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BLUE NILE INTEGRATED AGRICULTURE DEVELOPMENT PROJECT

PDBAL 039

FINAL REPORT

FROM THE

RANGE, LIVESTOCK, AND SOILS TEAM

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December 30, 1981

EXPERIENCE, INCORPORATED

MINNEAPOLIS, MINNESOTA 55402

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INTRODUCTION

The objectives of the Blue Nile Integrated Agriculture Development Project are the comparison and development of three farming systems and the provision of technical services and assistance to the graziers in the project area. A team of consultants in the disciplines of range, livestock, and soils was assembled to provide information and recommendations towards achievement of the project goals. The team members were David Faulkner, range specialist and team leader, Dr. El Kheir Khalafalla, livestock specialist, and Richard Trenholme, soils specialist. The scope of work developed by the team and Zach Lea, project management officer, included many items recommended in the Terms-Of-Reference for the project. The objectives of the team were as follows:

1) To establish contact with the various livestock owners in the project area and enlist their participation in project planning and programs;
2) To conduct an animal disease and livestock survey;
3) To review and evaluate all range and soil activities in the project area;
4) To assess the need for an expatriate livestock/range specialist;
5) To conduct a soil fertility study on lands traditionally used for farming; and
6) To develop both a livestock and a range management plan.

The report following this introduction discusses each of the above objectives in detail. Additional basic information about the various nomadic groups that use the project area and a comprehensive land use plan are presented. The appendicies consisting of consultant's daily logs and GOS Range Management Department proposed work plan are included in the report. The results and interpretations of the soil fertility study will be presented later as Appendix III.

BASIC NOMADIC INFORMATION

The majority of the recommendations made by the team concern the Roffa'a El Hoi tribe, the nomadic graziers who utilize the project area, primarily during the dry season. An understanding of the divisions, organization, and movements of the tribe is necessary for a full appreciation of the team's recommendations. Several other nomadic groups, such as the Ingessana and the West African tribes, use the project area to some extent and will be briefly discussed.

ROFFA'A EL HOI

The Roffa'a tribe is by far the largest tribe using the project area and whose cooperation in any management program is essential. They are locally known as the Arabs due to their ancestral background. They are divided into three separate subtribes: Awlad Bidiga, Awlad Hawati, and Elsebihab. There are few differences between the three subgroups with respect to their organization, attitudes, and other social factors. Thus, unless otherwise specified, the information presented below can be considered representative of each subtribe.

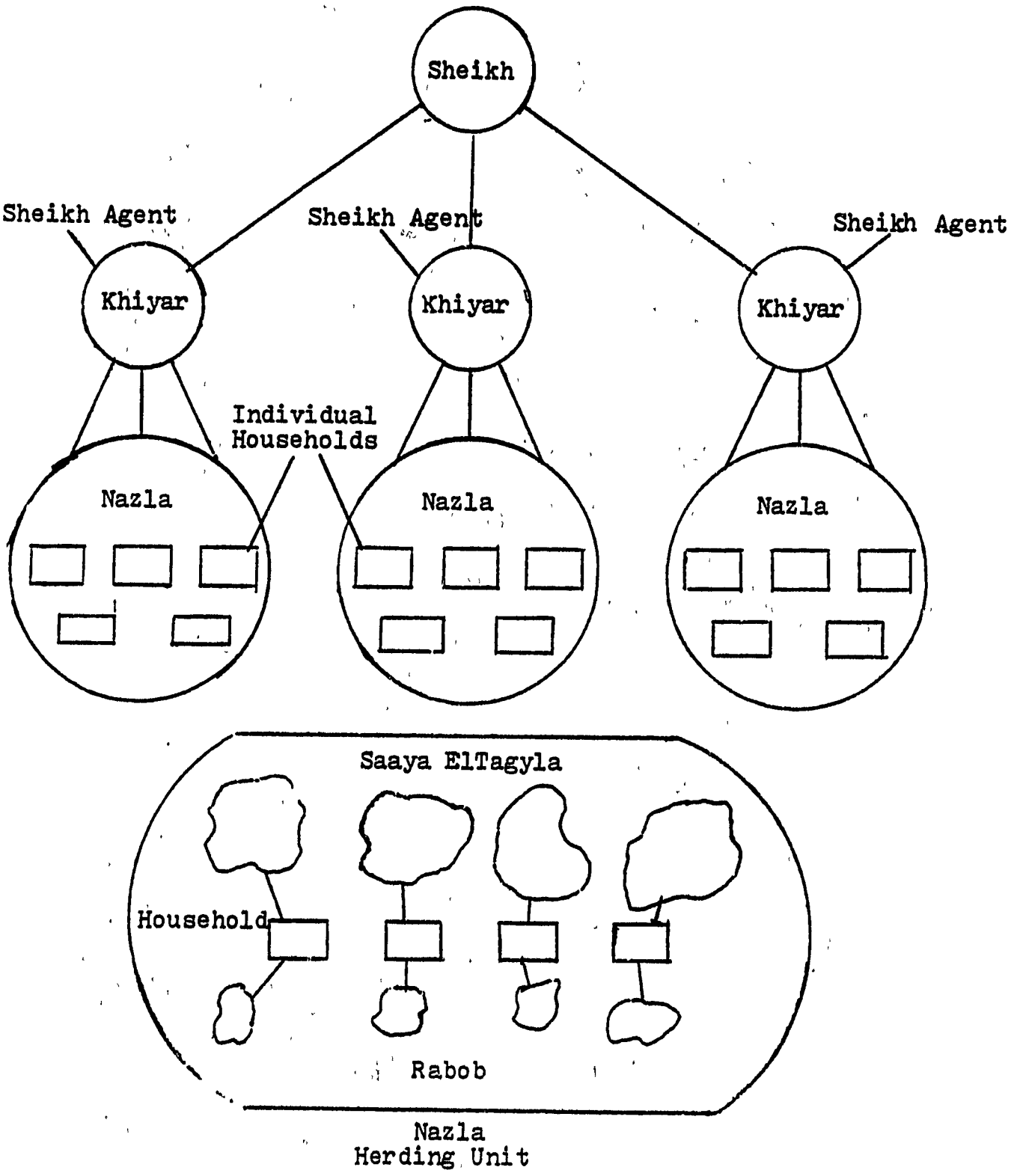
Organization

Within each subtribe, there are several decision-making levels (see Figure 1.). The basic unit of organization is the household, which consists of a father and his unmarried sons and daughters. Married sons and daughters will sometimes stay with their father if they want to or are needed. The household is the herd-owning unit with each herd divided into two parts, the rabob and the saaya eltagyla. The rabob consists of a small number of sheep and goats used for household dietary needs, the camels, and the young and/or sick animals. The saaya eltagyla contains the main bulk of the herd with 100 to 800 head of sheep and 10 to 100 head of cattle.

Ten to fifteen households form a larger unit called a nazla. The nazla is composed of close relatives such as married sons or brothers and forms a herding unit. Each household maintains a separate herd, but the herds travel together by nazla group.

From within the nazla, a group of men form a body called a khiyar. Generally, the khiyar is composed of the elderly, the wise,

Figure 1. Organization of a Roffa'a El Hoi Subtribe



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and the successful men within each nazla. The size of the khiyar is dependent on the size of the nazla from which it is formed. Issues affecting more than one household are generally resolved by the nazla khiyar.

A group or cluster of nazlas form a community called a farig, headed by a sheikh. The sheikh is the representative of the farig in all governmental matters and is its spokesman. The decision-making body of the farig is made of the nazla khiyars and the sheikh. The group does not have a formal structure, but convenes as the needs arise.

Labor Division

The young and middle-aged men of each nazla are responsible for the care of the main herd. If the main herd is sufficiently large, additional shepherds are hired. The herd may be away from camp for several weeks. The rest of the nazla, the elderly, the women, and children stay in camp, tending the rabob and day-to-day affairs.

Movement

The movement of the Roffa'a El Hoi subtribes is dictated by the distinct weather changes that occur in central Sudan. There are three generalized phases to their movements: the period from June to October or the rainy season, the period from November to early May or the dry season, and a brief transitional period between May and June.

June to October

The three subtribes spend all of the rainy season in the White Nile area. During October, as the rains cease, they start their movement south towards the project area. In the past, the trip took several months; now, due to the scattered mechanized farms in the area, the journey must be completed in several days. In their movement, they travel the following route: El Hamryn-El Taru- El Mazmum-El Garabin-Agadi-El Damazin. The same route is used by other tribes known as the Northern Badya, the Northern Roffa'a, and the Keenan. These latter three groups start to separate at Damazin. From Damazin, the Roffa'a El Hoi follow the south side of the Blue Nile to Uffat and then enter the project area near Eseil. Some of them stay at Uffat village.

November to May

Each subtribe has its residential area or camp (diyar) located near the Blue Nile River or a large khor, such as Khor Uffat and Khor Tumat. The camps of the three subtribes are located as follows:

Awlad Bidiga - near Abu Gemai and Gabir

Awlad Hawati - near Shaeira

Elsibihab - from Abu Sheneina to Bikori.

The main herd will usually precede the rabob and the camp. After a camp has been established, usually in early November, the herd will move towards the interior of the project area, grazing the cultivated fields, which have hopefully been harvested, and the native rangelands. Water is sporadically available from the larger khors. Depending on forage and water availability, the herd may also travel outside the project area to Khartoum Bilil and Quissan. As water and forage become more scarce during March to May, the herd will return to the Blue Nile.

The dry season movement described above is very generalized. For the four months of November through February, the herds move throughout the project area. Consequently, the entire project area is utilized to some extent during the dry season.

May to June

All three subtribes generally move south in the project area during May. The rains usually start earlier in the Ragreig region (Kharen-Kharen). The nomads graze the area and then return back through Abeigu, Mosfa, and Banat to their dry season area near the White Nile. Some tribes, which spend the dry season north of the project area, also move their herds south to the Ragreig region to graze the early grasses. As the rainy season progresses, all the tribes move rapidly northward to avoid problems associated with the rainy season, mainly biting flies and cracking, clayey soils which damage animal hooves.

INGESSANA

The west bank of Khor Uffat, especially near Abeigu, Khor Adar, Eldom, Mosfa, and Banat is occupied mainly by different Ingessana tribes. Most of them are both farmers and herders with their settlements located west of Uffat. The herds spend the rainy season in the Ingessana Hills.

During November to January, the Ingessana move eastward to Quissan and Khor Yabus, traversing the project area. Their route is usually mosfa-Kadam-Abeigu-Bikori-Quissan. On their return in June, the Ingessana again traverse the project area.

WEST AFRICAN TRIBES

Little information is known about the West African tribes that use the project area. It is difficult to locate them as both the herd and the camp are almost always in movement. They apparently can be divided into two groups, the nomads and the semi-nomads. The nomads, primarily the Umboro and some Wyla tribes, are exclusively herders, mainly of cattle. The semi-nomadic group includes the Wyla, Malee, and Felani tribes. They herd cattle as well as practice some farming.

Both groups traverse the project area during the dry season on their way to Quissan and Yabus. They spend the rainy season near Agadi, Grabin, and Wad El Nyla. They usually enter the project area prior to the Roffa'a and exit after them during the rainy season. The West Africans, consequently, have access to and the use of the best available forage in the project area despite their brief stay within it.

GRAZIER PARTICIPATION

In order to develop a livestock and range management program that was acceptable to both the Roffa'a El Hoi subtribes and the various sedentary groups in the project area, a series of meetings were organized and held under the leadership of the livestock specialist. The meetings with the nomads were in a group situation (the khiyar) and the meetings with the sedentary people were held both individually and in groups.

Each meeting followed a very generalized format. The project objectives and plans were initially explained to dispell any confusion surrounding the issue. The group was then asked to state the major constraints to increased livestock and crop production and to propose possible solutions. A discussion of the implementation of the proposals by both the project and the concerned group then followed. Finally, a general agreement to the principles discussed usually concluded each meeting. It was made clear to every group that such an agreement was flexible and subject to change by either the project or the involved group. The final decision was to be made by the project.

During the course of each meeting, the team emphasized that without the group's cooperation and contributions, nothing would succeed or be developed. Both the Roffa'a and the villagers offered their support to any endorsed proposal.

The specific results of the meetings will be divided in relationship to the two groups: the meetings with the nomads and with the villagers. Throughout the remainder of this section, the term nomads refers to the Roffa'a El Hoi subtribes discussed under the nomadic section.

SEDENTARY VILLAGERS

Almost all the villages that exist within the project area were visited and meetings held with the inhabitants. The villages included Eseil, Mosfa, Adar, Eldom, Abeigu, Kharen Kharen, El Lawa, Uffat Regreg, Abogono, Bikori, Ilyas, Abu Sheneina, Shaeira and Abu Gemai. At every meeting a similar set of constraints to livestock

production emerged. The major limitations were: 1) diseases and external parasites, 2) lack of dry season forage, and 3) in some villages, a lack of water during the late dry season. There was also general agreement to possible solutions. All villagers agreed to:

1) Construct, from local materials, veterinarian facilities;
2) Purchase the necessary drugs;
3) Send some of their sons to a training program a: care of his compensation;
4) Introduce forage crops in rotation if they are adequately advised and supplied with seed;
5) Relocate their fields in a specified direction if requested and supervised by the project to minimize conflict with the nomads; and
7) Learn and practice any forage conservation techniques demonstrated by the project.

