBLIGATIONS AND PREREQUISITES

1. Prior obligations

None.

2. Prerequisites

The government will ensure the timely recruitment and posting of the required staff and will ensure that such staff are suitably qualified and experienced. It will ensure that each long-term national staff is recruited on a minimum three-year contract, extendable to five, to minimise the deleterious effects of staff turnover. The government will also ensure the timely availability of buildings in Bara, including utilities.

The Ministry of Economic Planning and Investment will ensure the immediate disbursement of funds agreed upon with RPA and UNDP through the GCCC arrangement for personnel and local

procurement of equipment. Funds are to be calculated in US\$ and disbursed in local currency using the exchange rate prevalent at the time of disbursement.

The project document will be signed by UNDP and UNDP assistance to the project will be provided, subject to receiving satisfaction that the prerequisites listed above have been fulfilled or are likely to be fulfilled. When anticipated fulfillment of one or more prerequisites fails to materialise, UNDP may, at its discretion, either suspend or terminate its assistance.

H. PROJECT REVIEWS, REPORTING, AND EVALUATION

The project will be subject to annual review (joint review by representatives of the government, UNDP, GEF, and UNSO) at least once every twelve months, the first such meeting to be held within the first twelve months of the start of full implementation. The National Director shall prepare and submit to each tripartite review meeting a Project Performance Evaluation Report (PPER). Additional PPERs may be requested, if necessary, during the project. UNDP will ensure that copies of this report are forwarded to UNSO and the GEF Coordinator in the Regional Bureau for Arab States.

In addition, a quarterly report will be prepared elaborating on the activities carried out during the quarter in question and comparing these to the established work plan for the project. The report will further outline which delays and problems have been incurred by the project and what actions the project management is taking to correct them. This report is to be submitted to UNDP for forwarding to the GEF and UNSO. This reporting requirement is essential for GEF support.

A project terminal report will be prepared for consideration at the terminal tripartite review meeting. It shall be prepared in draft and sufficiently in advance to allow review and technical clearance by the executing agency at least four months prior to the terminal tripartite review.

The project shall be subject to an evaluation during the first half of the fourth project year. This evaluation will be conducted at a number of levels and will include a full assessment of the global benefits of carbon sequestration in the drylands. Building on the pioneering work done in the Sudan on participatory evaluation, this project will evaluate impacts at the community level. Most importantly, the evaluation will assess the sustainability of the various community-level institutions set in place during the project period. The organisation, terms of reference, and timing will be decided after consultation between the parties to the project document.

I. LEGAL CONTEXT

This project document shall be the instrument referred to as such in Article I of the Assistance Agreement between the government of the Sudan and the United Nations Development Programme, signed by the parties on 24 October 1978.

The government implementing agency shall, for the purpose of the standard basic agreement, refer to the government cooperating agency described in this agreement.

The following types of revisions may be made to this project document with the signature of the UNDP Resident Representative only, provided he or she is assured that the other signatories of the project document have no objections to the proposed changes:

- Revisions which do not involve significant changes in the immediate objectives, outputs, or activities of the project, but are caused by the rearrangement of inputs already agreed to or by cost increases due to inflation
- Mandatory annual revisions which rephase the delivery of agreed project inputs, or reflect increased expert or other costs due to inflation, or take into account agency expenditure flexibility.

J. BUDGETS

The project budgets are attached.

