LOCUSTS IN SUDAN

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AN OVERVIEW

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SUMMARY AND RECOMMENDATIONS

A. Unquestionably, there is an increase in both locusts and grasshoppers in Africa. This is most likely due to the end of a prolonged drought and the increased availability of food.

B. The general build-up of pests in the Sudan is reason for concern, however, a major locust outbreak in the Sudan is not presently in evidence.

C. A two-stage strategy is envisioned in order to control the existing population levels and to prepare for any potential major outbreak. Phase I would consist of strengthening the agencies responsible for the control of these pests at endemic levels, i.e., the Plant Protection Department in the Sudan (PPD) and the Desert Locust Control Organization (DLCO) both in Sudan and at a regional level. The second phase (Phase II) would consist of an increased alertness via public concern and enhanced survey operations while simultaneously increasing preparedness for an outbreak.

D. Regarding Phase I, to date this has consisted of replenishing those insecticides used up during the 1985-1986 campaign and some stockpiling of additional insecticides and ground application equipment. Both PPD and DLCO argue that major constraints for Phase I are ground transport and improved storage. These arguments are suspect by some since a locust "crisis" provides a long-awaited stimulus for correcting the general deficiency of MOA ground transport in the Sudan.

Donor action at present has taken a back-stopping rather than that of a strengthening position. The "Ashal Plan" proposed by FAO provides for the creation and equipping of mobile ground treatment teams which,

while not under the direct control of PPD, are responsive to priorities recommended by PPD. The workability of this strategy, however, has yet to be demonstrated.

E. Regarding Phase II, first of all it should be pointed out that even if Phase I were put into action completely, it would still be insufficient in the event of a major locust outbreak. At present in the Sudan there exists no reliable predictive technology, therefore the only alternative is preparedness for immediate, short-term needs (e.g., 4-6 weeks) with contingency plans for a long-term campaign (e.g., 1-5 years). Short-term plans are already in place. This, along with some increased stockpiling of pesticides for aerial application should prove adequate. Long-term plans, however, are only partially developed.

F. Information has been assembled on the availability and adequacy of spraying aircraft (PPD, DLCO, commercial and extra-national), however, a standard procedure is badly needed in-country for mobilizing the purchase, transport, and storage of pesticides whenever the need arises in the future. The extraordinary difficulties met with during the present emergency effort (delays in customs clearance, lack of logistics personnel, etc.) should be taken as a lesson for future efforts in control of migratory pests in Sudan.

G. Lastly, there is a need for correcting in-country constraints as well as developing a regional effort. The former include research, training, vehicles and storage. DLCO can help in these, as well as form the basic of a regional effort.

REPORT

1. Background

As a result of a return to near-normal rains, Africa began experiencing widespread and increasing densities of grasshoppers and locusts in 1985. In the eastern and central sorghum growing grasslands of Sudan there was a marked increase in African Migratory Locust (AML) beginning in August of last year and treatment was initiated. In January of 1986, mature swarms of Desert Locust (DL) were reported in northeastern Sudan in the Red Sea area (Figure 1). Throughout February and March egg laying and new hatching were observed from Tokar to Halaib. Control measures were initiated during February and over 4500 hectares were covered. During June, three small swarms were observed in two locations in northeastern Sudan but since then only scattered solitary locusts have been seen.

Rainfall, though adequate, was below average in Sahellian Sudan this year, and this may be responsible for the delay in locust increase in August. Until mid-August only light to moderate grasshopper populations and occasional solitary locusts (AML and DL) were observed in the area between Nyala (in the west) to Gedaref (in the east). By the third week in August migratory swarms of DL were being reported in the Kassala region in the east. It was decided, therefore, to make a tour through the central and eastern districts during the fourth week of August to ascertain the current locust status and to gain an overview of the preparedness and ability of the Sudan Plant Protection Department (PPD) to handle local campaigns as well as a potential outbreak situation. This report summarizes the findings on that survey

as well as contacts with other locust control organizations in Khartoum and elsewhere.