The team can state with full confidence that promotion of livestock production is one of the dreams of almost all sedentary people. Thus, considerable understanding and cooperation can be expected from them.

NOMADS

The meetings with the nomads were the most difficult aspect of developing grazier participation. A majority of the time was spent in convincing the nomads that the project is sincerely interested in improving their livestock production and general living conditions. The gradual understanding of the project was exemplified by the increased seriousness of the discussions. For example, during the initial meetings, the nomads asked for farming land in the new mechanized scheme proposed by the project. One nomad even requested a license to operate a restaurant in the proposed village center near Abu Gemai. Later, as they began to understand our objectives, they showed great interest and offered definite proposals.

The genuine feelings of the Roffa'a tribe can be summarized by the nomad statement, "Our animals are everything in our lives, and we are willing to do everything possible if we feel that it will help to maintain and improve our herds." As with the villagers, the nomads

proposed several specific items for project evaluation. They were:

1) Develop sufficient forage and water supplies within the project area. The nomads would prefer the Blue Nile Valley, but admitted that land developed in the interior would be acceptable;
2) Secure a wide route to the White Nile area. The nomads are aware of the fact that their animals cannot survive during the rainy season in the project area;
3) Provide them with sufficient veterinary drugs and teach them proper usage; and
4) Reserve for them their traditional residential areas near khors and prevent tree cutting in these areas.

In return for project acceptance of the above suggestions, the nomads were willing to commit themselves to:

1) Provide reasonable financial contribution;
2) Follow any controlled grazing program or regulation providing it has limited negative consequences on their livestock;
3) Send some young people to short training courses;
4) Limit the number of livestock to any agreed upon figure in an improved range area; and
5) Decide amongst themselves the grazing areas to be alloted to each subtribe, provided the government will remedy the problems with the West African groups.

In summary, even the nomads can be cooperative and will contribute with money, management, and respect of modern range management practices if they are convinced of the projects worthiness. (A more detailed discussion of a nomadic grazing plan is under the section entitled, "Comprehensive Land Utilization Plan")

LIVESTOCK

There were several areas of study concentrated on by the livestock specialist. A very broad survey of the nomadic herds as well as livestock diseases was conducted. Meetings were held among the nomads and villagers to explain project plans and solicit their support. These two topics will be discussed in the present section. In later sections of this report, broad management plans and detailed annual and life-of-project plans are presented.

LIVESTOCK SURVEY

In order to determine current usage of the project's rangelands, a livestock survey was requested. The survey was to include herd enumeration and determination of herd structure. It was soon apparent to the team that the very detailed census originally recommended could not be collected. The reasons were many:

1) Livestock owners were reluctant to provide accurate information due to an association of enumeration with taxation. Large herd numbers mean high taxes.
2) Nomadic tribes are very transient and their herds were not concentrated at this time of the year in any one area.
3) Some nomadic tribes, mainly West African, were unapproachable
4) A general lack of trust and confidence existed amongst the graziers towards the project. The failure to disseminate accurate information concerning project plans and objectives increased the mistrust. (The prevailing rumor among the nomads was that the project was going to confiscate their grazing lands and relocate them away from the project area.)
5) Previous attempts to gather information on nomadic herds by Sudanese high school graduates inadvertedly increased the level of mistrust mentioned above. Nomads were especially suspicious of being asked their name and locations
6) The project area is located within three rural councils, El Rosseris, Quissan and Kurmuk. As a result, official livestock information was difficult to obtain due to lack of time and fuel.

7) Data collected through provincial vaccination programs primarily reflect sedentary cattle population. Nomadics are vaccinated either outside the province or outside the project area.

The team, nevertheless, understood the importance of obtaining a general estimation of livestock numbers and herd structure. Several approaches were used to collect this information. Meetings were held with herders and farmers and the project objectives were discussed. (See Grazier Participation section.) During the course of these meetings, the need for a livestock census was explained and some information was thus gathered. An indirect approach was also used during the meetings. The nomads were asked what amounts of vaccines and drugs would be necessary to treat their livestock. Additionally, they were asked to estimate the maximum number of animals they would have if grazing rights and areas were established. During the meetings with the villagers, they were asked to estimate the size of the nomadic herds. Finally, field observations of West African tribes provided some information about their herds. Table 1 gives the general estimate summarizing all sources of information.

If the project desires additional livestock information, there are several possibilities. The most accurate and costly method is through aerial observation which has been used by the GOS in the past. Its expense, however, makes it inadvisable. The most feasible way to enumerate livestock is through the proposed vaccination disease treatment program (see proposed management plan). Additional trained personnel will be needed if this alternative is selected. Lastly, the nomads, if and when they are convinced of the project goals, will probably divulge accurate numbers about their herds. When grazing areas are established, precise livestock numbers will be a prerequisite to range use by a subtribe.

DISEASES AND PARASITES

Diseases and parasites represent one of the major constraints to both increased and year-round livestock production in the project area. Diseases and parasites also seriously affect livestock production of the sedentary villagers and the breeding of livestock in both groups.

Table 1. Animal Number Estimates

Group	Cattle	Sheep	Goat	Camel	Donkeys
Minimum Figures					
Awlad Bidiga	1,500	15,000	3,000	100	10
Awlad Hawati	1,000	12,000	2,500	100	---
Elsebihab Abu Sheneina	800	7,000	2,000	100	---
Elsebihab Elyas	700	6,000	200	100	---
Sedentary	1000	300	7,000	15	1,000
West African	10,000	2,000	1,000	---	---
Estimation					
Awlad Bidiga	1,000	30,000	4,000	250	---
Awlad Hawati	3,000	2,700	3,000	180	---
Elsebihab Abu Sheneina	2,000	11,000	2,000	100	---
Elsebihab Elyas	100	10,000	200	100	---
Sedentary	2,000	4,000	12,000	---	1,000
West African	25,000	3,000	2,000	---	---
Figures Declared by the Nomad as Maximum					
Awlad Bidiga	* * No Figures Obtained * *				
Awlad Hawati	1,000	25,000	5,000	200	---
Elsebihab Abu Sheneina	2,000	17,000	3,000	200	---
Elsebihab Elyas	1,000	20,000	5,000	250	---

Animal health problems usually result from interaction of several diseases. Each disease contributes in varying degrees to the overall damage. The important diseases and parasites reported by the livestock owners were catalogued and can be found in Table 2.

Ticks and flies represent the greatest hindrance to livestock production in the project area during the rainy season. They are one of the primary reasons why the Roffa'a migrate out of the project area. Other tribes, such as the Ingessana, tend to move upland to escape the pests. Most of the villagers keep their animals in sheds and use dung fires to drive them away.

It is not too surprising that many of the livestock diseases and parasites are found in the project area. Two important reasons for their numbers are the general lack of adequate medical facilities for treatment and the introduction of "exotic" disease by the West African tribes. The extent and severity of each disease needs to be further investigated to facilitate treatment. The project will hopefully contribute to the proposed veterinary facilities, which would be very helpful in the identification and treatment of the diseases and parasites found in the project area.

Table 2. Important Diseases and Parasites

NAME	REPORTING GROUP	ANIMALS AFFECTED
DISEASES		
Rinderpest	All	Sheep, cattle
Contagious Bovine Pilerpneumonia	All	Cattle
Anthrax	Nomads	Cattle
Haemorraghic septicameia	All	Sheep, cattle
Contagious Carpine Pleuropneumonia	All	Sheep, goats
Sheeppox	Nomads	Sheep
Piroplasmosis	Sedentary	Cattle
Trypanosomiasis	All	Sheep
INTERNAL PARASITES	All	All
Roundworms		
Tapeworms		
EXTERNAL PARASITES	All	All
Ticks: Babesiosis, Anaplasmosis, Theileriasis		
Flies		
Mosquitoes		
Tibanite		

OTHER DISEASES: Foot and mouth disease, Leplospirosis, Fasciolosis, Schistosomiasis, Vibriosis, Streplolhricosis, Heart water, Foot rot, Blue tongue

RANGE

The range specialist was involved with many aspects of both the existing range program and the development of new programs. His work included assessment of the GOS Range Department range activities and analysis of the range condition and trend, grazing capacity and forage production, and soils potential for range improvement. Additionally, the potential for water developments was also investigated. The range specialist was also involved with the development of the comprehensive land utilization plan. Finally, an assessment of the need for an expatriate livestock/range specialist was conducted. Each area of concern will be discussed in detail.

GOS RANGE ACTIVITIES

The Government of Sudan range technicians proved to be an invaluable source of information about the resources of the Blue Nile Project. Most of their activities were applicable and appropriate to the context of the project. The individual technicians were diligent, imaginative, and hard working. Their projects were well-designed and appropriately located. The two major projects undertaken by the GOS range staff were a range monitoring program and several reseeding trials. The project should continue to support these activities and utilize the resulting expertise and information.

Range Monitoring Program

The range monitoring program consisted of a series of field measurements for production, composition, and cover. Sampling sites were located both within and adjacent to well constructed grazing exclosures. The resulting comparison of grazed and ungrazed areas will be indicative of the effects directly attributable to grazing. Other factors affecting rangeland production, such as the effects from burning will be closely monitored. The exclosures will also serve as demonstration plots.

Range Improvement Activities

The range team had also established several seeding trials. The primary trial area and seed nursery was at Damazin. A second trial was established at Abu Sheneina to determine the ability of

various crops to withstand intensive grazing pressure. The results from these trials indicated that several species were well suited for forage production. Foremost among the species tested were Clitoria ternata, Cenchrus ciliaris, and Phaseolus aureus.

Future activities and plans include the establishment of a large seed nursery either near the village of Banat in the project area or near Agadi. Additionally, reseeding of deteriorated rangelands will start and is expected to be completed just prior to the rainy season, 1982. Sufficient seed is available to reseed between 600 and 1000 feddans. Beginning in September a series of burning experiments will also be started to determine the optimum time and intensity of burning. It is expected the burning demonstration will show that early burning allows vegetative regrowth.

RANGE CONDITION AND TREND

Range condition is defined as the present relationship of vegetative composition, vigor and cover to the land's potential. Five general classes have traditionally been used to describe that relationship: excellent, good, fair, poor and very poor. Several random areas within the project area were analyzed to determine if any distinct patterns to range condition existed. The rangelands in the project area are rated as fair to poor.

Trend, as the word implies, is the direction in which the condition is progressing: up, stable, or down. The general trend within the project area is down.

One cause for the present poor condition and downward trend is burning. Most perennial grass and forb species have been eliminated. The remaining species are mainly annuals, fire resistant trees, or species that tend to have seeds easily transported by wind or animals.

A second cause of the present condition is heavy grazing pressure Some indication of overgrazing in the general vicinity of the villages was observed. The overgrazing was caused primarily by the villagers' lack of management. Their animals were allowed to roam freely; hence, they seldom travelled very far from either water or the confines of the village. Even when herders were assigned, (usually young boys) they did not push the herds very far from the village. Some heavy use also occured at watering points and along trails frequented by nomadic herds.

GRAZING CAPACITY AND FORAGE PRODUCTION

Grazing capacity is regarded as the maximum number of animals that should graze the land during a specific period of time. Any amount over that number induces a downward trend in forage production and forage quality. Only time and monitoring, however, can substantiate the number. Using the concept of grazing capacity to set stocking rates invites waste since high rainfall years will produce an abundance of forage that will be ungrazed. Production of perennial forage may also be two or three times as much in one year as in another. Forage production from annual species fluctuates even more.

A further difficulty is encountered when the concept of curability is introduced. Some forages have a high nutrient level when green but rapidly lose nutritional value when dried. Other species retain many of their nutrients when dry or when harvested green for hay. The latter species are said to "cure" well.

Under the climatic conditions existing within the project area, most plant species begin a rapid drying process very soon after the rains stop. Unfortunately, very few of the grass species "cure well." Some nutritional value does remain in the leguminous forbs throughout the dry season. The main source of nutritional forage is the leaves, young twigs and flowers of the trees and shrubs. With their deeper root systems, they tend to stay greener much later into the dry season.

The determination of grazing capacity is based primarily on forage production. Actual measurements of grasses and estimates of tree leaf growth indicated that the land is capable of producing between 6500 and 7500 pounds of vegetative dry matter per acre. As already indicated the forage is not uniformily available nor uniformily nutritious.

Current forage production indicates the majority of the rangelands in the project area are capable of supporting four-five animal units (AU) per acre during the months of September and October. Grazing capacity drops to one AU/acre in Nov./Dec. and to .1 AU/acre throughout the remainder of the season. It will rapidly increase again as the rains start in May or June. The grazing capacity for the project area in a normal year without burning will average

one AU/acre throughout the season. Much of the forage availability is in the early part of the dry season.

