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5. Author(s)
1. Allan Showler
2.
3.

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SUPPLEMENTARY ENVIRONMENTAL ASSESSMENT FOR LOCUST AND GRASSHOPPER CONTROL BY THE DESERT LOCUST CONTROL ORGANIZATION FOR EAST AFRICA (DLCO-EA) IN SOMALIA

In Cooperation with
USAID/Ethiopia
the Desert Locust Control Organization for East Africa (DLCO-EA)
and the Government of Ethiopia

Addis Ababa, Ethiopia

November 1993

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ACRONYMS AND ABBREVIATIONS

AChE	Acetyl cholinesterase
AELGA	African Emergency Locust/Grasshopper Assistance Project - AID/Washington
AFR	Africa Bureau in AID/W
AGRHYMET	Agro-Hydro-Meteorologie, in Niger.
A.I.D.	Agency for International Development
AID/W	Agency for International Development/Washington, D.C.
APHIS	Animal and Plant Health Inspection Service of USDA
CFR	US Code of Federal Regulations
CIDA	Canadian International Development Agency
CPD	Ethiopian Crop Protection Department
DLCO-EA	Desert Locust Control Organization for Eastern Africa
DRCO	Disaster Response and Coordination Office (in AFR)
EA	Environmental Assessment
EEC	European Economic Commission
EPA	US Environmental Protection Agency
EPLF	Eritrean People's Liberation Front
EWCO	Ethiopian Wildlife Conservation Organization
FAO	Food and Agriculture Organization of the UN
FAO/WFP	World Food Program, FAO
GPS	Global Positioning System
GTZ	Deutsche Gesellschaft fur Technische Zusammenarbeit, German Development Agency
ha	hectare
IFAD	International Fund for Agricultural Development
IPM	Integrated pest management
km	kilometer
mg/kg	milligrams per kilogram
MOA	Ministry of Agriculture
MONR/EP	Ministry of Natural Resources and Environmental Protection
NGO	Nongovernmental Organization
ODA	Overseas Development Agency, United Kingdom
OFDA	Office of Foreign Disaster Assistance (USAID)
OP	Organophosphate insecticide
PEA	Programmatic Environmental Assessment
PPM	parts per million (ambient concentration)
SEA	Supplemental Environmental Assessment
SIDA	Swedish International Development Agency
TDY	Temporary Duty
ULV	Ultra Low Volume (pesticide formulation)
USAID	United States Agency for International Development
USAID/Ethiopia	USAID Mission to Ethiopia
USAID/Somalia	USAID Mission to Somalia
USG	United States Government

PREFACE

This document is a supplement to the Programmatic Environmental Assessment (PEA) concerning USAID assistance in Locust control Programs. This Supplementary Environmental Assessment (SEA) was prepared by consultants from USAID/W, with support from the Desert Locust Control Organization for East Africa (DLCO-EA) the Government of Ethiopia. Contact persons are listed in the Appendices.

The SEA herein is unique in that it centers on an organization, DLCO-EA, rather than on a country. The reason for this is that due to the volatile security situation in Somalia, the absence of a crop protection or anti-locust service in Somalia, and the probable fluid nature of the infrastructure and capabilities for locust control in Somalia, conducting an SEA inside Somalia would be both unsafe and generally unnecessary given that DLCO-EA is currently the only organization doing survey and control in Somalia. The fluidity of the political situation in Somalia has also made it necessary to place a time limitation on this SEA which is to be for one year from when this "temporary" SEA is approved by the AFR Bureau's Environmental Officer. If, after one year, DLCO-EA is still the sole locust control force in Somalia, it is possible that this SEA could be extended for a period to be determined by AFR Bureau's Environmental Officer.

This document has been reviewed by DLCO-EA, and USAID/W. It reflects the best current description of future options for the USAID assistance programs to the DLCO-EA for locust management. It contains the best available estimates of environmental impact and possible mitigating strategies. This may include training programs covering improved health and environmental protection, as well as support for early survey and spot treatment programs. Alternatives to chemical pesticides are encouraged in this document. This document also supports prudent and environmentally sound use of pesticides when these materials are necessary. Any commitments for possible future programs are contingent on the future needs for locust control, the capabilities of the DLCO-EA, coordination of efforts as necessary by the Food and Agriculture Organization (FAO) of the United Nations and on a decision by USAID to provide assistance.

1.0 EXECUTIVE SUMMARY

This assessment is a supplement to the Programmatic Environmental Assessment (PEA) for Locust and Grasshopper Control in Africa and Asia (TAMS/CICP, 1989). It was developed to provide explicit, country-specific environmental details and guidance for DLCO-EA operations in Somalia in order to allow USAID assistance in regard to locust management. This SEA is unique in that it is time-limited (one year subject to extension) and focusses on DLCO-EA operations in Somalia since, for the time being, DLCO-EA is the only locust control force operating in Somalia. The material in this document considers the locust species in Somalia and the potential environmental impact of control operations. This environmental assessment is an extension of the PEA and is, as such, an integral part of it. DLCO-EA/Somalia-specific PEA recommendations are included in the Appendices. SEAs were completed for Eritrea in the spring of 1993 (at the time that Eritrea was gaining independence from Ethiopia) and for Ethiopia in June 1993. There is some overlap in coverage between these SEAs and this SEA, and commonalities in locust/grasshopper control. This SEA and the Ethiopia and Eritrea SEAs, along with the PEA, should be consulted during planning and operational stages of implementation.

DLCO-EA headquarters are now located in Addis Ababa, Ethiopia, and there are small sub-bases in other DLCO-EA member countries (e.g., in Khartoum and in Asmara). For the purposes of this SEA, since operations that will be conducted in Somalia will be launched from DLCO-EA bases in Ethiopia (no such bases exist at this time in Somalia), DLCO-EA will be discussed only in terms of operatons that originate in Ethiopia rather than other bases located in other countries. The specific structure and mandates peculiar to DLCO-EA are to be found in Appendix A.

Salient recommendations of this SEA include, but are not limited to those mentioned in this executive summary. One key recommendation is that strategic control be implemented whenever possible. If strategic control is successful, then locust plagues will be prevented and there will be no need to implement major crop protection campaigns against swarming locusts. The USG should (and has been) urging FAO to put in place a preventive control plan for the "Central Locust Region" in particular, that is, the area surrounding the Red Sea and the Horn of Africa, which is generally regarded as the epicenter of most desert locust plagues.

The information contained in this document is intended for use by the DLCO-EA and USAID/Somalia Mission to guide environmentally sound desert locust management in Somalia. Additional relevant information should be added to this SEA as deemed necessary in the form of appendices.

INTEGRATED PEST MANAGEMENT

This document recommends that any U.S.-funded assistance concerning locust management should promote the development of an integrated pest management (IPM) program for pest control. **An IPM program reduces pesticide usage by relying on a variety of locust control methods and using insecticides only when necessary. IPM also promotes monitoring, early warning, preventive measures,and threshold-based decision making when feasible.** Non-chemical methods of locust control can include destroying locust eggs by turning the soil and, in the future, applying micro-organisms (that are pathogenic to locusts, but not humans) to locust breeding areas. In addition, continued research into the identification and use of natural chemicals that are species or insect-group specific should be supported. This SEA recommends that FAO take the lead in coordinating these alternative control measures, since FAO has had considerable experience in Africa and because FAO already has an international coordinating role regarding locust control.

FAO and USAID support survey and immediate treatment operations to prevent locust outbreaks. Prevention reduces crop loss and operational costs. Early intervention requires less pesticide than late emergency operations, and therefore has less impact on the environment.

INVENTORY AND MAPPING PROCEDURES

This SEA recommends that inventory and mapping procedures be developed for determining and tracking environmentally fragile areas, pesticide stocks, manpower and equipment possessed by DLCO-EA. DLCO-EA should also provide updated lists of pesticide, equipment, and manpower inventories to FAO. FAO should then be responsible for establishing a system of dynamic inventory for presentation to USAID/Somalia and other donors. USAID should take an active role, with DLCO-EA and FAO in assisting in identifying alternative use or disposal of pesticide stocks.

ENVIRONMENTAL PROTECTION

Environmental awareness is emphasized in this SEA. The fragile ecosystems represented by rivers, lakes, and national parks merit special attention. Fragile ecological areas, as well as human settlements, need to be protected from chemical pesticides, as the impact can be both dramatic and long lasting. Buffer zones of 2.5 to 5 km surrounding established protected areas should be observed in any U.S.-funded locust control operation. Both chemicals that should and should not be used near these buffer zones are identified in the Appendices. Pesticides used should be those with the minimum impact on non-target species. Information on species of animals found in Somalia are included in the Appendices.