2. Current Status of Locusts (Sept. 1, 1986)

A. Central Region - The Kosti district reported seeing gregarious forms of AML in sugarcane during April of this year. There have been no locusts observed since that date. Numerous grasshoppers and a few solitary 1st and 2nd instar AML were seen just southeast of Sennar. A below average density of AML (some gregarious) are reported in the El Damazine area in the south, although this report requires confirmation. An extensive trip thru the Gezira, east of Wad Medani, revealed numerous grasshoppers but no locusts. Much of the central region because of its rainfall and soil type is characterized as primarily an AML area. Currently there is only minimal activity of no concern.

B. Eastern Region - In the Gedaref district excess rainfall prevented any vehicular traffic off the main road, thus observations were limited. While many AML were observed and treated between September and December of last year, no locusts have been reported so far in 1986. A medium density population of gregarious and solitary Desert Locust covered an unknown ground area located about 5 km. from the Eritrean border due east of Kassala. Many of these are new adults. The area is receiving ground treatment.

C. Coastal Area - The Red Sea area is traditionally a winter breeding area for DL and no locusts are presently reported in that region.

D. Prognosis - No AML populations of concern are being currently reported in the Sudan. This species, while observed in August

last year, normally doesn't begin hatching until September. Thus, with continuing rainfall, it is possible that damaging population levels may still occur. Desert Locust which breeds in the lighter soil areas begins hatching as early as July in the eastern region. Except for the medium population observed east of Kassala, there have been a paucity of sightings within Sudan. Of concern, however, are the reported occurence of high density swarms migrating from Eritrea.

Thus, while population levels of locusts in the Sudan currently are of little concern, there is no justification for assuming the 1986/87 crisis is over. The potential for a severe outbreak still exists and Sudan can ill afford a lack of readiness.

3. Anti-Locust Resources in the Sudan

Locusts, in the Sudan, are considered "national pests", along with Quelea (weaver) birds and rodents, and as such become the responsibility of the Plant Protection Department (PPD) within the Ministry of Agriculture. Sudan is a member country of the Desert Locust Control Organization (DLCO), and it therefore receives benefits from control activities of that body and can call on it in the event of a major outbreak.

4. PPD personnel resources

Sudan has one of the largest plant protection departments in Africa. It is probably second only to Egypt in number of post-graduate entomologists (ca. 55). Additional entomologists in the Universities, the Agriculture Research Council, the Mechanized Agricultural Corporation and in association with the Gezira Irrigation Scheme and

other schemes brings the number into the hundreds. The technical staff of the PPD consists of about 600+ individuals trained to the BS university level or at least to the post-secondard level at other institutes. Other staff exceed 2,000 located at 18 bases in 6 regions. Approximately 150 "Locust Scouts" should be added to this number.

It is apparent that the number of qualified personnel within PPD does not constitute a constraint for locust control in Sudan. The PPD is capable of mobilizing additional labor if warranted. As will be discussed later, facility and transport shortages prevent optimum utilization of the talents of these personnel.

5. Locust Control

A. History - Mechanical methods have been used in the past, such as trenching, plowing, flooding, barriers, flame-throwers, etc. but these are generally useless in the short or long term. Numerous parasites and predators attack and reduce locust numbers, but these biocontrols are ineffective during outbreaks. Chemical control has proven the most effective strategy for control of locusts in all of the LDC's and Sudan is no exception.

During the 1979 outbreak, before the advent of organic insecticides, it was necessary to rely on the unstable and expensive pyrethrums and on toxic sodium arsenite baits. Organic insecticides introduced after World War II included chlorinated hydrocarbons, such as BHC and dieldren. The organophosphates: diazinon, fenitrothion, and malathion were in use during the

1960's as was the carbamate, carbaryl. Little research on pesticide efficacy has been conducted since that time and currently recommended materials consist of fenitrothion, diazinon, and malathion. Improved formulations of carbaryl and the synthetic pyrethroids, such as decis, pydrin, or fendona should be tested under field conditions and used with caution. Dieldrin, because of its effectiveness at low dosages and BHC because of its effectiveness and low costs are still utilized in many African countries but are not recommended by USAID. This is primarily because they are restricted chemicals according to the EPA. USAID, therefore does not allow their use or procurement if USAID funds are involved.