The primary effect from improved forage will be to lengthen the period when vegetation remains nutritious. This effect will be accomplished through species that remain green later into the dry season or have a high curability factor. The expected increase should nearly double the grazing capacity of each improved acre.

SOILS POTENTIAL (See also section of Soils)

Although present range productivity is fairly uniform, the potential is much more variable. Of the four soil types represented in the rangelands, only one, the Typic Ustorthents, clayey-skeletal, was producing near its potential which is very low. The Typic Ustropepts and the Typic Ustorthents, clayey over sandy, have low natural fertility and need to be seeded with leguminous species to maximize production.

The most fertile areas are classified as Typic Chromusterts. Most range seedings on this soil type will increase production. These soils will also respond quickly to improved management practices and are the best available for crop production.

WATER DEVELOPMENT

Although part of the team's original work plan included locating specific sites for water development, this was not entirely possible due to several factors: 1) travel into the interior of the project area was greatly restricted, 2) topographic maps and large-scale aerial photos were not available until very late in the tour, 3) the type of development needed could not be agreed upon between the graziers, project personnel, and local authorities, and 4) it was determined that some development and planning had already taken place.

Two existing water developments were located near the village of Kakadu or roughly halfway between Kharen Kharen and Bikori. They were built by the British in the late 1950's but were never fully operational and were finally abandoned after about ten years. The main problem with the selected sites was a lack of a watershed to support the associated facilities. The developments themselves were well constructed and quite large, but apparently never filled

with water. The team's recommendation is that a geohydrologist survey the area to determine if one or both developments could be revitilized. The task may be as simple as digging lead-in ditches from nearby natural drainages.

There does not appear to be any possibility for obtaining subsurface water. Geologically the project area is underlain by a basement rock complex, a formation which does not have aquifers.

The remaining possibility for water development is the construction of structures designed to capture surface runoff such as a series of stock ponds, hafirs, and reservoirs.

Additional details about water development can be found in the section entitled "Comprehensive Land Use Plan."

RANGE/LIVESTOCK SPECIALIST

The team was requested to assess the need for a range/livestock specialist. It is recommended that a qualified expatriate range/livestock specialist be added to the project staff. The position should be filled as soon as possible, preferably within the current dry season. This would allow him some field time to become familiar with the area and the local problems. The primary need is for a specialist qualified in both disciplines to coordinate, evaluate and otherwise manage range and livestock activities. It is anticipated that the outlined duties and responsibilities would last for the length of the project.

QUALIFICATIONS

The educational and experience background of the specialist should include both range management and animal science. The candidate should have a MS in either Range Management or Animal Science . Work experience should include range surveys, range improvements, remote sensing, grazing systems, livestock handling, animal health, and animal breeding. In addition, experience working with primitive African cultures is essestial.

RESPONSIBILITIES

A major responsibility of the range/livestock specialist would be to further develop and implement the range management plan for the project area. Some of the aspects involved in the plan include water developments, grazing patterns, forage improvement, conflicting uses by different tribes, present cultural practices, monitoring effects.

A second responsibility will be to assist the sedentary farmers with their livestock. Most of the overgrazing in the project area is adjacent to the villages. Overgrazing will undoubtedly increase as animal traction farming is sponsored and encouraged. The specialist will work closely with the farmers and farm cooperatives to implement the animal traction program and to help them manage adjacent rangelands and produce supplemental forage.

The final major responsibility is related to the health and quality of livestock. The specialist will supervise the animal

health and animal breeding programs. He will also assist in establishing a series of clinics and treatment centers and in selecting technicians from various grazier groups.

The success of many of the proposed programs, both in range and livestock, lies with the proposed range/livestock specialist. The results of his success will be the improved cooperation between all classes of livestock producers, the improvement of animal health and quality, an increased rate of offtake, and a more evenly distributed sustained yield from the rangelands.

COMPREHENSIVE LAND USE PLAN

The need for a comprehensive plan to resolve the nomad/farmer conflicts and increase productivity from the nomads was soon apparent to the team. Both the need for and the formulation of the plan evolved from a series of meetings held throughout the project area with both the nomads (primarily the Roffa'a) and the villagers (see Grazier Participation section). Contact with interested governmental departments was also made to gain their concurrence and support.

The plan is basically the division of the total project area into two parts delineated by a line 10 kilometers from the project area boundries of Khor Uffat, Khor Tumat and the Blue Nile River (see Figure 2). The inside area will be exclusively used for range by the various Roffa'a subtribes. Farm development will be limited to the 10 kilometer wide area on the periphery of the grazing area. The initial development will be along Khor Akhodda.

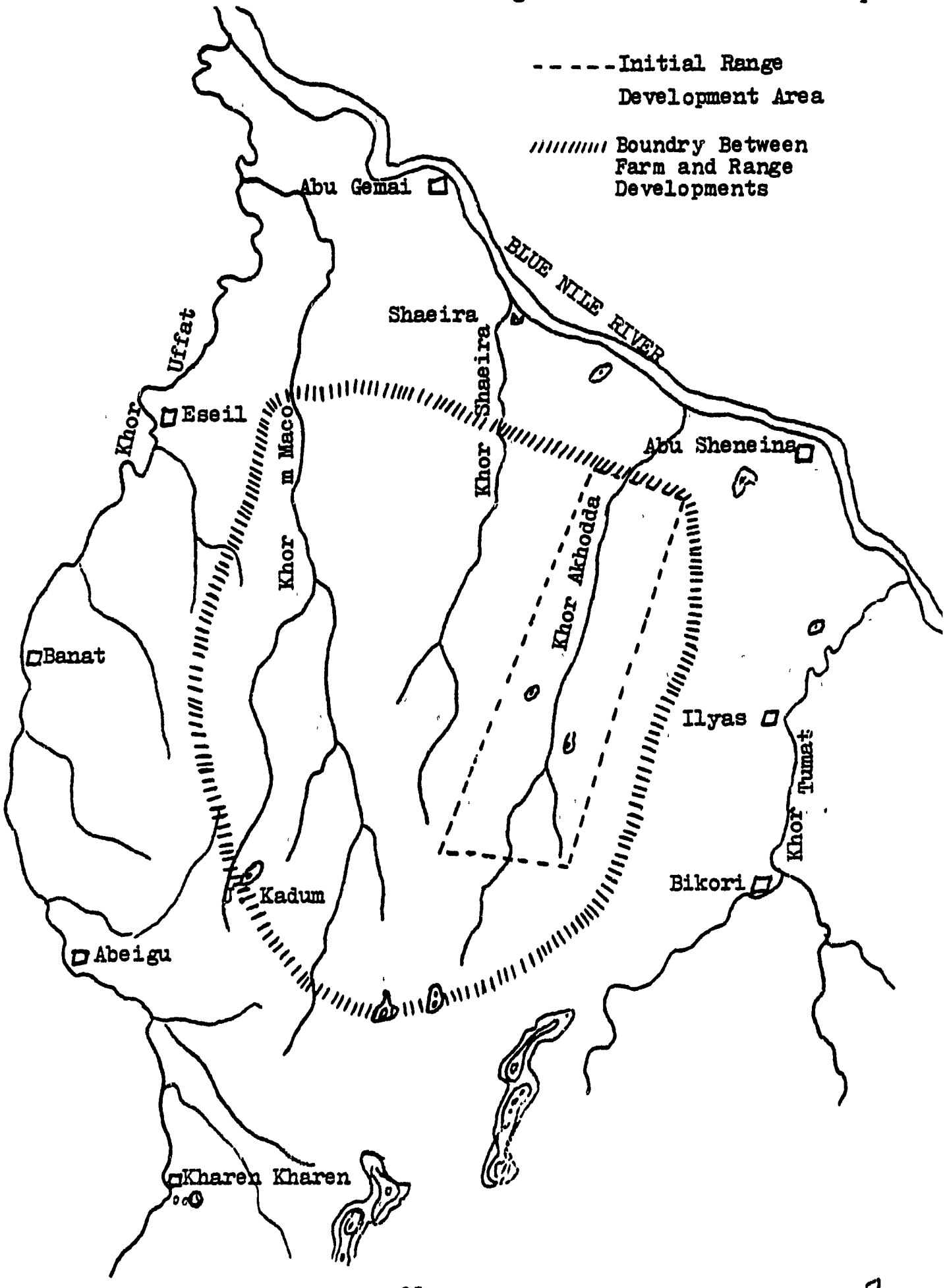
It should be noted that the term nomad(s) throughout this section refers to the various subtribes of the Roffa'a El Hoi.

The plan has six separate phases to implementation. Although some activities of the phases will be concurrently developed, each phase is generally sequential. The six phases, in order of development, are the establishment of water storage, the improvement of rangelands, planting and harvesting of forage crops, implementation of a village grazing plan, organization of nomad grazing associations, and finally, future development of other khors. A very crucial aspect of the plan is the cooperation and contributions from the nomads. Following a brief background, each phase of the plan as well as expected nomadic contributions will be discussed.

BACKGROUND

A very similar set of problems emerged from the nomadic/villager meetings. Various solutions and the resulting programs and schemes were also discussed at the meetings. One positive approach was presented by Mr. Ibrahim M. Gibrel of the Elsibihab subtribe of Roffa'a El Hoi. He suggested developing a specific area for grazing use by the nomads and thus reducing much of the farmer/nomad conflict.

Figure 2. Land Utilization Map



An area along Khor Akhodda was recommended. A preliminary survey of the area by the team, interested nomads, and GOS water resources and range personnel revealed that it was well suited for an exclusive grazing area. Only two cultivated fields existed within the proposed area and they were within 10 kilometers of the road. The area also has the potential for viable range improvements.

The primary restriction to dry season use of the area was the unavailability of water. For dry season use development of stock water sources and improvement of the rangelands was needed. Out of this reconnaissance trip and the ensuing discussions with project and GOS personnel, the team developed the proposed plan.

NOMADIC CONTRIBUTIONS

The success of the plan rests largely on securing the contribution and cooperation of the nomads. A general agreement as to the kinds of contributions from the various subtribes of the Roffa'a was achieved. They agreed to the following:

1) Establish and maintain boundaries of subtribal grazing areas;
2) Provide a reasonable financial contribution;
3) Participate in range management experiments including use of grazing systems, controlled burning, and a supplementary feed program;
4) Suspend grazing of farmlands until all harvest activities are completed; and
5) Select young men for training.

WATER DEVELOPMENTS

One of the limiting factors to increased use of the project area's interior is a lack of water during the dry season. Two alternatives have been proposed to improve water availabilty.

The first possibility is the construction of dams across each of the large khors (Maco, Shaeira, and Akhodda). Large reservoirs would be created, serving as a permanent water supply. As a result the nomads could plant vegetable gardens and avoid using the land near the villages.

A second alternative was the construction of a large number of small stockwater ponds in the depressions and drainages. Some

should be large enough to store water for several months into the dry season. It would be necessary however to preserve stock driveways or grazing corridors to the Blue Nile for water late in the dry season.

The decision as to the type, location and size of water developments should be left to the regional hydrologists. The Rural Water Cooperative has submitted a proposal to survey the area and develop a water storage plan. It is recommended that the survey be supported by the project and that initial construction begin before the 1982 rainy season. Additionally, a topographic or contour map will be needed. Contour interval should be no more than 2 meters. The firm responsible for the 1:50,000 imagery should be able to prepare the desired map.

RANGE IMPROVEMENTS

Two major types of range improvements are possible starting this dry season (spring 1982). The first is the planting of improved forage species. The second is to start a program of controlled burning. The GOS Range Management Department of the Blue Nile Province has submitted a proposal to initiate a range improvement program within this proposed development area. See Appendix II. Their program includes the establishment of a seed nursery, the planting of improved varieties of forage crops, the construction of firebreaks and a series of experimental controlled burns to determine optimum usage of fire. It is recommended that full support be given to their request for logistical and financial support. They are prepared to begin work before the onset of the 1982 rains.

FORAGE CROP CULTIVATION

A major activity proposed for the nomads in the plan is the growing and harvesting of supplemental forages. Several species of both grass and legumes need to be planted specifically for hay or silage. Experiments with harvesting time and storage methods will be necessary to determine the optimum combination. Two such combinations with high potential are *Clitoria ternata* mowed and baled in early October or *Sorghum sudanenses* chopped in late September and stored in a silage pit. Preparatory work could all be completed during the 1982-83 dry season with the first harvests in 1983.

These feeds would be available for livestock in April or May of 1984 when other nutritious feeds are the least available. The early harvest time (Sept.-Oct.) is necessary to gain both maximum curability and maximum nutrition. It should also allow a period of regrowth which would produce a standing green crop suitable for direct grazing.

VILLAGE GRAZING PLAN

Any implementation of a villager grazing plan must be coordinated with the plan for agricultural development. The best approach to developing a grazing plan is to first organize the village owners into a grazier association. The association would be responsible for allocating grazing lands or creating a system of pastures. It would also work closely with the farm cooperative to insure the introduction of forage crops into the crop rotational system.