Monitoring for pesticide effects on non-target species and the environment should be included as an integral part of any pesticide use program. The results from this, as well as treatment efficacy, should be used in the planning and operational phases of future locust control programs to adjust or curtail environmentally damaging operations. Unfortunately, such environmental monitoring will not likely be possible during the one year duration of this SEA. However, the fate of pesticides in neighboring countries, each with an SEA in place for USAID-assisted locust control, can be monitored and the results applied to similar DLCO-EA operations in Somalia. When it is possible for the Somali governemnt to monitor pesticide fates in the environment, this course of action will be recommended. It is likely that a more long-term SEA that deals with a more stable situation in Somalia will be developed.

PESTICIDE MANAGEMENT

Proper pesticide management must be a priority in locust control operations. A list of the pesticides that can be provided with U.S. assistance is included in the Appendices. Misused pesticides have a negative effect on the environment, human health, and crop production. When spraying is required, the minimum area should be sprayed, and small spray planes should be favored over medium to large two- or four-engine transport type planes. Pesticide storage, application, and disposal are important components of pesticide use. As recently as March of 1993, DLCO-EA had pesticides at their Addis storage facility stored with fertilizer, old papers, broken electronics equipment, and used jet fuel containers. Many of the pesticides containers were unlabeled though the contents were known by the storeroom manager. Expired pesticides were not separated from useable pesticides. Upon being notified, the situation was quickly rectified by DLCO-EA. USAID/Ethiopia should continue to monitor the storage situation, when possible.

Pesticides should only be stored with other pesticides and should **never** be stored with flammable or potentially explosive materials. Pesticide containers must be disposed of in a manner that will prevent food or water from being stored in them. This SEA encourages the Government of Ethiopia to enforce its regulations dealing with pesticides where DLCO-EA is concerned, and for DLCO-EA to practice pesticide safety and storage with maximum care. Pesticide disposal is problematic at this time due to a paucity of viable options. At the very least, the outdated and banned (in the USA) pesticides should be stored under proper conditions until disposal options become available. These issues must be fully considered and monitored in a USAID-funded activity.

As of June 1, 1993, DLCO-EA in Addis Ababa had 7,600 liters of fenitrothion and 14,600 liters of malathion. The fenitrothion

barrels were dented and leaking and considered to be too unsafe to load onto trucks. To solve this problem it would be necessary to decant the pesticide into newer barrels or containers for shipment to areas of most urgent need, such as Dire Dawa and the Hararghe region. As of June 22, 1993, the DLCO-EA storage facility in Dire Dawa contained no stocks of useable pesticide; however, there were 14 barrels of fenitrothion 100% ULV (2,800 liters) stored at the airport runway for current use. Up to this point 12,000 liters of malathion 95% ULV had been applied from DLCO-EA storeroom in Dire Dawa during 1993, and it was emptied. USAID had authorized the donation of 40,000 liters of additional pesticide, as of June, 1993, and by August, these stocks were delivered to Ethiopia. There are also stocks of obsolete and banned (in the U.S.) pesticides being held by DLCO-EA at two locations in Ethiopia, Dire Dawa and Addis. These are being stored properly and should continue to be stored until methods for their disposal are planned. A list of these obsolete and banned pesticides is included in the Appendices.

PUBLIC HEALTH

In the past, USAID, through the AELGA project has produced an array of education materials dealing with pesticide safety and health issues; USAID should support the reproduction, distribution, and presentation of such public education materials to DLCO-EA for eventual use in Somalia. All health centers should be provided with posters describing diagnosis and treatment of pesticide poisonings, as well as medicines and antidotes required for treatment of poisoning cases. Analysis of blood acetylcholinesterase levels in handlers and applicators of organophosphate (OP) insecticides is recommended, and should be a part of any system using pesticides donated by the U.S.

TRAINING

Training must be part of any USAID pest control assistance program. Attention to public health, pesticide safety, and the environmental effects of pesticide use and misuse should be emphasized to DLCO-EA personnel, and to the general public through education and public awareness campaigns. Farmer training and village brigades can be an important and economical part of management operations. Village brigades, however, require continuous external resources to be sustained (if the only object is to move pesticides) and have been shown in the Sahel to induce serious dependency upon pesticides. Also, use of farmer brigades at this point in time is not safe or feasible given a general lack of training and organization in Somalia. This is at least part of the reason why only DLCO-EA is currently operating in Somalia with regard to locust control. Safe use of insecticides is encouraged and every shipment of pesticides from the U.S. is accompanied by safety equipment. A list of the

safety equipment possessed by the DLCO is included in the Appendices.

RESEARCH

Research on forecasting, monitoring, and alternative control techniques should be pursued by the donr community, possibly in collaboration with FAO or even, if possible, DLCO-EA. Research on biological control are being pursued in other parts of Africa by the AELGA project in coordination with Montana State University and Mycotech Corporation. Several promising fungal species have now been identified as possible controls for locusts and grasshoppers. Research and testing of these species should be undertaken in Ethiopia and Eritrea, in cooperation with DLCO, the Ethiopian Crop Protection Department (CPD), and the University community for eventual application in Somalia. The use of greenness maps and rainfall data should be used in Somalia for DLCO-EA monitoring and forecasting probable locations of locust breeding areas and outbreaks.

Research on locust control alternatives to pesticides has been carried out by the FAO in the past. This type of research should continue, and be transferred to countries in the Horn of Africa and Red Sea area. Such research includes the use of insect growth regulators and other chemicals which may disrupt locust behaviors, such as mating and swarming. More research is needed on the efficacy of various pesticides and pesticide application. The results of research on techniques for assessing environmental impact of insecticides, which has been performed in West African countries, should be transferred to and validated in East Africa. As well, research on the use of plant extracts, such as sesame, should be pursued in Ethiopia, Eritrea, and, when possible, in Somalia.

IMPLEMENTATION

USAID/W should continue to provide guidance in locust control to USAID/Ethiopia, USAID/Eritrea, and USAID/Somalia, which can transfer relevant aspects to DLCO-EA. The AELGA Project has already provided technical assistance, situation reports, and guidance regionally and to USAID/Ethiopia and USAID/Eritrea. Due to the currently unstable security situation in Somalia, USAID has only been able to supply USAID/Somalia with situation reports on appropriate actions to take in dealing with locust outbreaks, and in completing this SEA, and ones like it in surrounding countries. USAID has worked multilaterally in the Horn region through the FAO, and should continue to be involved in regional multidonor efforts to control outbreaks.

In Somalia, limited locust survey has been conducted primarily by FAO consultants, while DLCO-EA is expected to perform aerial survey and control efforts which are currently

limited to relatively short excursions across the border into northern Somalia. Pesticides from DLCO-EA are being used in the control effort. The cooperation between DLCO-EA, the Ethiopian Crop Protection Service, and FAO has been effective at coordinating donor's efforts. The main constraint to DLCO-EA is funding, especially during locust recession periods when donor and DLCO-EA member country interest wanes. One possible solution to the intermittent funding of DLCO-EA would be to explore the possibilities that DLCO-EA be made into an associate International Agricultural Research Center on emergency outbreak pests with strong operational functions.

2.0 PURPOSE AND PROCEDURES

2.1 Background

Due to a plague of locusts in eastern and Sahelian Africa in 1986-1989, the Administrator of the U.S. Agency for International Development (USAID) declared an emergency waiver of the Agency's Environmental Procedures [22 CFR part 216] governing the provision of pesticides. The waiver permitted USAID to procure and use pesticides for locust control without full compliance with the Agency's environmental procedures. The waiver expired in August 1989. Since then, all USAID assistance for procurement and use of pesticides must fully comply with the Agency's environmental procedures while a PEA (see below) was being prepared. The 1989 Programmatic Environmental Assessment (PEA) for Locust and Grasshopper Control in Africa/Asia and the country-specific Supplemental Environmental Assessments (SEAs) provide guidance on environmentally sound locust management procedures. SEAs have been completed and approved for Senegal, Mauritania, Burkina Faso, Mali, Niger, Chad, Cameroon, Sudan, Ethiopia, Eritrea, Morocco, Tunisia, Afghanistan, and Madagascar. In 1991, A.I.D.'s African Emergency Locust and Grasshopper Assistance (AELGA) Project reviewed the PEA and SEAs in a *Review of Environmental Concerns in A.I.D. Programs for Locust and Grasshopper Control*, Publication Series No. 91-7.