B. Pesticides - The first requirement for locust control is the availability of suitable insecticides. The two materials most widely used for locust control in Sudan are fenitrothion, for aerial application in non-crop areas, and diazinon, for ground application in either crop of non-crop situations. In addition, BHC is extensively used in a mixture of groundnut shells as a bait.

Except for the Kosti station, which has about 500 liters of fenitrothion destined for the south, none of the PPD stations has any carry-over storage. In fact, PPD is obliged to replace 3000 liters of fenitrothion and malathion used by DLCO in their Red Sea coast campaign. Through donor support, 135,000 liters of fenitrothion have been tendered for the 86/87 campaign: about 100,000 liters are already in the country. It is calculated that

will treat about 540,000 feddans (216,000 hectares). AID advises that this material should be used with care around large populations of birds.

On-site counts as well as reported inventory reveals that PPD presently has about 40,000 litres of diazinon (60 EC) distributed among its centres. Because of the deteriorated condition of this material an increased dosage rate must be used (750 cc/feddan) whenever estimating the potential treatment. The maximum area possible that could be treated with this diazinon would be 53,000 feddans (21,200 hectares).

In addition, donors have purchased and received in-country 20,000 liters of diazinon (60 EC). At a dosage of 150 cc/feddan, 40,000 feddans (16,000 hectares) could be treated bringing the diazinon total to 93,000 feddans (37,200 hectares). BHC is a chlorinated hydrocarbon unacceptable to USAID and is no longer recommended by either FAO or DLCO for locust control. However, it remains an effective, inexpensive, and available pesticide in use in Sudan. Bait is prepared using five parts by weight of 2.6% BHC dust in 95 parts of groundnut shells. An estimated 3500 metric tons (MT) of bait have been prepared and partially distributed to subcenters. A late delivery and short supply of groundnut shells has been a constraint, at least in Gedaref. In addition to the prepared bait, PPD has at least 130 MT of 2.6% BHC in covered storage which would provide for another 2500 MT of prepared bait. As will be

discussed later, distribution and storage of prepared bait represents a further constraint. Because of the method of application and spot type treatment it is not possible to relate these quantities to area treated.

The above materials constitute the major pesticide arsenal for locust control in the Sudan. A number of additional pesticides require comment, however. The FAO is recommending that pyrethroids receive further consideration for use against locusts. Cypermethrin (decis, ripcord) was successfully used during the 85/86 campaign. Except for a small reserve at Kassala the in-country supply is depleted. As a substitute for decis, donors have tendered 8,000 liters of alphacypermethrin (fendona). Shell reports this material to be 2.5 times as active against locusts as cypermethrin. The formulation is not known at this writing, but if it is 1%, it will be adequate to treat 10,000 feddans (4,000 hectares). AID advises that pyrethroids have toxicity to aquatic life and may also be extremely irritating to the skin.

Propoxur (baygon) 2% dust has been used successfully against locusts/grasshoppers in West Africa. This material, as well as carbaryl and bendiocarb are considered to be viable substitutes for BHC. It should be remembered, however, that these compounds are significantly more expensive than BHC and will require donor support.

Malathion and diazinon are less persistent, less effective and have lower mammalian toxicities than fenitrothion. Aerial application of fenitrothion ULV was reported to cause severe, yield-reducing, phytotoxicity in sorghum in the Gedaref area. Its use is restricted to open land or roadways bordering sorghum plantings. It is recommended that the steering committee consider the purchase of 20,000 liters of malathion 96% ULV (or diazinon ULV) for possible treatment of standing crops. These materials plus the fendona would then be available for direct protection of 50,000 feddans (20,000 hectares) of sorghum.

It is claimed that the older formulations of carbaryl were only about 25% as effective a fenitrothion. A new formulation, carbaryl 41 L tested in Mali has proven comparable to fenitrothion against grasshoppers when used at a rate of 454 grams A.I. per feddan. This compound should receive serious consideration for use in Sudan. Of particular concern is the identification of alternatives to fenitrothion if a shortage of this compound should, and probably will, develop.