The introduction of either a herding system or a rotational grazing system will be the responsibility of the association. Very close cooperation between the range/livestock specialist and the grazier association is crucial. He will be able to advise them on alternatives to various grazing systems and improved forage crops. All preliminary work associated with the organization of the grazier group whould be under the responsibility of the cooperatives coordinator.

GRAZING ASSOCIATIONS

The fifth phase of the plan is to formally organize the nomad graziers into grazing associations. Organization of the nomads was not possible early in the development because of the distrust felt towards outside organizations. Even though this distrust is being dispelled, the nomads are reluctant to make commitments until they see some actual results or progress. Most attempts to introduce change into their present organization will be met with suspicion and possibly hostility. They are much more open to practical demonstrations, and each step in development will solidify their trust.

FUTURE DEVELOPMENTS AND MONITORING

The area along Khor Akhodda proposed for initial development represents less than 25 percent of the total area available for exclusive grazing. The original plan also involves only one of the three subtribes. The initial area will serve as both an experiment and demonstration area.

A monitoring program to determine the viability of the development needs to be initiated. The program should determine the grazing capacity of the improved rangelands. Particular attention should be paid to potential overgrazing around water developments.

As the monitoring program determines what modifications are needed to the developmental plans, other areas along Khor Maco and Khor Shaeira can be similarly developed. Future development of the remaining area should start with water developments and reseedings during the 1984-85 dry season.

LIVESTOCK MANAGEMENT PROGRAM

From the information collected from the livestock survey and the livestock owners meeting, it was quite evident that several significant factors were limiting improvement of livestock production in the project area. The most significant were animal health, dry season feeding, existing land use patterns, lack of commercially oriented livestock operations at the sedentary level, and low breed productivity. The severity of each factor varies and, accordingly, the expectation for resolving all the above contraints within the project life is considered unrealistic. Solutions to some of the constraints need to be developed and tested.

The overall philosophy of the management plans can be stated by five broad principles. They can be used for implementation of any of the ideas proposed in the life-of-project program. The basic principles are:

1) Concentrate on problems and issues which are likely to be solved through practical applications and known measures;
2) Identify problem areas, design solutions, and test their feasibility;
3) Demonstrate the developed solutions to the concerned group;
4) Implement a program that is self-sufficient and self-perpetuating; and
5) Replicate the developed and tested solutions in other areas.

Two very broad managment plans are presented, one for the nomads and one for the sedentary group. Both are broad recommendations; detailed information can be found in the life-of-project program.

SEDENTARY LIVESTOCK MANAGEMENT PLAN

The plan for the sedentary villagers is based on five broad proposals. They are:

1) Establish an animal health program to help minimize the large losses due to high mortality. Such a program, if successful, would create a more positive attitude to livestock ownership among the villagers;
2) Concurrent with the animal health program, develop

different approaches to two major problems. The problems are the cultivation, conservation, and transportation of feed and the developement of small fattening operations based on the available range, agricultural by-products, and cultivated forage. Determine the optimum size of such an operation with regards to labor constraints;

3) Promote the expansion of the methods and solutions to the above-mentioned problems. Secure funding through the project credit policy;
4) Improve local goat breeds for milk production; and
5) Develop a training program to improve the animal husbandry practices of the farmer.

NOMADIC LIVESTOCK MANAGEMENT PLAN

There are four broad aspects to the management plan for the nomads. They are:

1) Gain more confidence among the nomads through concrete actions that have direct impact on their herds. Actions such as vaccinations, animal disease treatment, internal parasite control and a secured travel route are recommended;
2) Provide basic training in the areas of animal health and animal production;
3) With cooperation of other departments within the project, develop a pilot grazing area, demonstrating the benefit of controlled grazing, internal parasite control, and modern animal husbandry practices; and
4) Replicate the successful programs to include other groups.

LIFE-OF-PROJECT PROGRAM

The life-of-project program will be presented in two forms. The first will be a very detailed discussion of the different aspects of the program with very specific recommendations. The second form will be in a summary which presents the proposed actions in tabular form for quick reference.

ANIMAL HEALTH

The objective of the animal health plan is to make the project area a disease-controlled zone for at least the major diseases. It requires that all livestock within the project area are either free of identifiable diseases or are vaccinated against them. A four part plan has been formulated to achieve this goal. The plan calls for the increased coordination between the project and regional animal health services, the formation of a comprehensive disease control program, the establishment of rudimentary veterinarian services, and, finally, the establishment of a revolving fund for vet drugs. Each aspect of the plan will be discussed in detail.

Regional/Project Coordination

One of the difficulties in development of animal health services is the fact that the project is limited by certain geographical boundaries. Unfortunately, it is impossible, in the case of this project, to have a comprehensive health program within these boundaries. Two factors are responsible. First, movement of animals (by the Roffa'a and the Ingessana) present in the project area, is not confined to the project boundaries. Secondly, there are considerable numbers of animals (West African) traversing the project area and no one can quarantine them as they pass through the project area.

To overcome these difficulties, full cooperation between the project livestock body and the regional animal health department is needed. The regional livestock service is doing an excellent job despite the many difficulties. The project should support these services, enabling them to implement an area-wide animal health program.

The support would take two forms. First, one or two crushes

outside the project area should be constructed. Possible locations for these central crushes are El Rigiba, Uffat, or Damazin.

In the original project paper, several mobile crushes were recommended. Mobile crushes however are either strong enough to handle agressive cattle but too heavy for easy transport, or are light and easily transported but are inadequate to handle cattle. It is recommended, therefore, that fixed crushes be constructed (see Figures 3 & 4). Part of the fixed crush can be constructed using local wood, while the chute, locally called the neck, should be made of 3 inch steel pipe. Most of the village people have shown an interest in cooperating in building these holding pens.

The second form of support by the project to the regional department would be the funding of a fully equipped vaccination unit for use both in and out of the project area. Work outside the project area would be staffed by the regional health department. Further details about vaccination units can be found under the section entitles "Rudimentary Veterinarian Services."

Disease Control and Prevention

The second part to the animal health plan to improve animal health is the formation of a comprehensive disease prevention and control program. The program can be divided into three sections: disease prevention, external parasite control and internal parasite control. Each element is vital to the overall success of the disease control program.

Prevention

Preventive vaccination and early disease diagnosis are very important aspects of any disease control plan. Within the project area several steps can be immediately taken. First, all animals in the area should be vaccinated for rinderpest and Hameorraghic septicemia. Secondly, serological testing for contagious bovine pleuropneumonia (CCPP) must be conducted and, if necessary, biannual vaccination be started. Finally other vaccines should be available in case a disease outbreak occurs either in or out of the project area. Disease outbreaks along the nomadic route are especially critical and should be quickly handled. Outbreaks in areas outside of the project area would be the responsibility of the regional animal health department with logistical support by the project.

It should be noted that the Sudanese are quite accustomed to

Figure 3. Central Crush Construction

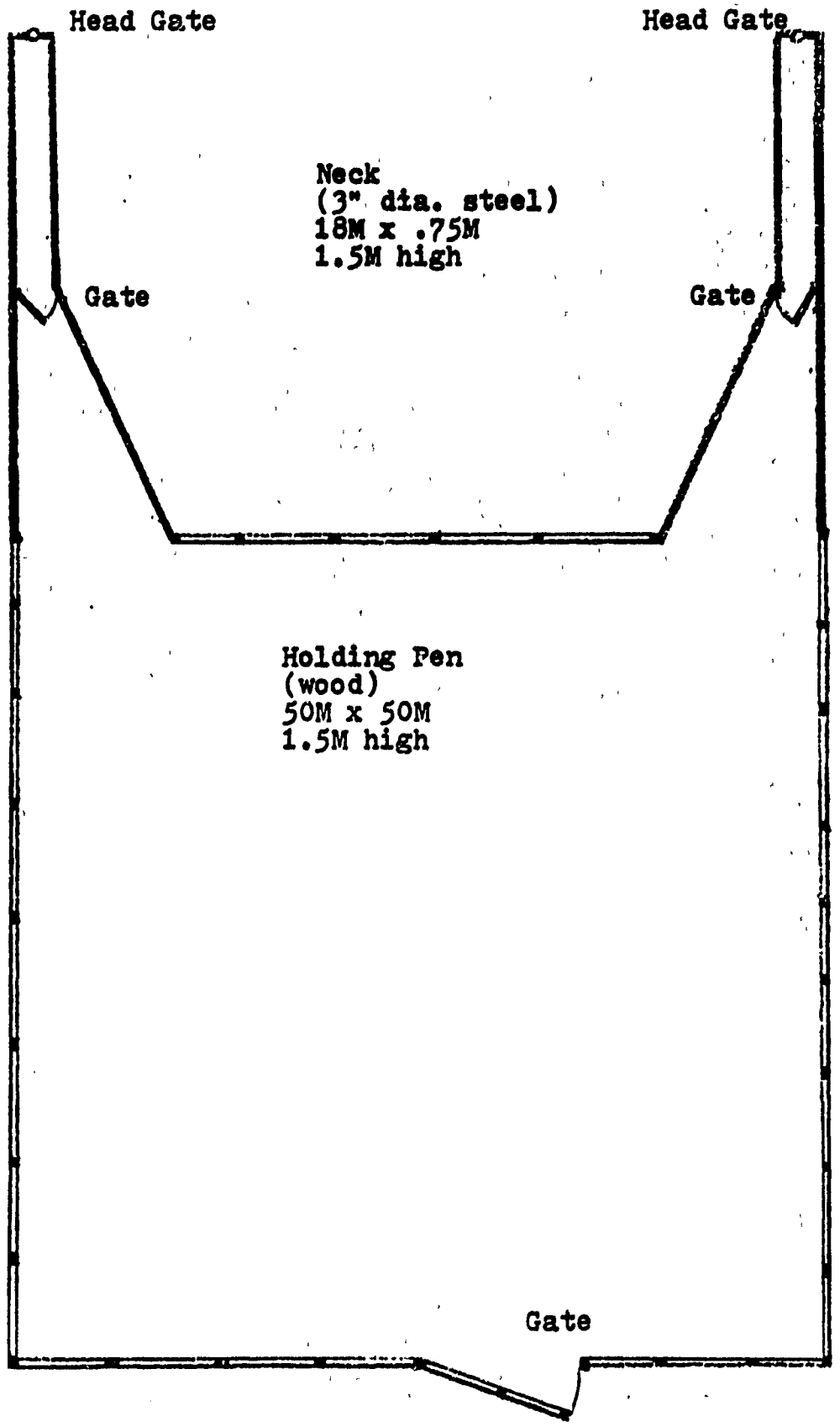
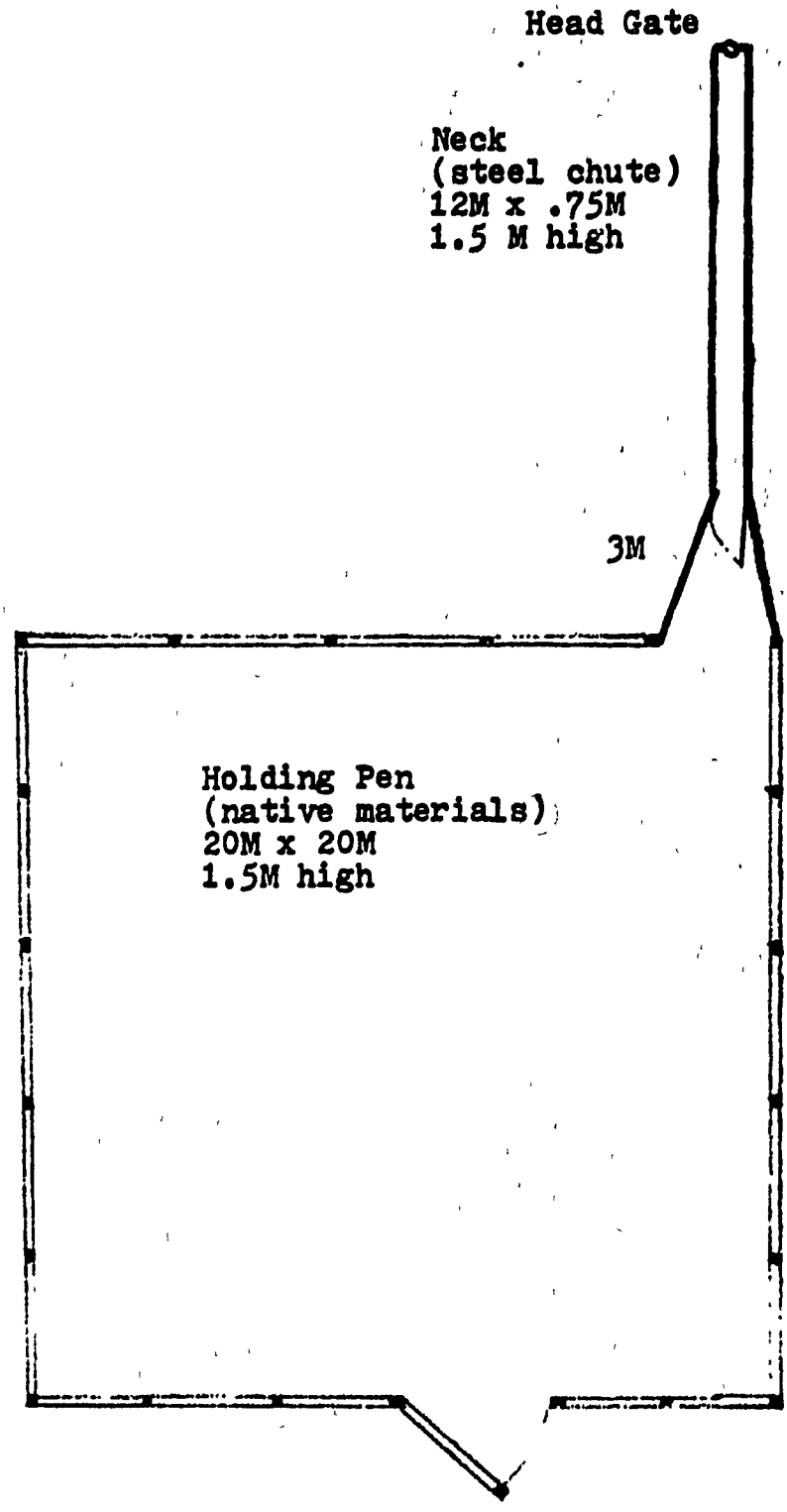


Figure 4. Village Crush



paying for vaccination services. The cost of the drugs of the proposed program would be borne by the animal owner.