PROJECT BUDGET COVERING GEF CONTRIBUTION (in US\$)

Project Title: Community-Based Rangeland Rehabilitation for Carbon Sequestration and Biodiversity

Project Number: SUD/93/G31

Code	Description	TOTAL		YEAR 1993		YEAR 1994		YEAR 1995		YEAR 1996		YEAR 1997		YEAR 1998		YEAR 1999	
		m/m	US\$	m/m	US\$	m/m	US\$	m/m	US\$	m/m	US\$	m/m	US\$	m/m	US\$	m/m	US\$
10.00	PROJECT PERSONNEL																
10.01	CTA (OPS)	12	140,000					12	140,000								
11.50	Intern. consultants	3	25,650	2	25,650												
11.51	Range Mgr/Pastoralist	2	36,000							1	12,000	1	12,000				
11.52	Veterinarian	2	24,000							1	12,000						
11.53	Carbon-sequestration	0.75	19,250					0.75	9,625							0.75	9,625
11.97	Consultants (PA phase)	2	23,525	2	23,525												
11.99	sub-total international	21.50	268,425	4	49,175	0	0	13.75	161,825	2	24,000	1	12,000			0.75	9,625
13.00	LOCAL HIRE																
13.01	Range reserve guards	720	15,600					240	5,200	240	5,200	240	5,200				
13.02	Misc. workers	714	15,470					324	7,020	270	5,850	120	2,600				
13.03	Mobilizers	180	3,900					60	1,300	60	1,300	60	1,300				
13.04	Senior Treasurers	72	1,560					24	520	24	520	24	520				
13.05	Asst. Treasurers	144	3,120					48	1,040	48	1,040	48	1,040				
13.06	Senior Accountant	36	780					12	260	12	260	12	260				
13.07	Asst. Accountant	72	1,560					24	520	24	520	24	520				
13.08	Pharmacist	36	780					12	260	12	260	12	260				
13.09	Feedlot attendant	72	1,560					24	520	24	520	24	520				
13.99	sub-total local hire	2,046	44,330			0	0	768	16,840	714	15,470	564	12,220	0	0	0	0
15.00	DUTY TRAVEL																
15.01	Project Staff & Advisory Comm.	0	7,000						1,400		1,400		1,400				1,400
15.02	Night Allowance	0	18,000						3,600		3,600		3,600				3,600
15.03	in-country travel	0	10,000		231				9,769								
15.99	sub-total duty travel		35,000		231			0	14,769	0	5,000	0	5,000	0	5,000	0	5,000
16.00	MISSION COSTS																
16.01	Evaluation Mission	0	20,000														
16.02	HQ Tech. missions costs (UNSO/GEF)*		17,619														
16.99	sub-total missions	0	37,619					0	0	0	0	0	4,348	0	4,348	0	4,348
17.00	NPPPs																
17.01	National Technical Advisor (OPS)	60	100,000					12	20,000	12	20,000	12	20,000	12	20,000	12	20,000
17.50	National Consultants	1	2,478	1	2,478												
17.51	Wild agronomist	2	3,520					2	3,520								
17.52	land use/regional planner	3	5,280					1	1,760	1	1,760	1	1,760	1	1,760	1	1,760
17.53	Wildlife expert	5	8,800					1	1,760	1	1,760	1	1,760	1	1,760	1	1,760
17.54	Range improvement expert	3	5,280					1	1,760	1	1,760	1	1,760	1	1,760	1	1,760
17.55	Credit specialist	3	5,280					1	1,760	1	1,760	1	1,760	1	1,760	1	1,760
17.56	Sociologist	2	3,520					2	3,520								
17.99	sub-total NPPP	79	134,158	1	2,478	0	0	20	34,080	16	27,040	16	27,040	13	21,760	13	21,760
19.00	Personnel Component Total	2,147	519,552	5	51,684			802	227,114	752	75,856	581	60,606	13	63,341	14	40,731
20.00	SUB-CONTRACTS																
21.00	Water development		118,625						59,625		59,000						
22.00	Soil analysis		2,000						2,000								
23.00	Lorry rental		6,000						1,500		1,500		1,500				
24.00	Construct pharmacy/stores		11,000						11,000								
25.00	Rehab. of project offices/stores		5,000						5,000								
29.00	Subcontract component total		142,625					0	79,125		60,500		1,500		1,500		
* Due to funding limitations, trips will have to be undertaken in conjunction with other trips to the sub-region. UNSO and GEF HQ units will jointly determine most appropriate use of monitoring funds.																	