Locust and grasshopper control involves preventive intervention as well as emergency response. Ideally, strategic locust management will minimize the need for emergency response. An outbreak of locusts in the Horn of Africa requires rapid, coordinated preventive measures to avoid the development of a plague. Such a plague would likely devastate large parts of the region's agricultural production base, and would threaten the crops of the Sahel, North Africa, and parts of western Asia. The Red Sea coastal areas of Sudan, the Horn of Africa, and Yemen are critical areas where plagues often originate. The AELGA Project has been focussing more attention on these areas.

Unfortunately DLCO-EA has been severely limited in its preventive capacity due to under-funding. An important task is to supply DLCO-EA with funding, equipment, and labor to prevent a massive upsurge of locusts that could develop into a full scale plague. The long range goal of U.S. assistance should be to help effect a sustainable preventive approach to locust management in locust outbreak areas. This SEA will describe both the immediate and long term measures necessary to achieve environmentally sound locust management in Somalia.

Should USAID choose to provide chemical pesticides, the Environmental Procedures in Regulation 16 (22 CFR 216) must be followed. The PEA and this document fulfill the requirements

necessary to allow USAID to provide assistance to DLCO-EA for use in Somalia.

This SEA is unique among SEAs in that it centers on an organization, DLCO-EA, rather than on a country. The reason for this is that due to the volatile security situation in Somalia, the absence of a crop protection service in Somalia, and the probable fluid nature of the infrastructure and capabilities in Somalia, conducting an SEA inside Somalia would be both unsafe and unnecessary given that DLCO-EA is currently the only organization doing locust survey and control in Somalia. The unique political situation in Somalia has also made it necessary to place a time limitation on this SEA - which is to be one year from the time it is approved by the Africa Bureau Environmental Officer. If, after one year, DLCO-EA is still the sole locust control force in Somalia, it is possible that this SEA could be extended for a period of time to be determined by the Africa Bureau Environmental Officer.

2.2 Drafting Procedure

USAID Environmental Procedure 22 CFR 216.3 (a) (4) describes the process to be used in preparing an Environmental Assessment. The rationale and approach for country-specific SEAs are outlined in cables State 258416 (12 Aug. 1989) and State 275775 (28 Aug. 1989).

This SEA was completed in October 1993 by the Technical Advisor to the AELGA Project, Dr. Allan T. Showler from the approved SEA for Ethiopia. The USAID/Ethiopia Mission and AFR/AA/DRCO (AELGA Project) in USAID/W assisted in the preparation of this draft by providing logistical support, except local transportation in Ethiopia, for needed field work, reference documentation, and contacts.

2.3 Previous Assessments

The previous assessment concerning this subject, and the primary supportive document is the Programmatic Environmental Assessment PEA for Locust and Grasshopper Control in Africa/Asia (TAMS/CICP, 1989). This SEA is a supplement to the PEA, and should be considered an integral part of the PEA. This document concerns the country-specific environmental issues not necessarily addressed in the PEA.

The following documents were used in preparing this assessment:

(1) Review of Environmental Concerns in A.I.D. Programs for Locust and Grasshopper Control (U.S. Agency for

International Development, Washington, D.C., September 1991);

(2) Final Report on the Handling of Pesticide in Anglophone West Africa. (Youdeowei, 1989 FAO Conference report, Accra, Ghana);

(3) Final Report on Pesticide Management in Francophone West Africa. (Alomenu, 1989 Report on the FAO Conference at Accra, Ghana);

(4) Supplemental Environmental Assessments for Chad, Cameroon, Burkina Faso, Mali, Mauritania, Niger, Senegal, Sudan, Madagascar, Ethiopia and Eritrea;

(5) The Africa Emergency Locust/Grasshopper Assistance Midterm Evaluation (with specific-country case studies for Chad, Mali, Niger, Mauritania, and Cape Verde) (Appleby, Settle & Showler, 1989).

(6) Pesticide User's Guide: A Handbook for African Extension Workers. (Overholt and Castleton, 1989, USAID/AFR/TR/ANR/AELGA, Washington, DC).

(7) Pest Management Guidelines of the Agency for International Development. (Overholt, Showler, Waite, and Larew, 1991, USAID, Washington, DC).

(8) Locust/Grasshopper Management: Operations Handbook. (USAID, 1989, Washington, DC).

These documents and DLCO-EA data were used in this SEA without citation. Other relevant documents are cited in section 5.0 and the Appendices.

2.4 U.S. Environmental Regulations

It is USAID policy to ensure that any negative environmental consequences of an USAID-financed activity be identified and mitigated to the fullest extent possible prior to a final funding and implementation decision. This document covers specific environmental consequences involved with chemical pesticide use, and necessary safeguards and mitigation for any future control programs. In addition, alternatives to chemical pesticides are recommended when appropriate, and considered to be part of an overall integrated pest management (IPM) program.

According to *Pest Management Guidelines of the Agency for International Development* (1991):

"A.I.D.'s regulations require that the potential environmental consequences of USAID-financed activities are identified and considered by A.I.D. and the host country prior to the final decision to proceed with an activity. The procedures that guide this regulation are set forth in 22 CFR Part 216. Section 117(c) of the Foreign Assistance Act and Section 533(g) of the 1991 Appropriation Act require that A.I.D. review its projects, programs, and activities in accordance with requirements of 22 CFR Part 216. A.I.D.'s policy is to approve for procurement or use only those pesticides that are critically needed and proven safe."

U.S. pesticide contributions are regulated by U.S. pesticide laws and procedures (as described in the PEA). Only those pesticides listed in the PEA (or amendments thereof) as being approved for use against locusts or grasshoppers are acceptable (see the Appendices). In a U.S.-funded operation, pesticides are to be used according to label instructions only. Used pesticide containers and any unwanted pesticide resulting from a U.S.-funded operation must be disposed of properly and safely. No U.S. funds shall be used to purchase, transport, or apply any pesticide that has been banned in the U.S. This includes the chlorinated hydrocarbons such as dieldrin.

2.5 Somali Environmental Procedures

Currently, any environmental procedures that may have once existed in Somalia have been rendered effectively void as a result of the dissolution of the Somali government. DLCO-EA, being a regional organization without laws of its own, must operate according to the laws of the country from which operations are based. DLCO-EA's mandate and operative practices are explained in Appendix A of this SEA. DLCO-EA does limited survey and control work in Somalia from bases located in Ethiopia. Therefore, Ethiopian regulations are discussed below (Section 2.5.1).

2.5.1 Ethiopian Pesticide Regulations

DLCO-EA operations in Ethiopia are bound by Ethiopian law. This applies to operations that originate in Ethiopia (e.g., pesticide procurement, storage, handling) but that actually would take place in Somalia. Though such DLCO-EA operations in Somalia are not explicitely bound by Ethiopian law, DLCO-EA does, in fact, adhere to practices that are permissible under Ethiopian law.

As far back as 1971 Ethiopia had a decree (1971, #56) to provide for plant protection under the Ministry of Agriculture.

In this decree (written primarily for plant quarantine) was a section entitled "Powers of the Minister Relating to Pesticides" which allowed the Minister the power to prohibit, restrict, and regulate the importation into and the manufacture and sale of pesticides in Ethiopia. The problem with the decree is that it was not signed into law for implementation and enforcement. At the time of this assessment there were no existing regulations, nor enforcement mechanisms.

In 1990 another decree (1990, #20) was written specifically to provide for the registration and control of pesticides, but again it was never signed into law. This decree was very detailed and did provide the foundation for a similar decree written and to be signed into law by the council of Ministers in June 1993 (described below).

Implications of the decree are that Ethiopia will have laws very similar to those found in the USA and Great Britain concerning registration, manufacture, and use of pesticides. The laws of these two countries were referenced to produce the decree. The problem will likely come in implementation and enforcement. At present Ethiopia's resources are fully committed to resettle and rehabilitate drought and war victims. Thus, it is unlikely that enforcement of pesticide laws will take high priority in the near future. The AELGA project and other donors, in close cooperation with the MOA, will be challenged with providing appropriate training and oversight for pesticide use until Ethiopian laws and enforcement are implemented.

2.5.2 Ethiopian Environmental Regulations

DLCO-EA activites and operations in Ethiopia are subject to Ethiopian law, including environmental regulations. Spray operations that are conducted in Somalia but that originate from DLCO-EA bases in Ethiopia are also subject to Ethiopian law - at least until the spray craft has crossed into Somalia. Somalia also lacks a government at this time; its laws are unenforcable and therefore any existing laws are in practical terms not germaine to current realities. However, DLCO-EA does operate according to its own specifications which conform to Ethiopian law.