External Parasites

As previously discussed, ticks and flies are a major problem to the villagers and cause considerable losses to the nomads. Developing a tick control program is a very complicated issue due to the nomadic herds. There are several factors involved with controlling ticks.

When calves are attacked by ticks, they develop a resistance to the transmitted disease. Cattle in tick-controlled areas do not have a chance to develop this immunity. Consequently, when tick-free cattle are exposed to ticks, the losses are great. Tick control is also an expensive measure. It is not known whether it is economical to attempt control. Other aspects to the problem, such as evaluation of the severity, selection of the best pesticide, determination of pesticide resistance needs to be tested. Economical justification for control also needs to be determined.

On the national level, a tick control department, with financial assistance from F.A.O. is currently conducting studies on the tick problem. The Blue Nile Province is considered as part of the project area, but unfortunately, the project is concentrated in the Senga region.

The department has shown great interest in cooperation with the project. The team highly recommends that the project pursue this interest and develop a program in conjunction with the national department. They are willing to provide a well-trained specialist and pay his salary, provided that the project furnish housing and logistical support; such support should be available upon completion of the planned construction.

Until detailed studies have been conducted and different approaches tested, tick control should be limited to mechanical removal and taking advantage of the natural resistance of cattle. Spraying and oiling can be done on a small scale.

Internal Parasites

The extent that internal parasites affect the livestock in the project area has not been well documented. A detailed study is needed. The proposed vaccination campaign should do some fecal examinations or necropsies. Other studies concerning the economical

justification for treatment should be concurrently undertaken. Upon completion of these studies and development of successful treatments, as many animals as possible should be treated.

Rudimentary Veterinarian Service

The need for improved veterinarian services in the project area is acute. Animal health services should include one central clinic with one mobile clinic and one mobile vaccination clinic. These facilities could easily service the project area for major disease control. Requirements for such facilities are drugs, buildings, staff and housing. (See Figure 5 and Table 3)

Two problems are associated with the above proposal. One is the inability to treat individual disease and the other is the difficulty of operation during the rainy season. On the other hand, it is impractical to propose establishment of several facilities on the project account.

Dressing Units

Most of the settlers showed a great interest in having a small vet dressing unit in their village. A dressing unit is a small clinic usually managed by a vet attendant. Slightly larger units may have Assistant I vet officer in charge. The project should set a policy of assisting any interested group in establishing these facilities on several conditions. The villagers must agree to the following:

1) To construct the needed building facilities including crushes from the locally available materials and take responsibility for their maintenance;
2) To provide salary and other expenses associated with the person in charge of the facilities; and
3) To pay, on a cash basis, for all drugs, except for those donated by the government.

The project, on the other hand, will provide to any group accepting the above conditions with the following:

1) The necessary equipment for the vet unit in accordance with the level of the person in charge;
2) Training to selected persons responsible for the unit's operation. The individual must have a general secondary school certificate;
3) Access to the proposed revolving vet drug fund;

Figure 5. Clinic and Housing Diagram of Central Vet Facilities Proposed for Abu Sheneina

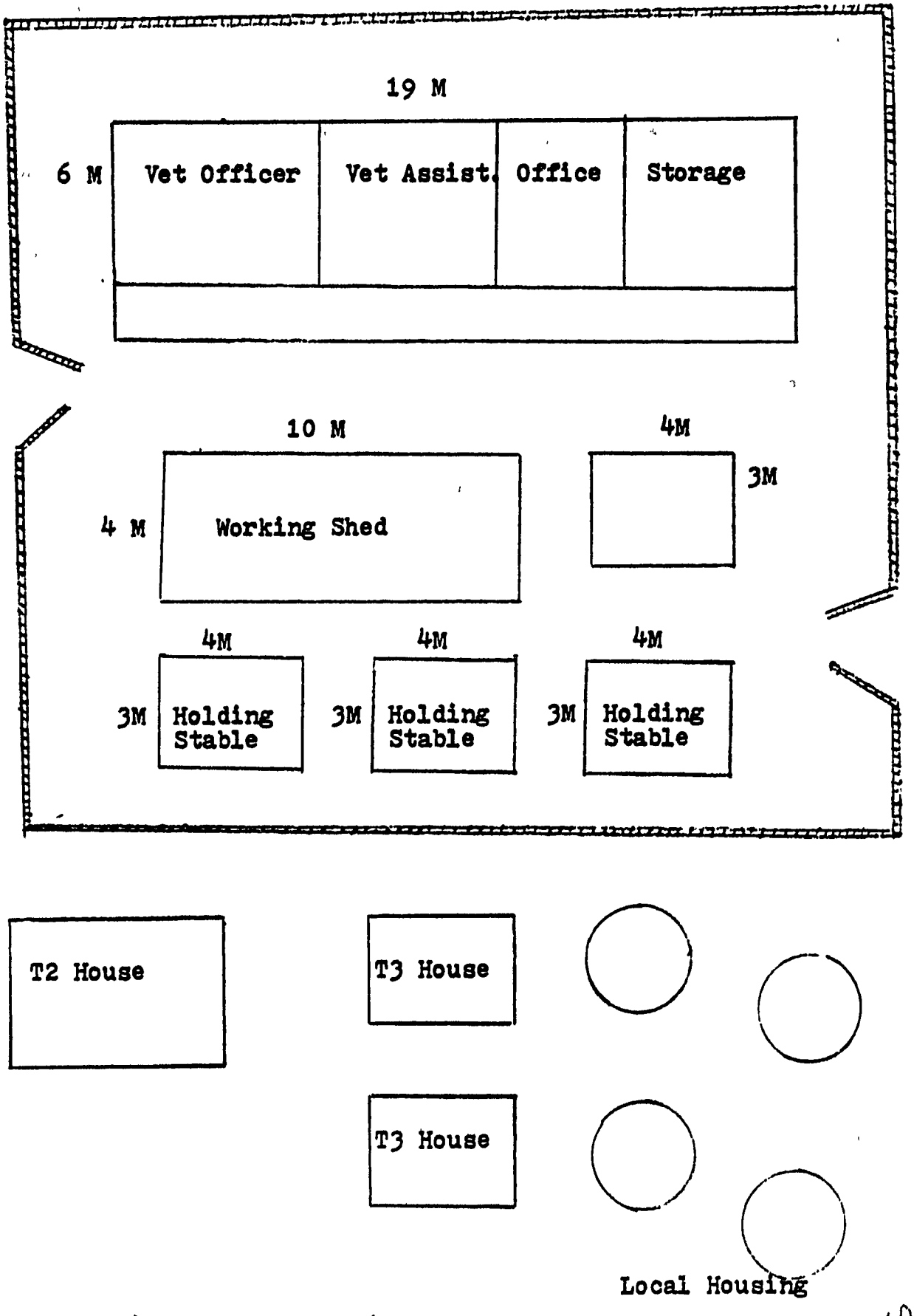


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Table 3. Mobile Vaccination Unit Equipment List

Trucks:	Three to five ton deisel truck selected partially on the basis of availability of spare parts and suitability on rough roads.
Deep Freezers:	Two kerosene deep freezers, 180 liters or smaller. One can be operated on butane. Sufficient spare parts such as wicks and glass are essential.
Camp Equipment:	Heavy duty camping gear. Two (2)-10 person tents Two (2)-3 person tents Three (3) kerosene cookers Three (3) kerosene lamps with sufficient wicks Ten (10) portable beds Three (3) large cases for transport
Ice Containers:	Six (6) heavy duty ice containers.
Syringes:	Twenty (20) automatic syringes with sufficient spare parts Fifty (50) 2cc syringes with 150 spare glass Ten (10) 5cc syringes with 100 spare glass
Sterilizer:	One (1) gas or kerosene sterilizer

4) Metal chutes and cement for crush construction; and
5) Supervisory personnel. Improvement of both the facilities and the quality of the personnel will be the project's responsibility if the unit is a success.

In the team's estimation, there are more than ten villages ready to accept the above agreement. It is recommended that one agreement be tested with a village and others gradually implemented.

Veterinarian Drug Revolving Fund

To insure the success of the proposed vet clinics, a revolving fund for buying the necessary drugs must be established. A new allocation for this fund will be needed. Any vet drugs sold through the clinics and units will be at a profit to insure the fund's solvency. Retail sales will be on a cash basis. Sales to the clinics will be on credit, with the previous order paid in full before additional orders are accepted. The fund would generally be used to assist in the formation of capital.

ANIMAL NUTRITION

Another component of the livestock management program is an improved animal nutrition plan for both the sedentary and the nomadic groups.

Sedentary Villagers

Lack of feed during the dry season is a limiting factor for livestock expansion within the sedentary communities. Forage crop production is expected to play a major role in the crop rotation system planned for the project area farmers. Hopefully, the project will place a high priority on the introduction of forage within the three farming systems planned to be tested.

Cultivation of forage crops will constitute one approach to overcoming the feed shortage. The second approach will be forage conservation. It is recommended that the project develop appropriate feed conservation methods and economical solutions for forage transport. It is also recommended that different approaches to improving straw quality and digestability be tested, such as using locally available chemicals, mixing with urea, and mechanical chopping. After initial testing of the various forage proposals, the project will hopefully have developed feasible solutions that can be demonstrated and replicated elsewhere.

Nomads

Two appropriate measures for the nomads are range improvement and forage production on the juroff lands or in khors. They will be discussed in the range section.

EXISTING LAND USE PRACTICES

The third major component of the livestock management program will work towards altering the existing land use patterns. The primary change in the villager land use would be the aggregation of the scattered fields that currently exist in the project area. This one change would greatly reduce the tensions between the nomad and the farmer and generally improve the productivity of both groups. A land use plan for the nomads was discussed in an earlier section.

ANIMAL BREEDING PROGRAM

Another aspect of the livestock management program is an animal breeding plan. Breeding plans are usually long-term and complicated measures. As such, a high priority can not be placed on this problem.

Within the nomadic sector, the only step recommended is an improvement in their animal selection practices. For the villagers, improvement of their local breeds, especially in goats, should be initiated on a small scale. Breeds from the central province should be introduced and tested.

EXTENSION

It was evident to the team that much extension work is necessary in both the sedentary and nomadic groups. The two aspects of increased extension work recommended are demonstrations and training

Demonstration

Practical demonstrations are the most effective way of introducing new management alternatives to the villages. The project should develop ideas and solutions at the Agricultural Center, modify them to fit a particular village, and then demonstrate it to the villages.

Two approaches to village demonstrations are possible. The first possibility is for the project to assume nearly all responsibility for the demonstration such as supervisory personnel,

livestock, and liabilities. The project could hire a project trained villager to conduct the demonstration and pay him from the generated income. The second alternative is to locate an interested villager and have him responsible for conducting the demonstration, using his own livestock, farmland and labor. He would be entitled to all profits. The project, however, would have to guarantee the person some sort of compensation in case of losses.

The extension for the nomads will be through the proposed grazing group discussed under the section on "Comprehensive Land Use Plan."

Training

Another component of extension is training. Both the nomads and the sedentary will have training programs. Local herders (nomads) will be trained to perform simple health services as well as to include preventative animal health care, basic nutrition, and animal husbandry in their livestock management. The vet school at Omdurman is available for such training in addition to the training of the required personnel for the proposed village clinics. Fifty nomads should receive training during the course of the project.