PROJECT BUDGET COVERING GEF CONTRIBUTION (continued)

	TOTAL	YEAR 1993	YEAR 1994	YEAR 1995	YEAR 1996	YEAR 1997	YEAR 1998	YEAR 1999
30.00 TRAINING								
32.00 Study tours/grp. training								
32.01 Mobilization Team				4,000				
32.02 Fodder specialist				1,500				
32.03 Local Pharmacist				800				
32.04 Staff tours to projects				6,000	1,000	2,000	1,000	
32.05 Villager tours to projects				12,000	3,000	3,000	3,000	
32.06 End - project workshops				10,000				10,000
32.07 In-service training				5,000	1,000	1,000	1,000	1,000
39.00 Training component total	39,300	0		12,300	5,000	6,000	5,000	11,000
40.00 EQUIPMENT								
41.00 Expendable equipment								
41.01 Drafting, mapping, marking				1,000				
41.02 Restocking animals				11,400	5,700			
41.03 Office supplies				12,000	2,400	2,400	2,400	2,400
41.04 Extension material				2,000	400	400	400	400
41.05 Seeds, seedlings, pots				3,000	600	600	600	600
41.06 CAHW & pharmacy				8,150	4,075			
41.07 Fodder & energy prototypes				3,000				
42.00 Non - Expendable equipment								
42.01 GPS & Satellite images				6,000				
42.02 Camping equipment				9,000				
42.03 Computers & accessories				18,000				
42.04 Extension machines				5,100				
42.05 Soil/Veg. survey tools				2,500				
42.06 CAHW & animal survey				1,950				
42.07 Fencing				2,000				
42.08 Office/house furniture				62,000				
42.09 Office machines/radio				15,000				
42.10 generator				20,000				
42.11 Vehicle				85,000			34,000	
43.00 Premises								
43.01 Premises rehabilitation				5,000				
49.00 Equipment component total	306,100	0		246,725	13,175	3,400	37,400	3,400
50.00 MISCELLANEOUS								
51.00 O & M of equipment				277,818				
52.00 Reporting costs				5,000				
53.00 Sundries				10,000				
54.00 Direct costs				43,225		1,557		
55.00 Revolving fund				40,000				
57.00 Contingency				100,844				
59.00 Misc. component total	476,487			119,160	106,115	20,000	84,096	20,000
91.00 Project Total	2,147	5	0	686,424	732	154,530	191,337	14
93.00 Agency costs (OPS)								
				17,513		1,200	1,200	
99.00 Grand total	2,147	5	0	696,024	261,846	155,730	192,537	138,667

PROJECT BUDGET COVERING GOVERNMENT OF SUDAN CONTRIBUTION (in Sudanese pounds)
 Project Title: Community-Based Rangeland Rehabilitation for Carbon Sequestration and Biodiversity
 Project Number: SUD/93/G31