In addition to the above materials there exists an undetermined quantity of old and often prohibited pesticides available in Sudan. The opinion has been expressed that in the event of a major outbreak these materials would be utilized in non-crop, open areas.

PPD reports that about 250,000 liters of pesticide were used primarily against locust during the 1985/86 season. Without a detailed breakdown on toxicity dosages it is not possible to accurately relate the current availability to possible need during the 1986/87 campaign. It is clear, however, that supplies of fenitrothion, diazinon, and fendona are at least equal to last year's requirements and should suffice for several months of a serious outbreak.

C. Application Equipment - An inventory by PPD (August 9, 1986) lists the following distribution of wheelbarrow and knapsack (including motorized) sprayers. The inventory for the eastern and central regions is verified and the total count is considered to be reliable.

	Sprayers	
Region	Wheelbarrow	Knapsack
Eastern	130	820
Central	70	500
Northern	40	255
Kordofan	15	450
Darfur	17	400
	272	2425

D. Constraints - Except for cotton, farmers seldom apply pesticides to their crops. Application equipment and pesticides are sold at a "nominal" price or loaned to the farmers by PPD. The large inventory suggests that the public demand for such equipment has been met. The equipment thus remains available for locust control

ground programs. Larger, high pressure sprayers, are either inoperative or lack suitable transport.

Such dilute spray equipment is useful in local campaigns where breeding areas are accessible by surfact transport. Obviously, in a country with an area one-third that of the USA, even with a good but limited road network, access is still extremely limited. Further, the magnitude of ground area to be treated far exceeds the capability of such equipment. Clearly, the utility and efficiency of modern, portable concentrate (ULV) application equipment should be investigated.

The Ashal Plan (devised by FAO experts) addresses these constraints and provides for a strengthening of PPD's control capacity during the 1986/87 season. This plan involves the use of mobile survey/spray teams (presently 25) equipped with Land Rovers, trucks, motorized and hand dusters, motorized knapsack sprayers, wheelbarrow sprayers, ULV hand sprayers, pesticides, radios, camp kits etc. These teams under the control of PPD and monitored by the Steering Committee (task force) are assigned and reassigned to areas of greatest need, thus backstopping the more stationery or regional PPD program. With supplemental, as-needed, aerial spraying, it is anticipated that at least a short term holding effort can be successfully waged.

In the event of a major invasion or outbreak within Sudan, the only strategy is a large scale aerial campaign. DLCO aircraft are

efficient but limited to a single Cessna Islander in Sudan. The PPD aviation division is largely decimated through lack of support for maintenance and spare parts.

In contrast to the situation in Sudan during the 1967/86 outbreaks, and in contrast to many other African countries today, Sudan has numerous companies providing aerial spraying service. It is likely that more than 100 aircraft could be mobilized if the situation should warrant it. Prerequisite to such a mobilization, contingency plans must provide for the acquisition, transport, and storage of pesticides and avgas.

E. Other Constraints

1. Research: Locusts, as a "national" problem comes under the responsibiltiy of PPD which is implementation oriented, not research oriented. The Agricultural Research Council (ARC) has 17 research stations with post-graduate entomologists in residence at most. The ARC has not budgeted for any research to be carried out on a national pest. Presently, the PPD stations have numerous technical staff with enough training in crop protection to qualify them for limited adaptive research. Pesticide evaluation, dosage determination, and on-site application equipment trials, should be pursued over the next several years. Training could be augmented through FAO and/or DLCO. Direct supervision by senior PPD staff, e.g. Seif Diab at Wad Medani or El Mustafa, Mohamed Hassan at Sennar, is advisable. A Land-Rover pick-up and an operating budget would

enable the researcher to follow locusts populations as the need dictates.

An alternative is to support research efforts proposed by DLCO. This approach would require a larger budget but would be less parochial and would involve the very important aerial application research. Perhaps the best approach would be a mix of basic research carried out in a cooperative way by both PPD and DLCO.