Environmental regulations have recently (1993) been drafted by the Environmental Regulations Department in the newly-formed Ministry of Natural Resources and Environmental Protection (MONR/EP). The draft document is extensive and covers the history of status of environmental management in Ethiopia (volume I) to all aspects of environmental protection, from theoretical foundation to implementation of legislation, and public awareness campaigns (volume II). Integrated Pest Management is not part of volume II, and should be included in any and all environmental program

planning. The documents are still in the draft stage and are considered to be sufficiently sensitive such that no quotes or copies of them could, as of June 1993, leave the Ministry. USAID/Ethiopia should strive to receive copies of these documents once they are released (September 1993).

It was stated by the head of the Environmental Regulations Department that the real value of the Ethiopian Environmental Regulations document will be felt only if the document receives legal status and the regulations are implemented and enforced. Volume II of the document lists a series of "Priority Needs," one of which is the environmentally sound management of hazardous wastes and toxic chemicals. When queried on the above decree on registration and control of pesticides drafted recently by the Ministry of Agriculture, the head of the Environmental Regulations Department was not aware of the document. Apparently there needs to be better collaboration and coordination between ministries, especially those as naturally linked as agriculture and natural resources. USAID should attempt to promote this interaction wherever and whenever possible.

The most urgent needs of the MONR/EP at present are those of capacity and institution building for long term development. MONR/EP would also like to receive copies of satellite imaging maps, both recent and those dating back several years, in order to begin to note the rate and state of environmental deterioration. Technical assistance in their interpretation would also be needed. This type of information is also useful, as "greenness maps", for predicting locust breeding and infestation areas; and there should be cooperation and sharing of information between the Ministries of Agriculture and Natural Resources/Environmental Protection. USAID should ensure that there is no duplication of effort (especially regarding the expense of satellite maps) between programs with the different ministries. It may be possible to obtain maps for Ethiopia from AGRHYMET (Agro-Hydro-Meteorologie) in Niamey, Niger.

The Ethiopian Wildlife Conservation Organization (EWCO) performs some environmental monitoring, and reports on fish kills or death of game animals; this work is often done in collaboration with university specialists. In addition, courses in wildlife conservation are offered to agricultural scientists at Alemeya University (the main agricultural university). Past strong links, through wildlife conservation projects, have been formed between personnel at Montana State University and EWCO. Currently the USAID/Africa Bureau AELGA project funds important research on environmentally sound locust control through Montana State University/Mycotech Corporation. These links should be capitalized on by future USAID/Ethiopia locust control and environmental monitoring efforts. If possible, NGOs with experience in environmental contamination monitoring and mitigation experience can be part of such efforts.

3.0 LOCUST SITUATION IN THE HORN OF AFRICA

3.1 Locust infestation of July 1992 to September 1993

Desert locusts breed opportunistically in the Tigray Administrative Region in northern Ethiopia, in the Ogaden, northern Somalia, and in most of Eritrea. A map depicting the administrative regions of Somalia is given as Map 1 in the Appendices. If the weather is favorable and the locusts are not adequately controlled, they spread further in Ethiopia and Somalia (especially on northerlies in the autumn). The origins of the most recent Eritrean infestations are uncertain. Locust breeding occurred on the central Tihama of Saudi Arabia and Yemen between April and June 1992. These locusts were presumably controlled, but some swarms moved westward across the Red Sea to Eritrea and Sudan. In July 1992 a locust upsurge in the summer breeding season in Red Sea coastal areas of northern Eritrea, the Red Sea coast of Sudan, Saudi Arabia, Yemen, and Egypt was reported. In late July there was widespread heavy rain on the Eritrean coast and on the Tihama of Yemen. There was also localized breeding in the interior of Sudan during the summer rains. Thus, the August 1992 infestation in Eritrea probably had multiple origins. This is typical of locust upsurges in the Red Sea area in winter and spring. These groups were, at the time, considered to be just extra-large populations of solitary phase locusts.

Above average rainfall in September and October of 1992 led to an upsurge of desert locusts in the winter breeding areas along the Red Sea Coast of Yemen, Sudan, and Eritrea. Desert locusts started breeding and two generations were probably produced before the first semi-gregarious populations were observed in early November 1992. In November 1992 adults were found at an average density of 500 per hectare. DLCO-EA initiated spraying activities in the infested areas of Sudan and Eritrea to control the locust populations before they reached the adult stage, when they develop wings and start to swarm. Unfortunately, these efforts were not sufficient and the locusts produced a third generation of semi-gregarious hoppers.

During normal seasons locusts form partially gregarious populations that die without producing fully gregarious hopper bands. However, in seasons with high amounts of rainfall and vegetation growth, outbreaks can occur whereby locusts become fully gregarised, breed successfully, and produce hopper bands and swarms. In February 1993, localized fully gregarious populations produced hopper bands in Eritrea and Sudan. There were over 1000 adult desert locusts per hectare, and more than 5000 hoppers per hectare in some infested areas. All of the locusts in each band were at the same stage of development. Desert locusts infested a total area of approximately 1180 km^2. By late February 158 km^2 were treated: 608 hectares were sprayed

from the ground and 15,200 hectares were sprayed from the air using 8,130 liters of fenitrothion ULV. At the early stages of this outbreak and during February/March, populations continued to be largely semi-gregarious.

The sprayed area included land mined areas from Massawa to Alg Ma'amas. The mines prohibited survey and spraying by ground. Aerial surveys indicated that the conditions and vegetation in the mined areas were suitable for locust breeding. However, air surveys were not sufficient to determine whether or not locusts were present. DLCO-EA assumed that locusts were in the mined areas and blanket sprayed fenitrothion ULV by air. While this decision made sense in terms of locust control, it may not have been the best environmental choice. Given that the spraying was done near the Red Sea coast, the potential for damage to wildlife, especially aquatic organisms, was high. Under these conditions it might have been better to apply acephate or malathion to the mined areas. Acephate and malathion are less toxic than fenitrothion to fish, birds, and aquatic invertebrates. However, fenitrothion is one of the USAID-approved insecticides (the Appendices). Each of these pesticides can be used in a locust control operation that receives assistance from A.I.D., but only after consulting the labels for safety and usage information. More detailed information on each of the insecticides listed in the Appendices can be found in the PEA.

March 1993

As of 1 March 1993, 1022 km^2 was infested by locusts. After assessing the pesticide inventory of DLCO-EA and MOA-Eritrea, USAID determined that 25,000 liters of 96% ULV malathion were needed to prevent a locust outbreak. The AID-supplied malathion, and MOA's own stocks of fenitrothion were used to treat the remaining locust-infested areas.

April 1993

Throughout April, Ethiopian Crop Protection Department (CPD) and DLCO-EA continued to survey Eritrea for locusts, but no spraying was necessary. On 29 April 1993, African migratory locusts were reported by DLCO-EA in Dire Dawa, Ethiopia. Weather conditions in the region were favorable for locust breeding, and the CPD and DLCO-EA accelerated the implementation of preparedness measures for locust outbreaks.

May 1993

On 15 May, DLCO-EA reported that the locust outbreak areas along the Red Sea coasts remained relatively calm during the first half of May, though substantial rains in Djibouti, northern Somalia, and eastern Ethiopia would likely enhance breeding

conditions for migratory and desert locusts. Ground surveys along the coast of Sudan found very few locust adults. Scattered, high density adult and hoppers were noted in Zulu, Foro, and Gela. In a mix of migratory and desert locusts, up to 1000 - 1500 adults/ha were recorded in areas around Badda. In northern Somalia, two unconfirmed swarms and many other smaller swarms were seen flying westward toward the Ethiopian border from areas west of Bulhar and from the northwest of Borama. Light infestations of migratory and desert locusts were observed everywhere in Djibouti. In eastern Ethiopia, swarms and infestations of migratory and desert locusts, probably coming from northern Somalia, were spotted coming from Dagahabur, Awareh, the railway line area between Erer and Aisia near the Djibouti border. A DLCO-EA aircraft was positioned at Dire Dawa and aerial control operations covered 220 ha with 110 liters of malathion ULV. Kenya, Tanzania and Uganda were reported by DLCO to be free of locusts.

By the end of May, the situation in Sudan and Djibouti remained relatively calm, but the situation in eastern Ethiopia was beginning to worsen. Swarms, hopper bands, and dense infestations covered the entire railway line area of eastern Ethiopia, from Awash to Shinelle and east to Borama on the northwest border with Somalia. Control measures were undertaken against sizeable groups only. In all, by the end of May, 5,980 liters of malathion 95% ULV and 400 liters of fenitrothion 95% ULV had been applied by air to locusts (mostly African migratory locusts) covering a total of 24,000 ha, half of which was covered by hopper bands and the other half by swarms.