Code	Description	TOTAL		1995		1996		1997		1998		1999	
		m/m	SUD POUNDS	m/m	SUD POUND:								
10.00	PROJECT PERSONNEL												
11.00	National Personnel	0	0										
11.01	National Director	60	626,400	12	122,400	12	123,840	12	125,280	12	126,720	12	128,160
11.02	Range Officers (3)	180	1,318,500	36	256,500	36	260,100	36	263,700	36	267,300	36	270,900
11.03	Horticultural Off.	60	439,500	12	85,500	12	86,700	12	87,900	12	89,100	12	90,300
11.04	Forestry Officer	60	439,500	12	85,500	12	86,700	12	87,900	12	89,100	12	90,300
11.05	Veterinarian	60	439,500	12	85,500	12	86,700	12	87,900	12	89,100	12	90,300
11.06	Sociologist	60	439,500	12	85,500	12	86,700	12	87,900	12	89,100	12	90,300
11.07	Small animal officer	60	439,500	12	85,500	12	86,700	12	87,900	12	89,100	12	90,300
11.08	Range Assistants (4)	240	1,370,400	48	266,400	48	270,240	48	274,080	48	277,920	48	281,760
11.09	Veterinary Asst.	60	342,600	12	66,600	12	67,560	12	68,520	12	69,480	12	70,440
11.10	Sociologist Assistant	60	342,600	12	66,600	12	67,560	12	68,520	12	69,480	12	70,440
11.11	Medical Officer	60	342,600	12	66,600	12	67,560	12	68,520	12	69,480	12	70,440
11.12	Mobilization Assts (5)	300	1,713,000	60	333,000	60	337,800	60	342,600	60	347,400	60	352,200
11.13	Extension agents (2)	120	685,280	24	133,200	24	135,200	24	137,040	24	138,960	24	140,880
11.14	Administrative assistant	60	439,500	12	85,500	12	86,700	12	87,900	12	89,100	12	90,300
11.15	Accountant	60	439,500	12	85,500	12	86,700	12	87,900	12	89,100	12	90,300
11.16	Mechanics (2)	120	685,280	24	133,200	24	135,200	24	137,040	24	138,960	24	140,880
11.17	Secretary	60	342,600	12	66,600	12	67,560	12	68,520	12	69,480	12	70,440
11.18	Drivers (5)	300	1,713,000	60	333,000	60	337,800	60	342,600	60	347,400	60	352,200
19.00	Personnel Component total	1,980	12,558,760	396	2,442,600	396	2,477,320	396	2,511,720	396	2,546,280	396	2,580,840
40.00	EQUIPMENT												
43.00	Premises	0											
43.01	Offices & housing rent	0	15,000,000		3,000,000		3,000,000		3,000,000		3,000,000		3,000,000
43.02	Utilities	0	1,300,000		260,000		260,000		260,000		260,000		260,000
49.00	Component total	0	16,300,000	0	3,260,000	0	3,260,000	0	3,260,000	0	3,260,000	0	3,260,000
99.00	Grand total	1,980	28,858,760	396	5,702,600	396	5,737,320	396	5,771,720	396	5,806,280	396	5,840,840

ANNEX 1 Gireigikh Village Councils, Villages, and Populations

Village Council	Villages within Village Council	Population of Village Council 1987
1. Gireigikh	Gireigikh, Nimir, El Kawa	1430
2. Et Tinna	Et Tinna, El Subahiya	926
3. Rawrawah	Khazoug, Khoragat, Wad El Nur, El Ileig	1505
4. El Gireid	El Gireid, Awad El Obeid	1200
5. Mereikha	Mereikha, Iyall Tumsah, Iyall Ali	786
6. Meima	Meima El Zaki, Meima Dikheri	538
7. El Srariya	El Sarariya el Daw, El Zaki, Makari, Umm Begheila	1150
8. Umm Dayogha El Tilib	El Tilib, El Goz, El Sanousi	1100
9. Umm Dayogha	Muzamil	666
10. Umm G'air	Umm G'air, El Sadaab, Umm Gezira	809
11. El Ajayik	El Ajayik, Umm Shatama	1085
12. Umm Ushara	Umm Ushara	824
13. Umm Daboos	Umm Daboos, Hegena	733
14. Kagebi	Kagebi, El Kranik, Umm Sireiha, Ed Dom	1500
15. Hamdan	Hamdan, El Murah	912
16. El Karamsha	El Karamsha, El Mudir, El Nazir, Umm Hager, El Oga, Zinara	1109
17. Al Higeir	Al Higeir, Danona	555
18. Umm Zein	Umm Zein	521
19. Er Rokab	Er Rokab, Umm Laham	1161
20. Umm Queiz	Umm Queiz, Awlad Hussein	1080
21. El Gaaliyeen	El Gaaliyeen, El Markha	733
22. Umm Galgui	Umm Galgui	500
Total	54 Villages	20823

ANNEX 2 Technical Guidelines

A new paradigm in natural resource management of African drylands has recently developed as a result of failures in achieving sustainable growth of pastoral and agro-pastoral systems. At the same time, anomalies in our understanding of dryland ecosystems have surfaced, as new research has revealed facts and trends that cannot be explained by the old paradigm. A thorough review—even revolution—of principles and conceptual frameworks in dryland ecosystem management is now underway. But the new paradigm is still in young. It needs the support of evidence provided by long-term research, which may prove or disprove early implications of the new paradigm.