2. Venicles: The serious transport deficiencies within PPD are recognized and well documented. Site visits in the central and eastern region stations in July of this year revealed that six stations had a total of only 25 operable (many only marginally) vehicles. A more recent survey suggested that with the restocking of pesticides, the only major constraint is that of transport - transport for moving pesticides, application equipment, and personnel, as well as moving quickly to confirm locust sightings.

Efforts to offset this deficiency have involved the purchase of Land Rovers and trucks for use by the mobile teams. These vehicles do not come under the jurisdiction of any single station but are routed to locust priority areas. The deficiencies are further offset by the temporary local rental of vehicles as needed. However, these are frequently not up to the job.

Currently, international support addresses the immediate and short term requirements of the locust emergency. It is eminently clear, however, that development of a severe long term locust outbreak will require a significant strengthening of the PPD. Outside donor support should be solicited in order to correct PPD's transport constraint.

3. Storage: While not as crucial to the locust problem as the above constraints, pesticide storage facilities are important. The present spaces are inadequate in that they do not provide enough protective space and often are highly dangerous in terms of creating a toxic hazard. Most have soil floors, some have metal roofs but many have natural product roofs that admit rain. More often metal drums are stored in the open (sometimes within secure fencing, sometimes not). Pesticide application equipment shares a similar fate. Aviation fuel stored in close proximity to highly toxic chemicals offers an unacceptable risk, but this case is often seen in Sudan.

In addition to the environmental impacts, it is also necessary to consider the degradation of stored chemicals in the Sudan climate. Most chemicals degrade rapidly under high temperature conditions making dosage requirements highly variable. This creates a problem in determining effectiveness as well as extra hazards for the applicator.

To provide for availability of needed pesticide during outbreak periods it may be necessary to store chemicals for extended periods of time. Vented structures with raised concrete floors should be strategically located for ready accessability. Where possible they should be located near airstrips.

Finally, minimal protective clothing for mixing and loading operations consist of boots, gloves, aprons and goggles. Adequate supplies should be available at each storage facility.