Eritrea became independent from Ethiopia in April, 1993 and an SEA for Eritrea was completed in the same month. By May, in the Foro area of Eritrea, 700 ha were infested with adults at 1,000/ha; and in the Arafale area, 150 ha were infested with a mix of adult desert and migratory locusts at 1,400 and 1,500/ha, respectively. In addition, an FAO consultant reported sighting 9,000 locusts/ha in Gela and 23,000 locusts/ha in Wangebo on a total estimated area of 150 ha. On a large plain between Massawa and Wachiro, desert locust hoppers and fledglings were estimated at 60,000 - 100,000/ha covering an area of 1,500 ha.

In Ethiopia, the swarms began to move northward toward Wello and Tigray, farmers in Tigray participated in control efforts. Crop loss (sorghum, finger millet, maize) damage in the Wello region was reported on 320 ha. Five aircraft were programmed for the control efforts, one for Mekele, one for Kombolcha, one to be sent to Dubti, and two on standby in Addis for mobilization when needed.

During the latter half of May, weather conditions, including heavy rainfalls, continued to make conditions conducive to further locust breeding throughout the entire infested area. It

was reported that DLCO-EA and Ethiopian MOA together had 47,800 liters of pesticides remaining for locust control at this time.

June 1993

As of June 15, DLCO-EA reported that "spectacular events" had occurred in the Hararghe region of eastern Ethiopia, in that large numbers of migratory locust hoppers were hatching as fast as DLCO-EA could eliminate them. DLCO-EA aerial spray operations in the first half of June had applied 4,660 liters of fenitrothion 96% ULV, covering a total area of 10,615 ha; and 800 liters of malathion 95% ULV, covering 10 X 4 km. Only four hundred ha were treated against mature adults and the remainder was treated for hoppers, mostly in the 3rd instar. In addition, there were reports of worsening infestations in Wello and Tigray (two of the most food insecure regions of Ethiopia), as well as the Afar region of the Awash Basin.

In Eritrea and Djibouti the situation remained relatively calm, but in coastal Sudan and Yemen large desert locust swarms had been sighted. Swarms in Yemen were extensive and measured over ten thousand locusts per hectare, with over 2,312 km^2 infested. Control efforts in Yemen were minimal due to lack of proper organization, sufficiently trained personnel, and control facilities. And the effect of this outbreak was beginning to be felt across the Red Sea in Sudan, where several swarms had been spotted. During this time conditions in the traditional winter and summer breeding areas remained prime for locust breeding due to unusually heavy rainfall and resulting vegetative growth; heavy infestations of the desert locust were predicted.

Most of the migratory locusts present in the south and north Wollo regions of Ethiopia in late June 1993 were second generation hoppers resulting from adult swarms that entered the area from the Afar region in late May and early June. As the locusts move from the lowlands regions of Afar and Haraghe to the highlands, and the long season crops begin to sprout, the percentage of pasture to crop lands affected began to shift. In early June, 91% of the land area affected was pasture, but by late June much of the control efforts in the highlands was on croplands.

July 1993

By early July, swarms of desert locusts and African migratory locusts had entered northeastern Somalia, and by mid July, hopper bands were also observed. Accurate estimates of the infestation in Somalia were unavailable due to a lack of survey by ground and by air. Swarms in eastern Ethiopia were tending to move with westerly winds across the Somali border. During July, most of the Ethiopian crop protection service and DLCO-EA

activities in Ethiopia focussed on destroying swarms that would enter Somalia presumably to breed and multiply there.

August 1993

In August, swarms continued moving into northern Somalia from eastern Ethiopia, and a 10-day survey effort by an FAO consultant revealed the presence of an number of swarms (some as large as 10 km in diameter) and hopper bands. Though the survey indicated a significant locust infestation, the populations were limited to the northeastern ravines - and many areas were devoid of locusts altogether. Control efforts in Somalia had not begun, and as August ended, the locust situation in both Eritrea and Ethiopia had lessened considerable.

September 1993

The locust situation in Eritrea and Ethiopia was very calm, with only small control operations conducted as necessary. Swarms and hopper bands in Somalia persisted, and upcoming northerly winds were expected to begin moving the locusts southward. DLCO-EA aircraft began to do some limited survey in northern Somalia.

Outlook

According to DLCO-EA, control activities will likely continue in part of the northern region, the Ogaden, and the southern region along latitude 5 degrees N. Northerly winds are expected to drive swarms into southern Somalia and Kenya. Limited locust activity is anticipated in October in Eritrea along the Sudan border and Red Sea coastal areas between Karara - Massawa - Danakil depression. In Ethiopia, the eastern lowlands of the Hararghe region between Dagahabur, Aware, Warder, and other parts of Ogaden will probably have locusts.

In late October and November, easterly winds from India and Pakistan are expected to bring swarms back across the Arabian Peninsual to East Africa if sufficient control in western Asia is not effected. Also, by December/January, breeding is typical in the Horn of Africa and Yemen, and southerlies would move swarms northward from southern Somalia and Kenya (if swarms exist there).

3.2 Agricultural Resources

Most of the food crops grown in Somalia are subject to locust infestation, including: millet, sorghum, maize, wheat, barley, pulses, oilseed, fruit trees, and vegetables. The Appendices shows major crop production. Coffee is not usually attacked, though locusts occasionally defoliate bushes. Locusts

do most damage to coffee at the flowering stage or when they settle on bushes in such large numbers that branches break under their weight. Tea and tobacco are also grown in Somalia, but the effects of locust feeding on them are unknown. Fiber crops such as cotton, kenaf, sisal, and dum palm are also grown but reports of locust damage are unknown. In addition, the rangelands used for feeding livestock are vulnerable to the desert locust. Thus, a locust plague can have a major impact on the supply of meat and dairy products as well as grain, fruit, and vegetables. By destroying seeds, locust infestations can affect local crop production for years. Even without locusts, food aid to Somalia is a necessity for survival of large portions of its population.

3.3 Desert Locusts

The following species of locust are found in Somalia: the desert locust (Schistocera gregaria), the African migratory locust (Locusta migritoria migratoriodes), and the tree locusts (Anacridium melanorhodon and A. m. arabafrum).

The desert locust is potentially the most dangerous of the locust pests because of the ability of swarms to fly rapidly across great distances. It has two to five generations per year. The life span of the desert locust depends on when and where it emerges. The winter generation of desert locust in eastern Ethiopia will live about 127 days. In general, the more quickly the locust matures, the shorter its life.

The Eritrean highlands and the northern highlands of Ethiopia (Tigray) slow movement of desert locusts to the breeding areas of the Red Sea coast. This means that desert locust plagues, which seem to originate largely in East Africa, can be prevented if action is taken before or during localized outbreaks in Eritrea and Sudan. Eritrea hosts spring, summer, and winter breeding areas of the desert locust. Spring and summer generations of the desert locust can also breed in Somalia, Kenya, Uganda, and Tanzania. During plagues they migrate northward through the Great Rift of Ethiopia.

Between plagues, swarms and hopper bands are rare and the desert locust inhabits the central, drier part of its distribution area. Populations tend to be scattered and the locusts exhibit solitary behavior. They are not economically important pests while solitary. Such periods of time are called locust recessions.

3.4 Locust Management - Overview

3.4.1 Past Locust Campaigns

The longest recorded desert locust plague began in 1941 and lasted, with one short lull, more than twenty years. This plague began in India. In 1940, the Indian Locust Warning Service reported locusts invading from the west. By the summer of 1941 the plague had spread to Egypt, Sudan, and Eritrea. Due to war, preventive actions could not be taken and the locusts could not be controlled in Eritrea. Within weeks the locusts invaded British Somaliland, Somalia and eastern Ethiopia. The British mounted a crop protection campaign against this plague with the assistance and cooperation of the World War II Allies. The description of the campaign that follows is summarized from The Desert Locust (1972) by Stanley Baron.

An Interdepartmental Committee on Locust Control was established in England, to ensure that every department of the government could be utilized as needed in the control operation. Control operations began in Sudan in 1941. The plague temporarily subsided in 1947. Applications of sodium arsenate and BHC were used for the first time against locusts. There is no record of the health and environmental effects of applying these two highly toxic chemicals. Only Eritrea and Sudan sustained major crop losses.

The locust situation in Eritrea, Sudan, and other Red Sea coastal areas was worsened by the system of cultivation dependent on seasonal rains and floods. This is still the case today (see section 3.7 "Cultural and Biological Management").