At present, the new paradigm is based on several major premises:

- Dryland ecosystems are dynamic and have a high degree of variability (space and time).
- Dryland ecosystems are usually in a non-equilibrium state, which in effect increases the ecosystem's resilience (but not resistance) to disturbance.
- Dryland ecosystems respond primarily to rainfall, and secondarily to other factors (biologic, anthropic).
- Management of resources within dryland ecosystems will by necessity have to take advantage of micro-opportunities (spatial, temporal). A "tracking strategy" is the most efficient form of resource management, since it responds to ecosystem potentials as well as user objectives.
- Static tools for natural resource management (fixed stocking rate, maximum trees culled per hectare, sedentary grazing) are not viable and may be destructive. Flexibility and mobility should be the basis of a new adaptive drylands management strategy.

Implications for natural resource tenure systems

Ecosystem dynamics, combined with adaptive management strategies designed to maintain or increase sustainable production and the environment, require a new way of looking at natural resource tenure systems.

Traditional systems of common resource management in Africa provide excellent examples from which to draw. However, many of the systems have disappeared or been modified as a result of increasing competition for scarce land-based resources. As resources become scarce, they will become progressively more controlled since the cost of control will be less than the benefits. This is occurring randomly now in most parts of Africa as rangeland privatization. Individualization and expropriation of land by rich and powerful individuals is an increasing trend that results in great hardships for the poorer segments of society who depend almost entirely on the existence of common lands.

The role of the government is of paramount to safeguarding the rights and access by all members of society to land-resources and other production inputs. The focus should be shifted from exclusively private systems to a judicious mix of private and communal forms of tenure.

The new paradigm implies at least four guiding principles for developing a new natural resource tenure system.

- Devolution of authority and tenure to local groups, to the "lowest" level possible
- The need for simple rules and legislature with a flexible adjudication process that can respond quickly to changing, variable ecosystems
- Allowing for mobility and flexibility in defining rights and responsibilities of users and managers of the resources.
- Incorporating a process of negotiation, compromise, and resource sharing among different users, particularly taking into consideration the different needs of mobile versus settled populations.

In order to ensure a flexible process and end product, several key elements need to be incorporated into the design of a new natural resource tenure system:

- Ensure an appropriate mix of communal and private tenure, making distinctions among ownership, stewardship, and usufruct.
- Make the allocation of rights inclusive rather than exclusive.
- Make communal tenure vested in cohesive groups of users, based on customary laws and institutions where possible. Institutions should be made accountable to the people, be representative of all heterogeneous interests in the group, and should ensure equity within the group. Communal tenure should be supported by both an appropriate pastoral organization and an appropriate pastoral administration.
- Incorporate historical precedence as one criterion—but not the only one—in assigning rights in areas of resource scarcity, so that newcomers are also given a fair share.
- Reinforce links between farmers and herders in the tenure system, rather than the reverse.
- Make tenure rights formally legitimate, without becoming static. That is, legislation should incorporate a flexible process of adaptation and change.
- Define users (user groups) according to three levels: primary user (permanent, all year round use of resource), secondary user (seasonal user, that comes every year), and tertiary users (intermittent users, whose rights are dormant for certain periods of time, such as use only in drought).

- Define rights to the resource using the following elements:
 - i) negotiable vs. fixed rights (determined by how often the rights are re-negotiated)
 - ii) conditional vs. unconditional rights (whether the type of use is restricted, or linked to another outcome)
 - iii) rotational vs. continuous rights
 - iv) free vs. paid access to rights
 - v) access to some or all resources in land area
 - vi) land-based resources can be contiguously or discontinuously spaced—dry season areas separated from wet season areas by farmland and connected by transhumance routes.