The villagers will also receive training from the vet school in Omdurman, enabling them to staff the proposed dressing clinics. The curriculum proposed is very similar to that proposed for the nomads, with additional emphasis on animal health and preventive medicine. The project will need to train at least 15 vet attendants and 50 vet assistants.

CREDIT

The need for credit exists within both the nomadic and sedentary sectors. For the sedentary people, the project should include credit to promote a small scale fattening project through the project credit fund. For the nomad, long term credit may be needed if establishment of grazing groups proves effective.

MARKETING

The project can do little in the area of marketing for the livestock owners, especially the nomad. The nomads market their livestock mainly in the White Nile area, such as in Rabak and

Kosti. Fortunately the Livestock Marketing Corporation is considering the Kosti market in their marketing project. In 1982 they will construct different facilities, such as a transit yard and holding pens near the railways to encourage livestock exportation.

If the project succeeds in introducing a feedlot or any sort of livestock finishing operation for the settler, the project will have to assist him in marketing. Any offtake increase from the sedentary sector cannot be absorbed within the project area and will have to be sold outside.

OFFTAKE

Associated with marketing is the problem of increasing offtake, especially in the nomadic sector. There are three main reasons why the offtake from the nomad is low. First, he is reluctant to sell more of his animals due to security reasons. There is also little additional cost associated with an increased herd size. Finally, the nomad, although he is normally ambitious, has little outside investment opportunity. The project cannot expect a miraculous change in attitudes. It can, however, help increase nomadic offtake by minimizing the risk of disease, providing a stable food and water supply, and improving range productivity. Addtional impetus for the nomad to sell some of his animals may come with increased financial obligations associated with a grazing association. It will not take place unless the nomad feels secure.

SUMMARY

The life-of-project program is presented in a tabular form for quick reference. Much of the specific information about the items in the program is presented in the livestock management section of this report.

1) Establish central veterinarian facilities at Abu Sheneina.
2) Construct dressing units. At least ten units will be needed.
3) Establish revolving fund for vet drugs.
4) Build animal crushes. Two will be outside the project near the nomadic entrance to the project. Six others will be needed at Eseil, Mosfa, Abiygo, Bikori, Abu Gona, and Abu Gemai.
5) Implement tick control program.

6) Hire a livestock/range specialist to assist in supervision of the grazing associations and range management. His responsibilities will include animal health, nutrition, livestock management, offtake determination, production and statistics.
7) Improve goat breeding
8) Cooperate with regional animal center on introducing improved breeds through cock exchange program.

ANNUAL LIVESTOCK WORK PLAN
January 1982 - June 1982

The activities of current dry season cannot be expected to start before January 1982 as a draft of this report will be submitted in late December. It is obvious that the project cannot, by itself, implement any of the livestock proposals, mainly due to a lack of equipment and a lack of time. The proposed work plan is based on two facts:

1) The project must depend on the available GOS animal health authorities and facilities and on the materials and equipment available on the local market and
2) The project must demonstrate concrete action to gain more confidence among the nomads. Several proposals for the current dry season are listed below.
   1) Appoint a Sudanese livestock specialist to manage all livestock activities.
   2) Develop a vaccination campaign. A two month vaccination campaign headed by the project livestock supervisor can start using the available regional animal health equipment and personnel. The proposal may require some financial contribution from the project to insure realization. The activities that will take place during the vaccination campaign are continued animal population surveys, blood and fecal sampling for a disease survey to determine the seriousness of different diseases and internal parasites, and the sale of vet drugs.
   3) Construct a vet dressing unit. The project can establish a vet dressing unit at Abiygo to test the feasibility of such arrangements and to gather livestock information during the rainy season. At the same time, have something concrete to demonstrate to the settler and nomad.

      A free building is currently available in Agiygo and the villagers are willing to construct housing. The necessary equipment is available at the vet general

supply department and on the local markets in Khartoum. Facilities such as crushes can be constructed with local materials by the villagers.

4) Begin training. The project can start selecting ten to fifteen herders to be sent to Omdurman vet school for the two month practical training course. The course would start in April 1982. The course includes basic animal health and animal husbandry training. The project must insure the well being of the vet trainees, as the success of the vet dressing units and other programs is dependent on their satisfaction.

5) Expand the nomadic route. A wider and better defined route between the project area and the White Nile area is a top priority of the nomads. Officially, the route was supposed to be made in 1980. Unfortunately, nothing has happened due to lack of finances and interest.

   The project, with the cooperation of the nomads and the departments concerned (mainly survey and range departments) can help in getting this route widened as stated in the Blue Nile executive council resolution. The main support needed is financing the cost which will not exceed LS 2000. The map describing the route is attached to this report. For reference, ask for the Provincial Executive Director Letter # MNZ/2/Z/2 dated 1/12/81 and addressed to the Assistant Commissioners for Survey.

6) Procure equipment and supplies. The following facilities will need equipment and supplies; mobile clinic, mobile vaccination clinic, central clinic, and at least 10 dressing units.

7) Construct the central vet facilities at Abu Sheneina. Three local houses will be needed for the vet attendants. Other facilities will also be needed (see Figure 5).

8) Begin studies for the pilot grazing area for the nomads. For more details, see "Comprehensive Land Utilization Plan."

9) Institute training program. From the villagers the project will need to train at least 15 attendants and 50 vet assistants. From the nomads, 50 men will receive a two month training course.

10) Conduct tick investigation program. In accordance with the tick investigation program develop tick control program.

11) Develop method for small scale fattening operation.

SOILS

Three areas of study were focused on by the soils specialist. They were: 1) a general review of the soils and vegetation mapping completed by J.R. Irvine with specific attention centered on the reddish-brown Typic Ustropepts; 2) a fertility study of the Typic Chromusterts used for sesame and sorghum production near Abu Gemai; and 3) consultation with the livestock and range specialists concerning the use and management of the soils in the project area. These subjects will be discussed in that order.

REVIEW OF SOIL AND VEGETATION MAPPING

Mr. Irvine conducted a broad (1:50,000 scale) soils and vegetation resource inventory in the spring of 1981. Spot checking of the soils mapping revealed few discrepancies in the actual delineations. The soils mapping is very accurate and should be useful in project planning. No disagreements with the vegetation mapping were found.

The only errors in the soils portion of the report was in the application of the U.S. Soil Taxonomy to the soils in the project area. The errors are merely academic and do not affect the use and management of the soils concerned. The most direct way of rectifying the mistakes is to present a revised soils legend (see Tables 4 & 5). The revised legend replaces the ones found on pages 13 and 14 of Mr. Irvine's report and on the soils map. Mr. Irvine will be contacted to obtain his concurence with the proposed changes.

To the uninitiated, soil taxonomy appears to be unintelligible words that only soil scientists can understand. Actually, the taxonomic name tells a great deal about a soil if the name can be deciphered. Since the Typic Chromusterts, very fine, montmorillonitic, isohyperthermic are the dominant soils in the project area, they will be used as an example.

The first part of the name, Typic Chromusterts, can be divided into four parts--Typic, Chrom, ust, and erts. Each root has a specific meaning. Ert means the soil is a V<u>ert</u>isol, a large group of soils that have deep wide cracks and distinct wet and dry seasons. Ust refers to <u>ust</u>ic moisture regime and indicates the area receives

Table 4. Soils Legend

Map Unit Symbol	Name	Percent Composition
100 -	Typic Chromusterts, very fine montmorillonitic, isohyperthermic, 0 to 2 percent slopes	85%
	Inclusions:	
	Typic Ustropepts, fine, montmorillonitic, isohyperthermic, 2 to 10 percent slopes	10%
	Rock outcrop.	5%
150 -	Typic Chromusterts, very fine, montmorillonitic, isohyperthermic, slightly eroded, 2 to 5 percent slopes.	90%
	Inclusions:	
	Typic Ustropepts, fine, montmorillonitic, isohyperthermic, 2 to 10 percent slopes.	9%
	Rock outcrop.	1%
200 -	Typic Ustropepts, fine, montmorillonitic, isohyperthermic, 2 to 10 percent slopes.	80%
	Inclusions:	
	Typic Chromusterts, very fine, montmorillonitic, isohyperthermic, 0 to 2 percent slopes.	10%
	Rock outcrop.	10%

Table 4. Soils Legend (cont.)

Map Unit Symbol	Name	Percent Composition
300 -	Typic Ustorthents, clayey over sandy, montmorillonitic, (nonacid), isohyperthermic, 0 to 2 percent slopes	85%
	Inclusions:	
	Typic Chromusterts, very fine, montmorillonitic, isohyperthermic, 0 to 2 percent slopes	13%
	Typic Ustropepts, fine, montmorillonitic, isohyperthermic, 2 to 10 percent slopes	2%
400 -	Typic Ustorthents, clayey-skeletal, montmorillonitic, (nonacid), isohyperthermic, 2 to 10 percent clopes.	50%
	Typic Ustorthents, clayey-skeletal, montmorillonitic, (nonacid), isohyperthermic, shallow, 10 to 100 percent slopes.	25%
500 -	Mollic Ustifluvents, fine-silty over sandy or sandy-skeletal, mixed, (nonacid), isohyperthermic, 0 to 5 percent slopes.	90%
	Inclusions:	
	Typic Usipsamments, sandy, siliceous, (nonacid), isohyperthermic, 0 to 5 percent slopes.	10%
	Typic Ustorthents, fine, montmorillonitic, (nonacid), isohyperthermic, 0 to 5 percent slopes.	10%

Table 5. Summary of Changes in Soils Legend

Map Unit Symbol	Change	Reason
100,500	Typic Pellusterts, fine to typic Chromusterts, very fine	Lighter soil colors; more clay than originally estimated.
200, 250	Typic Ustochrepts, to Typic Ustropepts.[1]	Very warm soil temperatures.
500	Typic Ustifluvents to Mollic Ustifluvents	Dark colored surface layer
400,500	Addition of reaction class (nonacid)	Require[illegible] all Entisoils
All	Isothermic to isohyperthermic soil temperature class	Average annual soil temperatures are greater than 22 degrees C.

[1]Subject to change pending laboratory analysis

between 400 and 1000 mm of rainfall. Chrom refers to color, other than black or grey, and indicates that the soil has some color to it. Typic means that the soil is a typical Chromustert. The last part of the name, very fine, montmorillonitic, isohyperthermic, is also very informative. Very fine refers to the amount of clay in an area between 25 and 100 cm in depth and, in the present example, the soil has over 60% clay. Montmorillonitic is the type of clay. Montmorillonitic clay has a very high shrink-swell potential which causes the wide cracks. Isohyperthermic describes the temperature regime and it means that the average annual soil temperature is over 22 degrees C (hyperthermic) and there is less than 5 degrees variation between summer and winter temperatures (iso). The above discussion will hopefully make the soils legend more meaningful and understandable.

Mr. Irvine requested the current soils consultant to investigate the soil classified as a Typic Ustochrept by Mr. Irvine. As noted in the revised soils legend, the correct classification is Typic Ustropepts. The difference lies in the soil temperature regime. The soils appear to be naturally infertile, the degree of which will determine their correct classification. They are generally not used for cultivation.

Several profiles representative of the Typic Ustropept soils were located, described, and sampled by layer or horizon. The collected samples, coupled with the samples procured by Mr. Irvine, will adequately characterize the soil and provide the necessary data to properly classify them.

SOIL FERTILITY STUDY

The soil that is almost exclusively used for sorghum and sesame production are the black, cracking clayey soils (Typic Chromusterts). The typical sequence of cultivation is to clear the land of trees, grow a rotating crop of sesame and sorghum for six years, and then abandon the fields. A study on the effects of this method of cultivation on soil fertility was undertaken.

Methods

Fields of varying ages were randomly chosen for sampling. The samples collected were composites from five sampling sites each 18 cm deep, randomly selected within the field. All samples

were placed in labeled paper sacks and air dried. The samples were sent to the Soils Testing Laboratory of the University of Maryland for analysis.

Results

This section will be completed upon receipt of the analysis results and be included as Appendix III.

Conclusions

This section will be completed upon receipt of the analysis results and be included as Appendix III.

Future Soils Testing

Additional soils testing may be necessary in the future, such as from the juroff lands or the demonstration farm. The Soils Survey Dept., located in Wad Medani, has a fully equipped soils testing laboratory. The cost per sample is SL 25,000, as opposed to the University of Maryland's U.S. $7.50. For testing on a scale smaller than the fertility study, the Wad Medani facilities will be quite adequate and cost effective. It does not seem necessary to provide soil testing chemicals to help establish another lab when the one in Wad Medani is already established.

USE AND MANAGEMENT OF SOILS

The two primary reasons for a soil survey are to provide delineations, on some form of a map, of areas of soils with similar properties and to develop interpretations about the behavior of the extant soils. In any soil survey, the interpretations should be project-specific; that is, they should reflect the informational needs of the users of the survey.

Within the project area, there are five major soil types, with two predominating, the Typic Chromusterts and the Typic Ustropepts. The bulk of the discussion about use and management will be centered on those two soils. The other three soil types will be briefly mentioned.