In October 1948 renewed locust outbreaks were reported from Saudi Arabia. By 1949 the swarms had spread back to India, Pakistan, and Iran. Campaign plans by FAO could not be implemented due to a lack of funds. The estimated cost of the proposed campaign was $1.5 million. According to Baron, it was the failure to take action in 1948 that led to the next ten years of locust disasters.

The worst of these disasters was the 1958 plague that destroyed 167,000 metric tons of grain in Ethiopia, enough food to feed 1 million people for a year. The U.S. supplied Ethiopia with 20,000 metric tons of grain. Still, it was necessary for the Ethiopian government to make large scale tax remissions to afflicted farmers. As a consequence, Ethiopia's entire economy was set back. In 1963, the locust plague ended. It is not known if the control efforts contributed to the end of the plague, or if weather conditions were sufficient to stop the plague.

In November 1967, heavy rains initiated a new locust breeding season in Eritrea and Sudan. The situation worsened

when locusts from southern Arabia flew into Eritrea. FAO issued a warning on 27 December 1967 that 30 countries were in danger of locust plagues if there was successful breeding in the spring of 1968. A coordinated control effort by DLCO and the Ministries of Agriculture in affected countries brought the plague to an end in 1969 using dieldrin and BHC. Dieldrin, BHC, and all other chlorinated hydrocarbon insecticides are no longer used for locust control, due to their persistence and the environmental hazards posed by these chemicals.

Twenty years passed as the locusts remained in recession, then in 1986, desert locust populations in Ethiopia (including Eritrea) and Sudan developed to plague status. Swarms reached Morocco and Algeria in 1987. By 1988, Tunisia was also invaded. From 1986-89 DLCO coordinated a campaign against locust outbreaks in Eritrea and Ethiopia, using fenitrothion. The war between Eritrea and Ethiopia was responsible for the lack of proactive intervention, and the unrest was a prime factor in allowing the outbreak to get out of control. Controls that occurred after the plague had started were not conducted at a level that would have any effect other than to protect croplands against hopper bands and adult swarms. General climatic conditions overshadowed crop protection tactics as a cause of the decline of the desert locust plague in early 1989.

3.4.2 Crop Loss Assessment

All crops in the region, except coffee and prickly pear cactus, are at risk. Crop loss estimates due to locust infestations are not available for Somalia. but based on the history of grain loss in Ethiopia during locust plagues, 150,000 to 170,000 metric tons of grain could be destroyed by locusts if the current outbreak becomes a plague. While this represents a loss of only 2-3% of the expected grain yield of Ethiopia, it is enough grain to feed one million people for a year.

3.5 Locust Management Operations

3.5.1 The Desert Locust Control Organization for Eastern Africa (DLCO-EA)

DLCO-EA was established by an international convention signed in Addis Ababa, Ethiopia, on 22 August, 1962. DLCO-EA headquarters were originally in Asmara, Eritrea, but were moved to Addis Ababa during the war. DLCO-EA has a branch office in each member nation, as well as an office in Asmara and Dire Dawa. Member nations are Ethiopia, Eritrea, Djibouti, Kenya, Somalia, Sudan, Tanzania, and Uganda.

The objectives of DLCO-EA are:

1) to promote the most effective locust control in the region;

2) to offer services in the coordination and reinforcement of national action against locusts in the region;

3) to assist member governments in the control of other major pests provided that the locust situation so permits and that the member governments requiring such services avail chemicals and ground logistics for such operations. The other major pests are tsetse fly, quelea bird, and armyworm.

At its peak, the DLCO-EA staff was composed of 60 professional and 290 general service staff who served under three specialized departments: Operations, Scientific Research, and Administration and Finance. However, the staff was recently pared back to 150-160 skeleton staff due to financial constraints. Finances are obtained from annual contributions paid by member countries, but in theory, only Ethiopia has paid its fee in full. The lack of steady funding has made DLCO-EA difficult to operate. Salaries are often paid several months late (as of June 1993, 6-7 months late). As a result of financial constraints, DLCO-EA activities have changed from those of strategic control to those of emergency control, just the opposite of what is hoped for in locust control efforts. And the mandate of DLCO-EA has expanded to add armyworms, quelea birds, and tsetse fly to appease governments not normally located in the path of the desert locust, further adding to the strain on finances (but also a necessary strategy to sustain the DLCO-EA during the desert locust recession).

In addition to the contributions of member countries, DLCO-EA receives external assistance from a variety of donors including SIDA, ODA, EEC, GTZ, CIDA, and IFAD. The external assistance is generally given during emergency locust outbreaks. External assistance takes the form of money, equipment, and technical assistance.

DLCO-EA has more than 30 years of experience dealing with locusts; it is a valuable organization and if funded and managed properly, should continue. DLCO-EA has suffered from lack of institutionalization due to member country and donor reluctance to finance them during locust recessions; funding only appears by the time situations have reached the emergency stage and are almost out of hand. Efforts need to be taken to strengthen DLCO-EA or to develop a more sustainable method for rapid response to emergency pest outbreaks at a regional (or larger) level. USAID and other donors and regional coordination groups could explore

the possibilities that DLCO-EA be linked into associate International Agricultural Research Centers with strong operational functions. One possibility for instituting this idea would be to combine the research capacity of the International Center for Insect Physiology and Ecology (ICIPE) with the operational arm provided by DLCO-EA. ICIPE already does research on pests that DLCO-EA controls and a dual function, particularly if donors have a formal voice in the direction of such a joint organization, would likely help to make support more sustainable, especially during locust recession years.

At this time, DLCO-EA has 7 Beaver-Islander aircraft which need to be refitted with turbo engines to use jetfuel. These aircraft are all 15 - 30 years old and do need to be renovated. DLCO-EA hopes to obtain Caravan aircraft which have a longer flight range, use relatively inexpensive fuel, and will be able to carry up to 500 liters of insecticide in wing-mounted spray tanks. DLCO-EA also has a fleet of 119 vehicles for ground control and for logistics. DLCO-EA has also assigned one scientist to carry out evaluation of activities during the emergency operations, to inventory pesticide stocks, assess training needs, and train in use of vehicle-mounted and hand-held sprayers.

In March 1993, USAID and DLCO-EA independently determined that there was an immediate need for 25,000 liters of malathion ULV in Eritrea in order to prevent a locust plague from beginning there. The USAID/AELGA Project and OFDA collaborated to supply the malathion, protective clothing (25 sets), and radios (5) to MOA-Eritrea (see 3.5.2). SIDA sent $70,000 to DLCO-EA in Eritrea for operational costs such as fuel, transportation of insecticides, per diem for field staff, etc. FAO sent $50,000 as emergency support for operational costs of DLCO-EA in Sudan ($15,000) and Ethiopia, which, at that time included Eritrea ($35,000). Helicopters for surveying and spraying were not an immediate priority, since the locusts were still in the lowlands where they are accessible by aircraft. Helicopters were eventually leased by USAID/Ethiopia and SIDA, and these have been deployed in Ethiopia and Somalia (one helicopter crashed on 21 September, 1993, in the Ogaden, killing an Ethiopia MOA staff person and severely injuring the French pilot and mechanic).

Locust control by DLCO-EA in May-June 1993 included African migratory locusts, a species not normally included in its mandate. This was done to assist the Ethiopian Crop Protection Service, since they had little capacity for control of this species by air.

In June 1993 DLCO-EA had 5 spray aircraft available for control efforts in Ethiopia, if needed (these were continuously being moved from one place to another and from one country to another). Other equipment, such as ground transport, protective

clothing, spray, communications, and camping equipment possessed by DLCO-EA is listed in the Appendices. DLCO-EA has cut back the use of village brigades, but assists ground control efforts of the Ethiopian crop protection service. They have also stopped doing acetylcholinesterase testing of pesticide handlers due to financial constraints. No training has occurred in the last 3 years either, again due to lack of funds.

Though locust control in Ethiopia has been a joint effort between DLCO-EA and the Ethiopian crop protection service, locust operations in Somalia are conducted solely by DLCO-EA. One helicopter funded by GTZ is deployed to carry out survey/control in eastern Ethiopia, northern Somalia, the Red Sea area and Djibouti.

The Jijiga DLCO-EA locust control center will receive aircraft deployed at the Dire Dawa control center should there be locust movement from the railway areas in eastern Ethiopia and in northern Somalia. The Jijiga center will be provided with insecticides enough for one month of operations from stocks in Dire Dawa. For the winter breeding season, DLCO-EA plans to set up satellite control bases to facilitate operations in the Ogaden and northern Somalia. These bases will all be in the Ogaden area of Ethiopia - Warder, Awareh, and Kebredare. The DLCO-EA base in Hargeisa, Somalia, was completely destroyed and looted in 1990 and is now abandoned.