Focal point management

The principle of focal point management is based on a recognition that the resources in a particular rangeland are heterogenous and vary in quality and productivity both in time and in space. These patches of distinct resources can be small in spatial extent (micro-sites) or large (macro-sites). Focal Point management furthermore assumes that it is erroneous to establish a fixed, single number for stocking rate (or density), since it will be a mathematical average that will lead either to overgrazing or undergrazing of patches.

The basic principle of focal point management is that if special, key patches are managed properly, then the rest of the rangeland (the peripheral patches) will most likely benefit. Focal point management relies on two major management tools:

- Stocking rate and density (manipulation of livestock numbers in a given area per time)
- Stock mobility (manipulation of the frequency in which the same area is used, length of time spent in that area, interval or time-lapse between use of the same area, and distance between two consecutive areas).

In the African, communal context, focal point management has one major advantage over classical block management: it is easier to manage by a newly created pastoral institution such as Legnat el Tansigh. Not only are the focal points or key sites smaller in spatial extent, but they have distinct characteristics that make it easier to develop specific rules and regulations concerning their management. In public meetings it is much easier to talk of, and obtain consensus on the management of specific points, than to talk of an entire block of land. The success of focal point management, or any communal management of natural resources, rests on obtaining the general public's approval and sanction of the rules and regulations. This establishes the necessary self-discipline and minimises the need for constant supervision (guards) and punishment of transgressors.

However, ways to deal with transgressors should be developed by the community as a matter of course.

In block grazing, the overall stocking rate (the main management tool) is lowered to the carrying capacity of the most limiting patch, thus resulting in undergrazing and low stocking rates in the peripheral patches. However, in the African communal context, animals are still herded—a vital fact that allows greater control over the animals, greater fine-tuning of movements to the present condition of each individual patch, and therefore higher stocking rates that are still within the carrying capacity of the land.

Focal points or key sites can be divided into three categories:

- High quality sites where the carrying capacity per unit area per unit time is higher in the key site than in the periphery, for example, depressions with high quality perennial grasses and areas of high browse concentration.
- Equal quality sites where the carrying capacity per unit area per unit time is equal in the key site as in the periphery, but the site has other special characteristics. For example, in the area around a village or well, the area *immediately* around it needs to be managed properly to avoid too wide a "sacrifice" radius.
- Lower quality sites where the carrying capacity per unit area per unit time is lower in the key site than in the periphery. For example, a salt lick, or an area with salt bushes has low biomass but is sought after for its mineral content.

In all three categories, the main management tool that should be used is stock mobility. The number of animals coming into the area is not as important (and in the African communal context not as easily manipulated), as the time they are allowed to spend in the area.

In the context of Gireigikh rural council, at least seven types of key sites can be distinguished:

Reserves

Some macro-patches, or a combination of micro-patches, could be held in reserve either for dry seasons, or deferred and used only in drought years. These patches should have good browse species or short-to-medium height perennial grasses that retain some nutritional quality in the dry seasons. If not, the rangelands should be improved in that direction. They should also be near (but not necessarily adjacent) to permanent water points. No grazing or browsing should be allowed during the deferment, and when it is opened for use, rules should be established on how long the area could be used.

Piospheres

A piosphere comes from the Greek word meaning circle around a water point. The radius of the circle, for the purposes of focal point management, can be small or large, but should not exceed one kilometre. It is normal practice to accept a 50 meter radius around a water point as a "sacrifice" area, but rules should be established to regulate stock mobility beyond this area, so as

to avoid a widening circle of degradation. In Gireigikh Rural Council, traditional land use planning already attempts to regulate this. The traditional system could be built upon with complementary action, such as marking of livestock corridors and live fences around wells with watering troughs away from human watering points.