Typic Chromusterts

These soils (MU 100, 200) are the black, cracking-clay soils that dominate the level plains of the project area. Where khors have incised the plain, the slopes are steeper and eroded phase of the Typic Chromusterts (MU 150) exists. Management of both soils is essentially the same with the exception that the eroded phase will

have slightly lower natural fertility.

The Typic Chromusterts are best suited for cultivation. The main limitation is its very narrow range of workability. When dry, the soil is extremely hard, making it very costly, if not impossible, to work. When wet the soil is very sticky and plastic, again making it difficult to work. Timing of mechanized operations, such as seedbed preparation, cultivation, and road grading is therefore critical.

Fertility in soils is governed by two characteristics: The presence of essential mineral elements and the capacity to retain those nutrients. The Typic Chromusterts have both a high natural fertility and a high nutrient retaining capacity. The main limitation to continuous cultivation of these soils will be the maintenance of enough plant nutrients to produce a yield that justifies the production costs. Rotation of crops, intercropping, green manuring, and residue incorporation will either reduce the loss of or maintain the presence of plant nutrients. For continuous cultivation and high yields, however, some fertilizers will be necessary. Fertility data derived from the laboratory results, coupled with information about crop nutrient needs, will determine what nutrients will be limiting and how those nutrient limitations can be mitigated.

The Typic Chromusterts also have a very high shrink-swell potential, causing wide cracks during the dry season and gentle undulations (gilgai) across the landscape. As a result, these soils should be avoided, if possible, for road and building construction.

The very high clay content makes the Typic Chromusterts suitable for earthen dam construction. Compaction of the soil, either by livestock trampling or machinery, will result in an impermeable layer. Additions such as straw to the material used on the dam face will prevent cracking with changing moisture contents.

Typic Ustropepts

The reddish to brownish, non-cracking clayey soils (MU 200, 250) are found in the eroded areas near khors and on level plains near the Blue Nile River. They are best suited for improved rangeland. Their main limitations are low natural fertility and low nutrient-holding capacity. Consequently, they are seldom used for sorghum or sesame production. Planting of leguminous forage species and

improved grasses will increase soil fertility and rangeland productivity (see Range section).

Because these soils have a low to moderate shrink-swell potential, they are moderately well suited for road and building construction. The main difficulty is the high clay content, resulting in high construction costs.

These soils are suitable material for earthen dam construction. Compaction will be necessary to form an impermeable layer.

Typic Ustorthents, clayey over sandy

These soils (MU 300) occur sporadically near the Blue Nile, with a large area existing just west of Abu Gemai. As the name implies, a layer of clay, usually less than a meter thick, is underlain by sand. These soils are best suited for improved rangeland. They are low in native fertility and have a low capacity to hold nutrients. Management for improved rangeland would include planting of leguminous forage crops and improved grass species. Water will tend to collect and saturate the clay layer before drainage begins into the sands below.

Typic Ustorthents are well suited for building sites. The clay layer is relatively thin, facilitating excavation and thus reducing construction costs. They are poorly suited for road construction due to the clayey upper layers and the sandy lower layers. These soils would be a good source of sand.

Mollic Ustifluvents

These soils (MU 300) occur along the jurouf land near the Nile River. They are well suited for vegetable and other cash crops, with few limitations to that use.

Typic Ustorthents, clayey-skeletal

These soils (MU 400) occur near the Jebels of the project area. They are poorly suited for cultivation and improved rangeland. Large amounts of rock fragments occur on the surface and throughout the profile. They are best left undeveloped.

APPENDIX I

DAILY LOGS OF TEAM MEMBERS

DAVID P. FAULKNER

DAILY LOG

Oct. 30-Oct. 31:	Travel to Khartoum
Nov. 1 :	Off
Nov. 2-Nov. 4 :	Project orientation; meet AID & GOS personnel
Nov. 5 :	Travel to Damazin
Nov. 6 :	Field preparation
Nov. 7-Nov. 10 :	Range survey with GOS Range Management Team
Nov. 11 :	Return to Damazin; prepare for team's field work
Nov. 12-Nov. 13:	Team arrive Damazin; develop scope of work
Nov. 14 :	Travel to project area
Nov. 15-Nov. 25:	Meetings w/villagers & nomads; cont. range survey
Nov. 26-Nov. 27:	Thanksgiving holidays
Nov. 28-Dec. 1 :	Travel to project area; analysis of range improvements
Dec. 2-Dec. 3 :	Report preparation
Dec. 4 :	Off
Dec. 5 :	Overflight
Dec. 6 :	Review of work completed to date; field preparation
Dec. 7-Dec. 11 :	Meetings with nomads; final analysis of rangelands
Dec. 12-Dec. 16:	Report preparation
Dec. 17 :	Travel to Khartoum
Dec. 18-Dec. 19:	Final typing and copying of draft report
Dec. 20-Dec. 22:	Travel to U.S.

EL KHAIR KALAFALLA

DAILY LOG

Nov. 2-Nov. 4	:	Project orientation; meet with GOS personnel
Nov. 5	:	Off
Nov. 6-Nov. 9	:	Develop work plan
Nov. 10-Nov. 11	:	Visit to Wad Medani facilities
Nov. 12	:	Travel to Damazin
Nov. 13	:	Develop team scope of work
Nov. 14	:	Travel to project area
Nov. 15-Nov. 25	:	Meetings with villagers, nomads; analysis of grazing patterns
Nov. 26	:	Travel to Khartoum
Nov. 27	:	Off
Nov. 28-Dec. 3	:	Obtain concurrance GOS and educational authorities for proposed work plan
Dec. 4	:	Travel to Damazin
Dec. 5	:	Overflight
Dec. 6	:	Meeting with animal health officers
Dec. 7-Dec. 11	:	Meetings with nomads
Dec. 12-Dec. 16	:	Summarize livestock survey & report preparation
Dec. 17	:	Travel to Khartoum
Dec. 18	:	Off
Dec. 19	:	Report finalization

RICHARD TRENHOLME

DAILY LOG

Nov. 5-Nov. 7	:	Travel to Khartoum
Nov. 8	:	Off
Nov. 9-Nov. 11	:	Project orientation and field preparation
Nov. 12	:	Travel to Damazin; develop scope of work
Nov. 13	:	Off
Nov. 14	:	Travel to Abu Gemai
Nov. 15-Nov. 19	:	Work with GOS range and agronomy personnel; procure soil samples
Nov. 19	:	Travel to Damazin
Nov. 20	:	Off
Nov. 21	:	Travel to Abu Gemai; organize field work
Nov. 22-Nov. 25	:	Procure soil samples
Nov. 26-Nov. 27	:	Thanksgiving holidays
Nov. 28-Dec. 1	:	Travel to Abu Gemai; procure soil samples
Dec. 1	:	Return to Damazin
Dec. 2-Dec. 3	:	Report preparation
Dec. 4	:	Off
Dec. 5	:	Overflight and demonstration farm tour
Dec. 6	:	Travel to Abu Gemai; procure soil samples
Dec. 7	:	Nomad meetings
Dec. 8-Dec. 10	:	Procure soil samples
Dec. 11	:	Break camp; return to Damazin
Dec. 12-Dec. 16	:	Report preparation
Dec. 17	:	Travel to Khartoum
Dec. 18-Dec. 19	:	Report finalization
Dec. 20-Dec. 21	:	Travel to U.S.
Jan.	:	Analysis of lab report

APPENDIX II

GOS RANGE MANAGEMENT PLAN

Approaching the problem of pasture in the proposed site of American AID Project I observed:

1) Severe reduction in quality of pasture during the dry season; this is based on a chemical analysis of pasture similar to the site and proved by long distant detachment of herds from households during late dry season. The herds move south as far as Upper Nile Province borders.

2) Severe reduction in quantity of pasture even at the beginning of the dry grazing season. Both villagers and nomads for one reason or another burn vast areas of rangeland. The huge quantity of straw if not being lost by burning and supplemented is sufficient as a conserving ration.

3) Disappearance of perennials and legumes as a result of over grazing due to overstocking and also due to frequent burning.

4) The area utilized by nomads freely; that means the absence of management, improvement, or protection.

I reveal here our program to manage, protect and improve the rangelands at the project area.

Institutional Framework

The project will be executed by the National Range and Pasture Administration represented by its staff at El Damazin headquarters under the supervision and financing of American AID. Work in the field will be carried on by existing provincial technical staff.

Activities

There are two approachs to improving deteriorating rangelands:

1) To establish completely protected areas by fencing, building firelines and enclosing all watering points. This would allow

natural plant succession to take place, but it is slow and time consuming.

2) To protect an area by fencing, firelining and seeding with carefully selected species compatible with prevailing conditions. This is a more rapid method of improving range conditions, but is relatively expensive.

In consideration of the necessity of balancing the immediate needs of restoring the degraded lands and developing a managment plan which can be duplicated elsewhere we advise that the project limit fencing just to the area needed for seed protection to protect them from reseeding naturally. Other measures will be adopted to serve as protection to the area reseeded.

WORKING AND TIME TABLE

Phase I--Jan - July 1982

A) Nursery establishment and operation.

Grass, legumes and bushes, seed production farm will be established on 1000 acres of the project area under rainfed agriculture. Emphasis will be placed on the production of seeds of perennial species. Seed from native species will also be collected from rangeland currently under protection. Both seeds produced in the farm and that collected from protected rangeland will be analysed as to purity and percent germination to insure proper seeding rates.

B) Site Selection

The areas to be fenced will be located within the sub-project area. Specific sites will be selected on the basis of the following criteria:

1) central location for demonstration purposes

2) proximity to water sources

3) willingness of nomads to participate in project activities

C) Demarcation fencing and fireline building.

User rights of land will be turned over to the nomads' cooperatives society by the local authorities for the purpose of pasture improvement, protection and utilization. Other nomads will consequently be prohibited from using the project area. Accordingly all grazing blocks will be marked with fixed signs either surveying benchmarks or by firelines. Firelines will be built around the perimeter to protect the reserved areas against seasonal fire outbreaks. A mounted guardman will be appointed by the nomads' cooperative society to protect the project area against trespassing, and a system of fines for trespassing will be worked out with the local authorities.

Phase II - April - July 1983

Rehabilitation of Grass Cover.

A certain part of the total area will be reseeded for each year of the early years of the project. The proposed areas for the reseeding operations will be listed. Previous studies conducted by the Range and Pasture Administration indicate that the following grasses, herbs, shrubs and legumes are adaptable and can successfully be established in the project area;

Clitoria ternata
Phaseolus aureus
Cajanus cajana
Cenchrus ciliaris
Panicum maximum
Panicum sp.
Panicum chloratum

Pennisetum purpureum
Andropogon gayanus
Brachiaria obtusiflora
Indigrofera linarifolia
Indigofera alongifalia
Cenchrus setigerus
"Green gram"
"Guar"
Desmodium sp.

As part of the reseeding effort, research will be conducted relative to seeding methods and techniques. Complete seed bed preparation methods which are generally known, such as ploughing, compaction and seed coverage will be compared with partial seed bed preparation methods and water harvesting techniques such as pitting. alternate strip ploughing on the contour, contour borders and interseeding will be tested.

Phase III - 1984 and later

Management and Observation.

Demarcation activites will also be undertaken to convey practical management techniques required for the reseeded selected areas and for the whole site.

Following the full establishment of grass cover, the reseeded areas will be opened for grazing. Stocking rate will be determined by range management personnel in accordance with the actual carrying capacity of individual blocks to allow for vegetative reproduction and regeneration.

SOCIO ECONOMIC AND ENVIRONMENTAL IMPACT OF THE PROJECT

The restoration of vegetative cover on badly degraded areas will reduce soil erosion, at the same time that quality and quantity

of range resources are being improved.

On the basis of similar experiences in range rehabilitation elsewhere, it has been estimated that the livestock carrying capacity of the land once it has been rehabilitated will increase two to three fold. This increased capability will also reduce pressure on outlying pastures, and thereby facilitate their regeneration by natural means.

The demonstration aspects of the project will also play an important role in environmental rehabilitation by showing the potential of the range land under effective management and thus encourage similar efforts by other nomads.

OTHER ACTIVITIES PROPOSED

A. We feel a necessity to create a link between the nomads and villagers so we offer a design for forage production of sheep fattening. The main idea of the proposal is:

1) The villagers cultivate dura and sesame each of which will produce by-products. The villagers are advised to adapt a system of rotation to restore fertility of their soil so we suggest "Green gram" as an effective legume in nitrogen fixation. Green gram seeds are well known to the villagers table and they give it a local name "Koda". Green gram plant is recommended as a forage.
2) The nomads are advised to get rid of surplus animal units to avoid overstocking in rangeland.
3) The villagers' cooperatives will buy sheep from nomads' cooperatives for the purpose of fattening.

B. Although fireline establishment will be the responsibility of the nomads cooperative we suggest entering into experiments to check

use of herbicides in fireline construction. Range and Pasture Administration already conducts experiments with chemicals.