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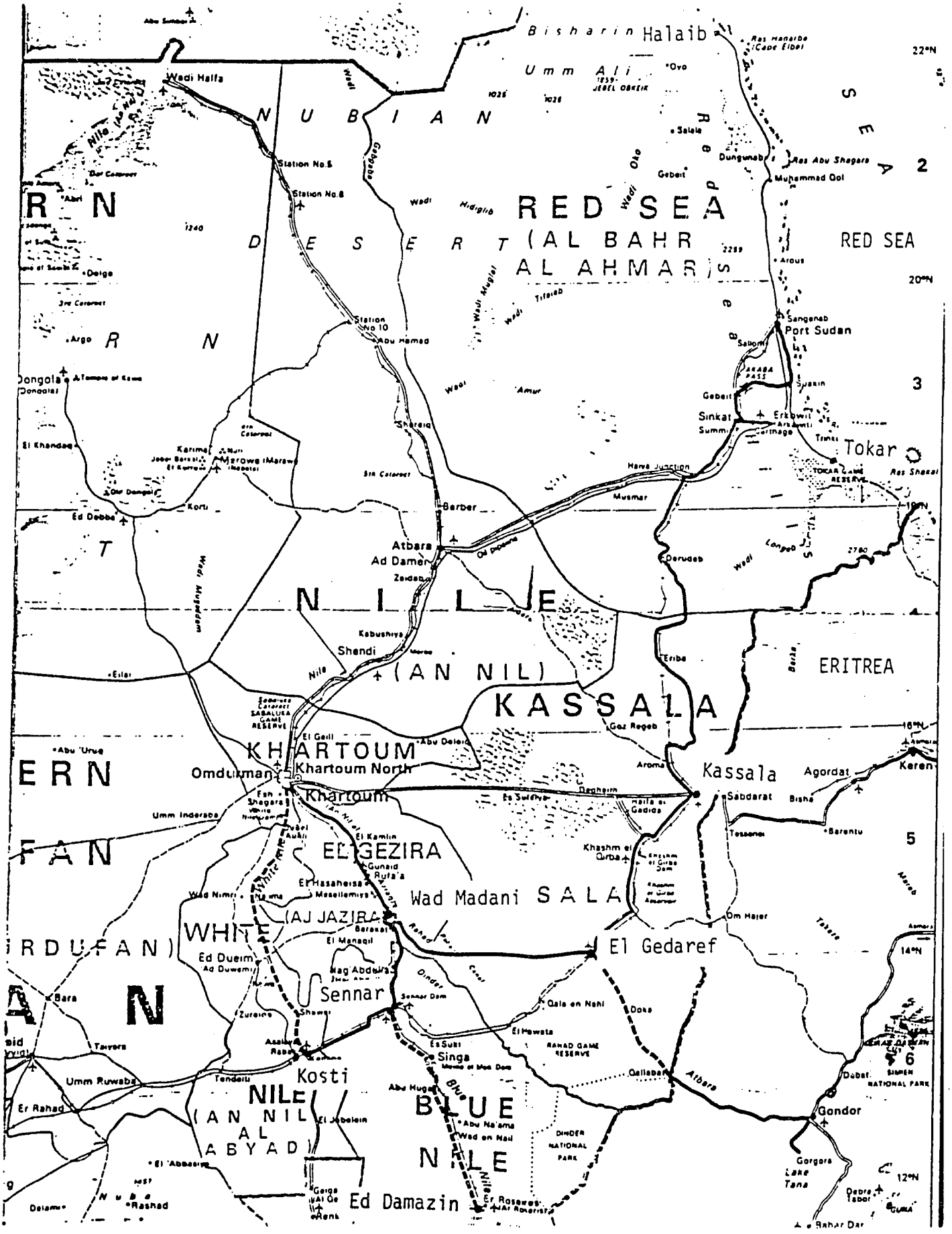
Figure 1. SUDAN


Bisharin
Halaib
Umm Ali
Wadi Halfa
N U B I A N
D E S E R T
RED SEA
(AL BAHR AL AHMAR)
RED SEA
Port Sudan
Tokar
ERITREA
N I L E
(AN NIL)
KASSALA
KHARTOUM
Khartoum North
Omdurman
Khartoum
Kassala
Keren
EL GEZIRA
Wad Madani
SALA
(AJ JAZIRA)
WHITE
El Gedaref
Sennar
Kosti
NILE
(AN NIL AL ABYAD)
BLUE
NILE
Ed Damazin
Gondor
Atbara
Ad Damer
Shendi
Berber
Dongola
Merowe
Sinkat
Musmar
Derudeb
Ed Debba
Umm Ruwaba
Er Rahad
Singa
Qallabat
Dabat
Gorgora
Lake Tana
Bahar Dar
Dinder National Park
Rahad Game Reserve
Simen National Park
Tokar Game Reserve
Sabalooka Game Reserve
Jebel Oberir
Jebel Marra
Ras Abu Shagara
Muhammad Qol
Ras Shaab
Port Sudan
Suakin
Gebeit
Arous
Sangenab
Salome
Akaba Pass
Tokar
Kassala
Agordat
Barentu
Tessenei
Sabderat
Bisha
Aroma
Gaz Regeb
Eritrea
Tokar Game Reserve
Dinder National Park
Rahad Game Reserve
Simen National Park
Sennar Dam
Roseires Dam
Khashm el Girba Dam
Jebel Auliya Dam
Merowe Dam
Aswan High Dam
Nile
White Nile
Blue Nile
Atbara
Rahad
Dinder
Tekeze
Baraka
Gash
Setit
Tana
Lake Nasser
Lake Tana
Lake Turkana
Lake Victoria
Lake Albert
Lake Rudolf
Lake Chad
Lake Nubia
Lake Kossou
Lake Kainji
Lake Volta
Lake Tanganyika
Lake Malawi
Lake Mobutu Sese Seko
Lake Edward
Lake Kivu