Degraded areas

A degraded area is a key site not because of its current carrying capacity, but for its future potential. It can only be chosen as a key site if the community decides that it is economically viable and desirable to rehabilitate the area. Degraded piospheres or degradation around high quality points may fall in this category.

In cases where the degradation is not very severe, a reserve can be established (deferment over several years, with access routes to the water point, for example) to allow natural regeneration. In cases where deferment is insufficient, land rehabilitation and revegetation will be necessary, and the exact techniques used will depend on the soil type, hydrological conditions, and actual and potential vegetation. In these cases, it is important to realize that the area to be rehabilitated will probably be small, and the decision will be based on an economic analysis by the community of the costs and benefits.

Salt and mineral resources

Salt pans (areas with exposed limestone and other mineral deposits) and salty or sodic depressions with salt bushes and plants are important elements in the annual transhumance cycle and in animal nutrition.

Management options include controlling access through establishment of schedules and devising rules that force animals out of the area as soon as they are satiated. In overgrazed areas, reserves would have to be established, and in some micro-patches, it may be desirable to plant more salt bushes (either native ones, or exotic such as *Atriplex* spp.). If the latter course is chosen, one season should be spent on testing the adaptability of *Atriplex*.

Browse reserves

Some areas have a high concentration of very desirable browse species, such as the kheiran. These areas could be managed by deferring grazing in sensitive seasons (flowering and fruiting stages) and by establishing rules on how long any herd can stay in the area.

Browse plantations

Some areas have seen a gradual but steady decline in the density of the desirable browse species, with little or no natural regeneration. Small micro-patches could be marked off and planted with the seedlings (coming from the village nurseries) in an appropriate density, such as ten per hectare. The area could be deferred until such time as the replanted seedlings are above the height of the goat browse-line (roughly 1.5 meters) which requires on average about three rainy seasons of deferment. Alternatively, each planted seedling could be protected with a thorn fence.

ANNEX 3 Results of Preliminary Research

In the summer of 1993 (July-August), a preliminary research assessment was conducted in the project area. Part of this study was a rapid vegetation and wildlife survey, which was conducted by the range officer and wildlife officer of El Obeid, respectively. The results of these surveys are briefly summarized here.

The ecosystem was classified into three ecozones (or range sites):

- The kheiran. Low-lying depressions with a catena of loamy sands on the slopes, grading into sandy loams, with a waterlogged, clayey center (all grey-white soil color).
- The *Leptadenia* dunes. About 20 percent of them can be classified as mobile, stretching northeast to southwest. Mostly fine to coarse sands, yellow to orange colored.
- The Acacia complex steppe. The flat and gently undulating steppes, consisting of loamy sand to sandy soils, yellow color.

Woody Strata

Data was collected using the point center quarter (PCQ) method on 15 plots in each range site. According to this information, the woody strata in the kheiran and Acacia complex appear similar. *Acacia tortilis*, *Leptadenia pyrotechnica*, and *Acacia senegal* are co-dominants (in decreasing order) in the kheiran and Acacia complex sites. However, tree and shrub density is higher in the kheiran (290 individuals/ha) than in the Acacia complex (133 individuals/ha). In addition, the kheiran have more water-loving plants, such as *Ziziphus mauritiana* and *Hyphaene thebiaca*, while the Acacia complex has more xeric plants, such as *Commiphora africana*. In the past *Salvadora persica* used to be abundant in the kheiran, but has now largely disappeared, as the process of desiccation has increased.

The *Leptadenia* dunes are dominated by the shrub *Leptadenia pyrotechnica*. This range site has the highest density of woody species, 418 individuals/ha, but its overall woody biomass is lower than the other range sites.

The species richness of the woody strata is lowest in the *Leptadenia* dunes (5), and almost equal in the kheiran (9) and Acacia complex (10). Table 1 gives the densities of the major species in the three range sites.