The physical dangers of the unstable security situation in Somalia has caused aircraft insurance premiums to increase. So far, SIDA has paid the premiums to the end of December, 1993. The next payment for the last half of the year is due in January, 1994. The cost of the premium from January to June 1994 is about $75,000 - donors are being requested to fund this expense.

DLCO-EA operations and budgets are summarized in the Appendices.

At the time this SEA was being written, the primary goal of DLCO-EA in Ethiopia and Somalia was to destroy swarms that would move south toward southern Somalia and Kenya. Helicopter use in Somalia is problematic due to the unstable security situation and the fact that local militia demand exorbitant payments upon each landing. Also, on September 21, 1993, a USAID-funded helicopter crashed in the Ogaden (the cause is thought to be mechanical failure though small arms fire has not been ruled out); an Ethiopian Ministry of Agriculture official was killed, and the French pilot and mechanic were seriously injured. The helicopter was made available by FAO/ECLO, and USAID has, as a result of DLCO-EA's correct assertion that helicopters (at least twice as expensive as fixed wing aircraft and usually more subject to mechanical problems) are not necessary for the extremely flat Ogaden, made it clear to FAO/ECLO that helicopters are to be used only when terrain is unsuitable for fixed wing aircraft.

3.5.2 Village Brigades

There are currently no village brigades operating in Somalia. DLCO-EA ceased training activities three years ago due to financial constraints.

3.5.3 Crop Protection vs. Strategic Control

The goal of crop protection is to destroy locusts near or in crops during plagues, while strategic control is an attempt to prevent plagues by managing sexually immature desert locusts in major breeding areas. This SEA recommends that strategic control be implemented whenever possible. If strategic control is successful, then locust plagues will be prevented and there will be no need to implement crop protection. The USG should urge FAO to put in place a preventive control plan for the "Central Locust Region," that is, the area surrounding the Red Sea and the Horn of Africa, where desert locust plagues generally start.

Integrated pest management (IPM) tactics will be important components of a strategic control program. An IPM program uses a variety of methods to keep locust populations below levels where crop loss is imminent. Pesticides should only be used when necessary, thereby reducing the environmental impact of locust control operations, costs, and exposure to handlers.

To apply pesticides at the optimal time, it is necessary to survey for locusts early in the season with trained personnel and proper equipment. A successful locust survey program requires survey teams that:

1) know the physical and temporal distribution of locusts;

2) monitor environmental conditions which could lead to increased numbers of locust;

3) conduct vulnerability assessments of the crops threatened by locusts;

4) have access to pest management support resources that can be rapidly mobilized for control, such as: pesticides, safety equipment, and application equipment.

DLCO-EA should ensure that each of their stations is prepared to respond to a locust infestation. Adequate preparation includes: radio communication, vehicles, application equipment, clean protective clothing and safety equipment, and a sufficient amount of the proper pesticides carefully stored and ready for use. Strategic control can only be effective when accurate, up-to-date records of survey and spray operations are maintained. Such records should include:

A. Survey

1) Where the survey was conducted
2) When the survey was conducted
3) How the survey was conducted
4) The density of locusts
5) The relative numbers of different stages
6) Crops affected, types of vegetation
7) Climatic conditions
8) Stage of locusts
9) Magnitude (area & density) of infestation

B. Spray

1) Where the pesticide was applied
2) What kind of pesticide was applied
3) What was the application rate and how much area was covered
4) When was the area treated
5) Crops and vegetation treated
6) Results of follow-up survey to see the effect of spraying: the percent of locusts that were killed by the operation
7) Non-target effects

3.6 Pesticide Management

In March 1993 there were 14,600 liters of malathion and 7,600 liters of fenitrothion at the DLCO-EA headquarters in Addis Ababa. The pesticides in Addis Ababa were available for locust control in any member nation of DLCO-EA. These pesticides were held in a large, well-ventilated, concrete-floored building. The pesticides at the DLCO-EA storage facility in Addis Ababa were stored with fertilizer, old papers, broken electronics equipment, and used jet fuel containers. Many of the pesticide containers were unlabeled, though the contents were known by the storeroom manager. Expired pesticides were not separated from useable pesticides.

The problems with the pesticide storage facility were explained to Dr. Karrar, the director of DLCO-EA, by an AELGA-funded technical assistant on TDY to write the SEA for Eritrea. Within a week the facility was cleaned and organized properly. All flammable materials were removed, all pesticide containers were labeled, and all pesticides were stored in order of their expiration date (with oldest pesticides near the front and most accessible). Expired pesticides were kept separate from usable pesticides and clearly labeled. At the time that this SEA was written (October, 1993) the storage facility was in good order.

Pesticides are distributed to satellite DLCO-EA control bases in quantities sufficient to last for about one month during outbreak periods. This wisely reduces the chance of stockpiles accumulating in the various satellite bases.

One potential problem with the storage facility is that it is not that remote from human habitation. There are people living within relatively close proximity (several hundred meters) to the storage facility and are thus at risk from exposure. There has been talk of moving DLCO-EA headquarters from Addis Ababa back to Asmara, where it once was. If DLCO-EA does, in the future, make plans to move, it should build the pesticide storeroom outside of Asmara proper, in a remote, safe location (this consists of isolated and well-kept, well-ventilated abandoned EPLF barracks several km from the Asmara airport).

The Ethiopian government and DLCO-EA have no resident expert in the area of pesticide disposal and have proposed that outside expertise be sought for consultation and advice. When such expertise is found, the stores of outdated and environmentally persistent pesticides housed by DLCO-EA should also be addressed. A list of these pesticides held by the DLCO-EA is included in the Appendices.

FAO has begun an Obsolete Pesticides Project with an aim to dispose of unwanted pesticide stocks. Destruction of DLCO-EA stocks be linked into this project once it has developed an environmentally and economically acceptable method of pesticide disposal.

3.7 Pesticide Application

Pesticide application must be accomplished with two clear objectives: to effectively control locusts and grasshoppers, and to minimize the potential non-target impacts. Assuming that the pesticide selection process was conducted with the same objecives in mind, possible significant adverse environmental disruption can be held to a relatively low probability. General USAID guidance on pesticide handling and application with an aim to protect the environment and humans (applicators and the general public alike) is available in USAID's *Pest Management Guidelines for the Agency for International Development*, *Locust Management Operations Guidebook*, *Pesticide User's Guide: A Handbook for African Extension Workers*, and the PEA for locust control. DLCO-EA's management, having been in the business of emergency outbreak pest control as well as being under the watchful eyes of donor agencies, FAO, and host country governments, is will aware of pesticide safety measures and proper pesticide application techniques. DLCO-EA itself has conducted training on these topics, being regarded throughout the region as specialists in many pesticide issues. DLCO-EA also routinely has training

within its own ranks to maintain an acceptable level of human and environmental safety.

Particular concerns relating to pesticide application against locust/grasshopper outbreaks invovle psicide drift and accuracy of targeting in remaote areas. Reducing pesticide drift invovles flying on the pesticide at the correct altitude and air temperature taking into account local wind conditions in order to maximize coerage on the target (in this case, bands or settled swarms of locusts). It is improtant to bear in mind local ecology in relation to wind direction to avoid or minimize pesticide drift onto human settlements, livestock animals, soon-to-be harvest crops, aquatic systems (e.g., wadis, oases, rivers, lakes, irrigations systems, and wells) and other fragile habitats. Reduction of drift is particularly important while using ULV formulations which are more apt to drift than other liquid or slurry pesticide formulations. Use of global positioning systems (GPS) in aircraft greatly enhance the pilot's ability to locate swarms in remote territory and to accurately treat them. Since the 1986-1989 locust plague, GPS units have been receiving more use and they have proven to be a major improvement to navigation.

3.8 Cultural and Biological Control Tactics

The major locust habitats in Somalia are in remote and rugged escarpment terrain in the north, and in areas subject to shifting cultivation, mainly within wadi areas (i.e., river beds, superficially dry except during floods). After wild plants are destroyed, millet is usually planted. The millet patches are a suitable habitat for locusts, particularly if the patches are not weeded. Abandoned fields invaded by certain weeds (e.g., Heliotropium pterocarpum, Dipterygium glaucum, and Aerva persica) are excellent locust habitats. The patchy nature of the vegetation cover leads to locust concentration which promotes gregarization. Cultural practices to mitigate local damage inflicted by locusts include: use of irrigation to avoid dependence on seasonal rains and floods for growing crops, and weed control.