C. Long-term ecological data collection better to continue. Beside the three livestock exclosures already established we suggest experimental work on carrying capacity using the animal method. A sedentary small herd better to be kept during rainy season in the project areaespecailly on light soils east of the project area and adjacent to the river bank. This is to check effect of mud and heavy rain on the animal movement. It will further check effect of fly irritation on the number of grazing animals.

Pasture and Range Management

Administration Requirements to

Carry on the Program

AGRICULTURAL MACHINERY

One full-track tractor, 120 H.P. with dozer blade and carry all unit.

One tractor 60 to 67 H.P.

One tractor equipped with front dozer and digger

Three bailers

Three mowers

Three side-delivery rakes

Two grass seed drills

One post hole digger

Three five-ton trailers

One disc plough

One disc harrow

Stock of various spare parts, implements and replacements

EQUIPMENTS

Barbed Wire

Weighing equipments

Different types of bags

Stationary

Furniture

Sprayers

Fencing establishment equipments

TRANSPORTATION

CHEMICALS, HERBICIDES, FERTILI:

SEEDS

Imported seeds for introduction in rangelands

RUNNING COST OF TRACTORS AND VEHICLES

STAFF

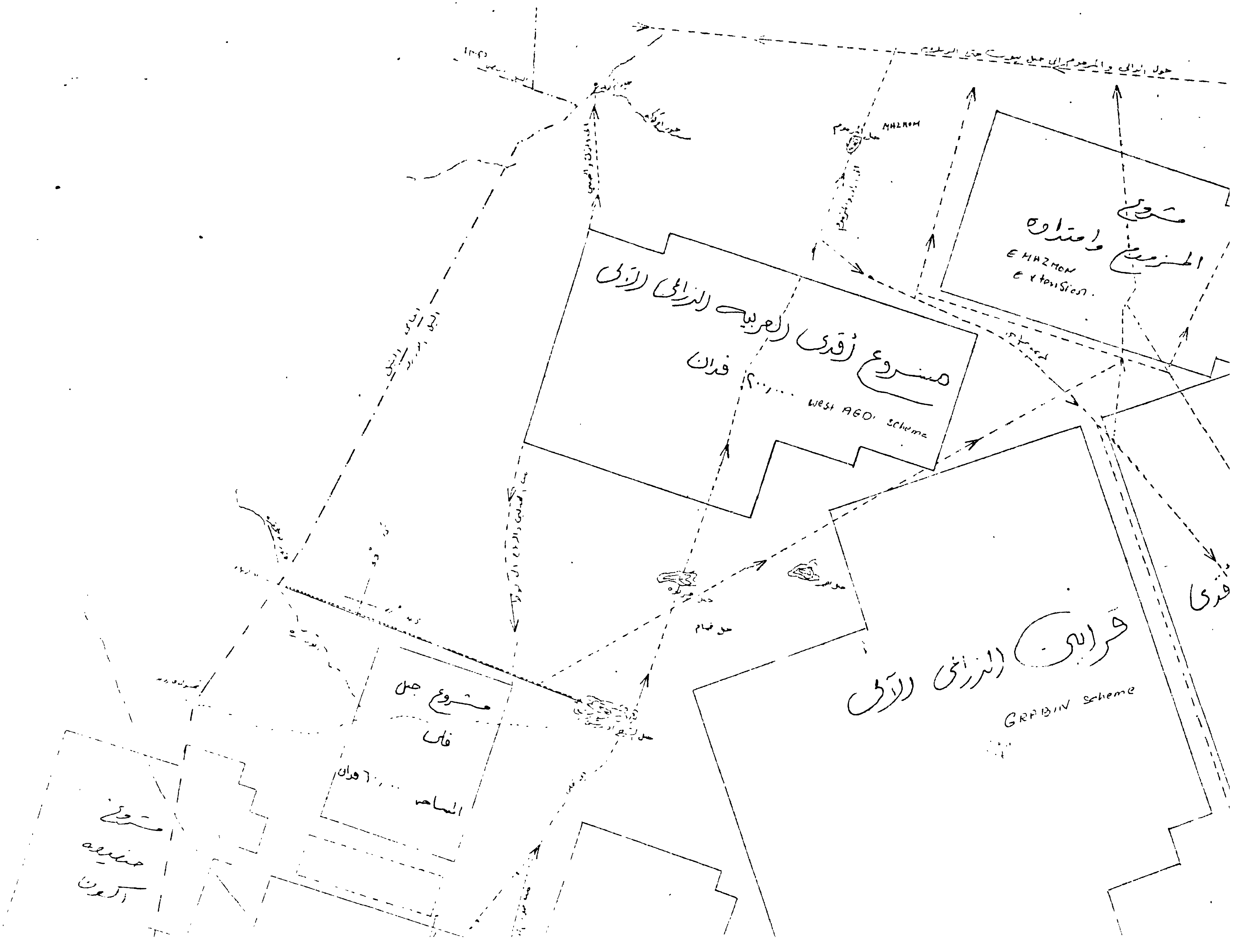
Tractor drivers, technical laborers

Abd Elfatah Ekrchier
A. of Commisioner for
Range Management - Damazin Office

APPENDIX III & IV

LABORATORY ANALYSIS OF SOIL SAMPLES

Will be published under separate cover upon completion of laboratory analysis of soil samples.



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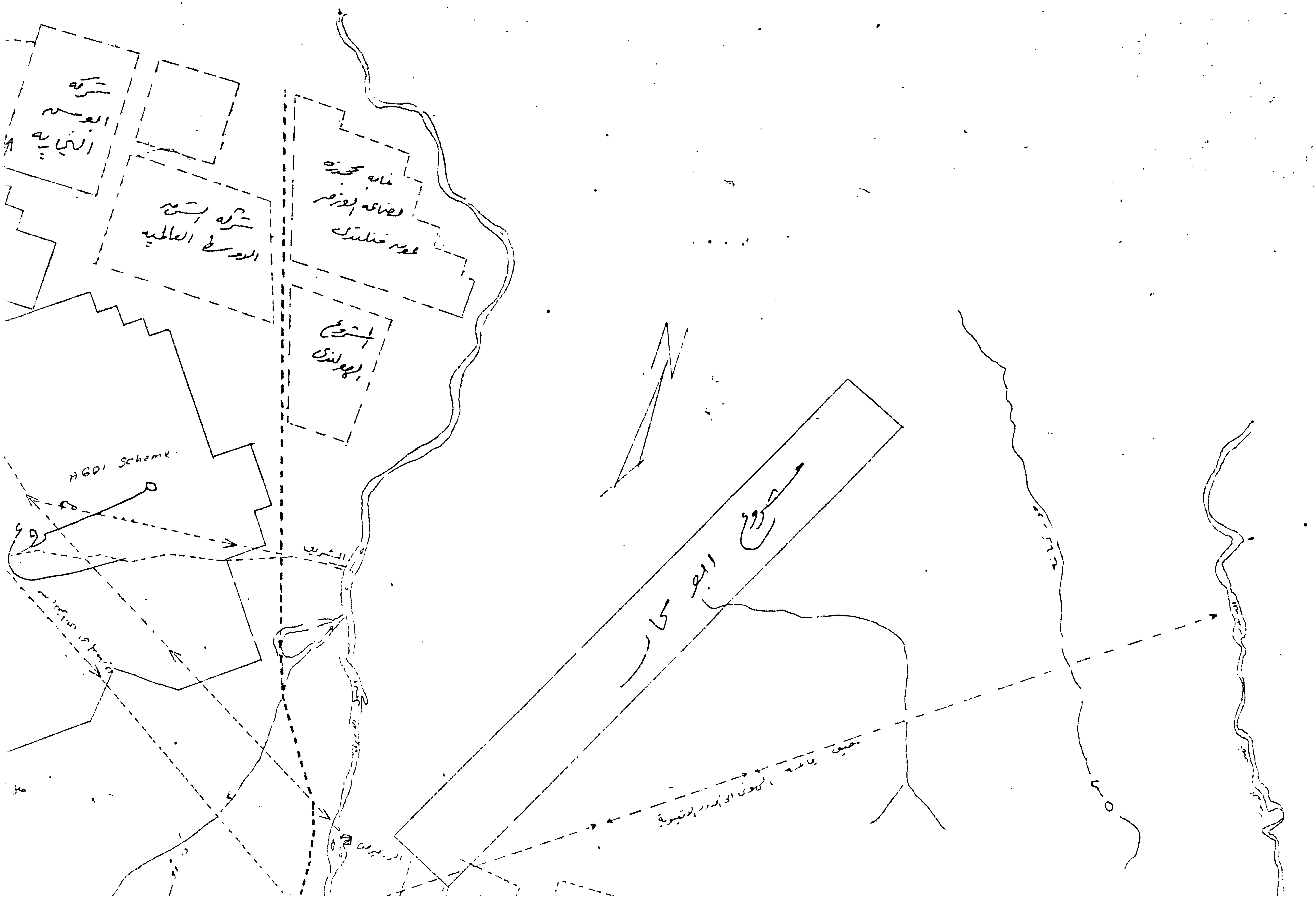
AGDI Scheme
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المشروع الهولندي

الكامل السودانى
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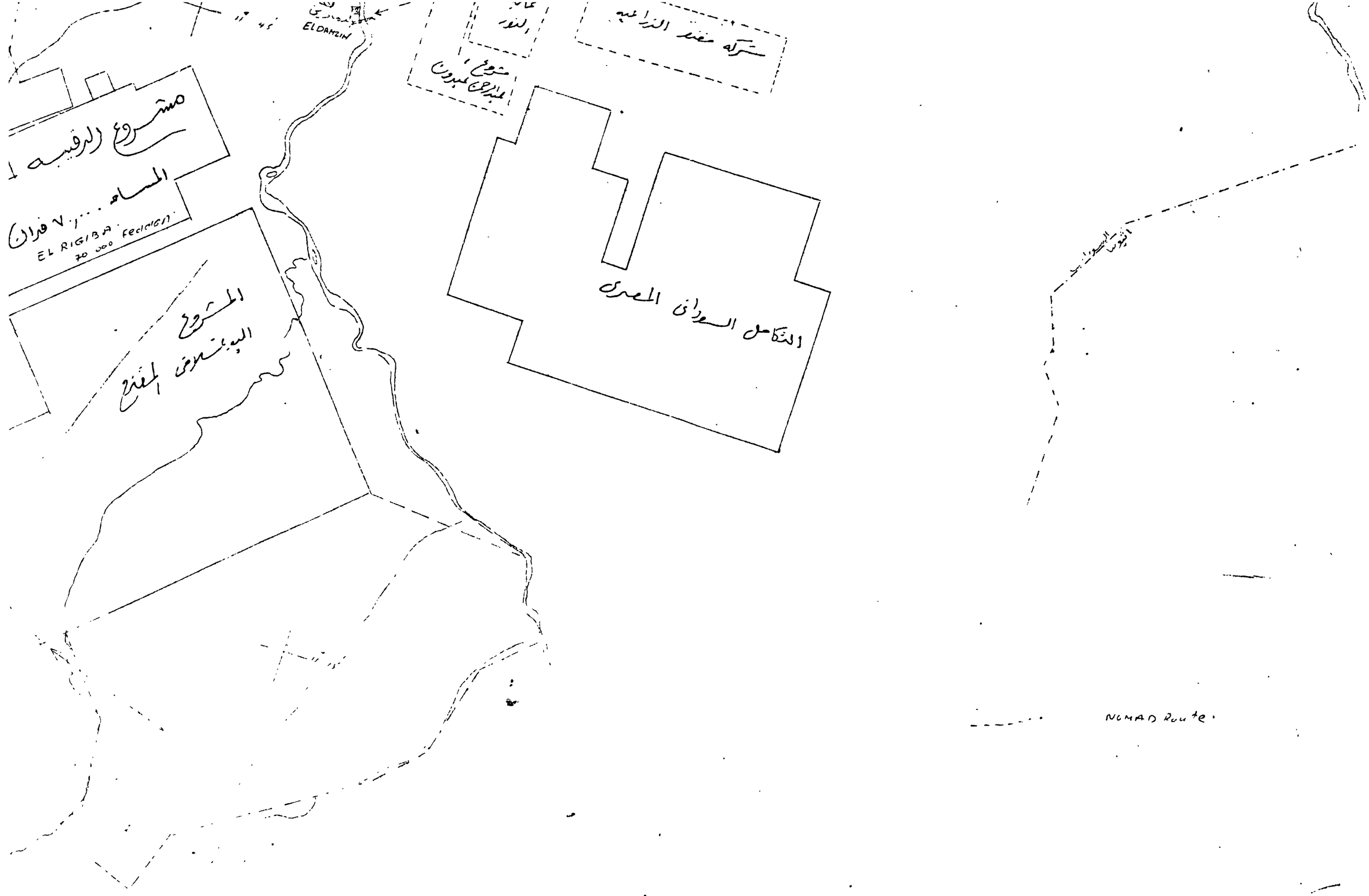
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