Woody biomass was measured by cutting, drying and weighing an estimated 10 percent (by volume) of the canopy, with a sample of five individuals per selected species. All the leaves and small twigs were cut. The sample was a cross section of tree sizes (young to mature trees or shrubs). The results are given in Table 2. The highest biomass obtained was 34.4 kg DM/tree from *Acacia albida*. The data conform with data collected elsewhere in the Sahel.

Table 1: Densities of trees and shrubs in project area

Woody Species	Kheiran dens./ha.	Leptadenia dens./ha.	Acacia complex dens./ha.
Acacia nubica	9	-	2
Acacia senegal	50*	17*	20*
Leptadenia pyrotechnica	67**	361***	30**
Acacia tortilis	121***	32**	63***
Acacia albida	4	-	-
Ziziphus mauritiana	18	6	5
Balanites aegyptiaca	16	-	7
Hyphaene thebiaca	2	2	1
Caparis decidua	1	-	-
Commiphora africana	-	-	5
Cadaba farinosa	-	-	-
other	12	-	-
Total	290	418	133

Table 2: Biomass of selected woody species.

Species	leaf & twig biomass (kg DM/tree)
Acacia tortilis (tree)	21.9
Acacia albida (tree)	34.4
Balanites aegyptiaca (tree)	16.9
Ziziphus mauritiana (shrub)	2.9
Leptadenia pyrotechnica (shrub)	9.7

Herbaceous strata

The herbaceous strata is composed primarily of annual grasses and forbes. In the past there were perennial grasses, such as *Cenchrus ciliaris* and *Panicum turgidum*, but these have almost disappeared. The present species richness is relatively low (15) and similar across all three range sites.

Herbaceous biomass was collected, dried, and weighed. The results reflect early wet season growth. This biomass is on average 0.13-0.15 kg DM/m² in all three range sites and is expected to grow to about 0.5-1.0 kg DM/m² by the end of the wet season. This year was an average year in terms of rainfall.

Wildlife

A rapid survey of wildlife in the area, during a two-week period in July produced the following data.

Table 3: Observation of wildlife abundance in project area

Species	Abundance	Type of animal
<i>Ardcotis kori</i>	low	bird
<i>Vulpes pallida</i>	low	mammal
<i>Felis margarita</i>	low	mammal
<i>Atelerix abiventris</i>	medium	mammal
<i>Poelagus margarita</i>	medium	rodent
<i>Xerus erythropus</i>	medium	mammal
<i>Procavia capensis</i>	medium	mammal

According to the wildlife officer, this area used to be abundant in other large mammals, such as hyena and dorgas gazelle.

ANNEX 4 Fuelwood Consumption Survey

During July 1993, a rapid survey of fuelwood consumption was carried out by the preliminary research team. Fuelwood is used primarily for home consumption, but also by the few bakeries in the area. Restaurants use charcoal. Before the 1970s drought, fuelwood was apparently abundant in the area, but now it requires a two-hour walk (one way) in order to collect enough wood. The main species collected now is *Leptadenia pyrotechnica*.

Women and girls collect wood within a communal system: women are organized in groups of three to eight, and they collect for each other. A load of wood collected each time weighs on average 58 kilograms. A household is estimated to use two loads per week, giving an average per capita consumption of 2.36 kilograms per day.

The two bakeries in the project area were measured to consume on average six camel loads of wood per week. On average that is 138 kilograms of wood per day per bakery. The main wood species used was *Acacia tortilis*.

Charcoal is either made by women at home or bought in the market to make food or tea. Average consumption in this way was estimated at 32 kilograms per woman per week. There are on average about 20 women in each market day. The restrictions imposed by the Forestry Department in felling trees for charcoal has resulted in a shortage and a blackmarket for charcoal. Prices have increased 1.5 times in one year to stand at £S 20-50 per jerry-can (16 kilograms).

Local stoves are either the three-stone ladaia, or the tin can stoves (canon). The latter is used for making tea, coffee, and soup. Both stoves consume high amounts of fuel. There is scope for introducing improved, fuel-saving stoves.