IPM utilizes all available control methods to achieve the most economically and environmentally sound management program. A.I.D. supports the implementation of IPM programs whenever possible. IPM is not an alternative to chemical pesticides; instead it is an integration of methods which may reduce the use of pesticides by employing them more judiciously. Some examples of IPM techniques are: determination of rational intervention thresholds and correct timing of sprays based on these pest population dynamics, mechanical control and use of biological control agents. Among the biological control agents with the potential for use in locust management are: the bacteria

Coccobacillus acridiorum; the fungal pathogens Beauveria bassiana and Metarhizium; various microsporidia in the genus Nosema; and some nematodes. Biocontrol will be most useful in strategic control efforts and less useful during crop protection emergencies. These microbial biocontrol agents may prove to be able to keep recession locust populations at acceptable levels so that they do not reach outbreak proportions.

Destruction of locust eggs could involve village brigades. Each village brigade could consist of 100 or more interested and enthusiastic villagers, farmers, or nomads. The participants would receive a few days of intensive training (covering the identification and biology of local pests and beneficial insects, the fundamentals of good survey techniques, the safe handling and use of pesticides, and instructions on locating desert locust egg-laying sites and destroying the eggs). Once the security situation in Somalia becomes stable, DLCO-EA should endeavor to help or encourage the creation of village brigades in Somalia until such time as a Somalian crop protection service becomes viable.

Farmers can use mechanical control to destroy hoppers and adults. This involves waiting until early morning or late afternoon, when the locusts are roosting and likely to be highly concentrated. The control consists of beating the locusts with tree branches and if the locusts are highly concentrated this can be reasonably effective. Occasionally hopper bands are trapped in trenches dug in their path, and at times are burned as well.

3.9 Safety and Human Health

3.9.1 Public Awareness

It is important that the Host Country Governments monitor the effects of pesticides on human health and the environment, and DLCO-EA should be funded to help support these activities. In Somalia, however, such organized studies are not possible given the current dangers of armed conflict. DLCO-EA, however, is aware of the need for this and does attempt to inform local human populations of incipient spray operations. The medical community and pesticide applicators need to have an understanding of the potential hazards of pesticides, of the precautions to prevent mishaps, and of the steps taken to solve problems associated with pesticide mishaps. Before applying pesticides in an inhabited area, pesticide handlers and the general public should be educated on pesticide safety. The Somali public is already generally informed that pesticides are dangerous and that empty pesticide containers should not be used for food or water storage. The Ethiopian Crop Protection Service and DLCO-EA should ensure that empty pesticide containers do not fall into the hands of the general public and should mark the used

containers with the poison (skull and crossbones) symbols. DLCO-EA does crush its empty pesticide containers and it stores them in secured facilities. People should also be warned against eating locusts in areas where insecticides are being sprayed. In Tunisia, public warnings against locust consumption discouraged people from eating locusts in treated areas. A good public information program would include:

1) warnings against eating pesticide-treated locusts;

2) information on specific pesticides and labels;

3) safe methods of pesticide transport and storage;

4) measures in cases of container leakage;

5) conditions for pesticide use;

6) safe use of application equipment;

7) measures to take to prevent and treat pesticide poisoning;

8) information on re-entry and residual intervals for pesticide-treated crops.

This information can be spread through newspapers, posters, radio, television, and public lectures.

3.9.2 General Pesticide Safety Concerns

Pesticide misuse and improper storage present hazards to the health of the general public and to the environment. Pesticides should be stored away from humans and animals. Unwanted or leaking pesticides must be repackaged or disposed of as soon as possible. Ethiopian pesticide regulations should be enforced once they have been passed into law. Both the DLCO-EA and the Ethiopian Crop Protection Service have dealt with the problem of used pesticide containers by either storing them or by puncturing, crushing and burying them. However, some of the containers in the past have fallen into the hands of the general public. This type of incident should be avoided in the future.

3.9.3 Handler & Applicator Safety

USAID encourages and funds pesticide safety training in Africa. Pesticide handlers and applicators working for DLCO-EA are trained in pesticide safety. Every U.S.-funded pesticide donation should be accompanied by safety equipment for the following operators: 1) workers and handlers responsible for transport, storage, loading and mixing, 2) applicators e.g., farmers, technical agricultural agents, crop protection agents,

and public health agents engaged in treatment activities, 3) pilots. The handling of the pesticides from the point that they arrive in the country to the time they are formulated, loaded and used in the field should be overseen by properly trained pesticide handlers. DLCO-EA staff receive training in handling and use of pesticides, but refresher courses are necessary.

Trained DLCO-EA personnel are encouraged to work with farmers and village brigades in "Train-the-Trainer" programs. Generally, such training is conducted by local Crop Protection Services rather than by DLCO-EA. This type of training allows essential information on pesticide safety and application to reach everyone working with pesticides. USAID encourages this type of training though this should really be conducted by local Crop Protection Services.

During June, 1993, visits by an AELGA project consultant to the Dire Dawa and Wollo regions, it was repeatedly noted that safety clothing (e.g., coveralls, rubber boots, rubber gloves, respirators as necessary according to label instructions) is not used, primarily because it is uncomfortable to wear at high temperatures, and also because much of the available equipment is old and unusable. All groups indicated the need for new safety equipment. There is a continued need for safety equipment that is comfortable to wear. USAID grants to FAO for locust control frequently include protective clothing as a priority procurement along with pesticide purchases.

Although farmers do not generally use safety equipment, the exposure to farmers is considered low since their fields are generally only sprayed once or twice a year in an outbreak; repeated exposure does not occur. Pesticides are supplied to farmers immediately prior to application and are not stored by the farmers. In Somalia, at the present time, there appears to be no structured distribution of pesticides to farmers at all, and farmers seem to play little or no role in Locust control efforts. DLCO-EA Chemical storehouse workers generally use safety equipment consistently, thus reducing repeated exposure. Lists of equipment held by the DLCO-EA are included in the Appendices.

3.9.4 Monitoring of Human Exposure

DLCO-EA has the capability to monitor symptoms of pesticide poisoning to those operators listed in section 3.9.3 above. The countries in which DLCO-EA is operating (in the case of DLCO-EA spraying in Somalia, Ethiopia is the base country) must be prepared to respond to and to treat pesticide poisoning cases, though DLCO-EA personnel are trained in basic procedures to deal with remedial cases of intoxification. Symptoms include weakness, loss of muscle control, shallow breathing, nausea, dizziness, vomiting, and abdominal cramps.

A diagnostic symptom for determining the level of exposure to organophosphate (OP) pesticides is acetylcholinesterase (AChE) inhibition. Testing all pesticide handlers for blood AChE inhibition should be a part of all U.S.-funded pesticide operations that use OP pesticides. This is a fairly simple and inexpensive test, and it can be performed by trained health workers in the field. The background AChE level for each person involved with OP insecticides must be determined before OP exposure. Then testing should be performed at intervals throughout the season to ensure that no worker is being overexposed to OPs.

If an operator is found to be overexposed to OP, it is recommended that the OP pesticide antidote atropine be administered immediately. The operator should then remove and wash his/her clothes and bathe with plenty of soap and water to remove pesticide residues. The operator's breathing and pulse should continue to be monitored for several hours following treatment.

3.9.5 Disposal of Drums and Obsolete or Banned Pesticides

Locust pesticide containers are kept under the supervision of DLCO-EA and Ethiopian Crop Protection Service agents and guards. Empty barrels are stored at plant health protection bases in Ethiopia where they can be destroyed or recycled. Destruction generally includes neutralizing (triple rinsing with kerosene), puncturing, crushing and burying the empty barrels in uninhabited places where no high water table, aquifers or water supplies originate. The kerosine rinsate is disposed of in the same manner, away from habitation. Both the DLCO-EA and the Ethiopian Crop Protection Service have dealt with the problem of used pesticide containers by puncturing, crushing and burying them. However, they both have stocks of used barrels that remain to be disposed of.

Options of recycling barrels would involve rinsing and relining them for use in storing more pesticides. Otherwise they can be washed and smelted down to produce other metal products. Such options, however, are not effected due to the expense and lack of local technical capacity of this. Barrels should not be cut up and used for other purposes such as construction materials. And they should **never** be used to store water, food, or animal feed.

Pesticide disposal is problematic at this time due to a paucity of viable options. At the very least, the outdated and banned (in the USA) pesticides should be stored under proper conditions until disposal options become available. Such conditions include a well ventilated, dry, shaded, cement-floored facility, with clear labelling of all pesticides. A list of obsolete and banned pesticides held by the DLCO-EA in Addis Ababa

and Dire Dawa is included in the Appendices. Most of the chemicals being held are known and labelled and stored properly, and were donated during the 1960s, 1970s and 1980s for locust control (there are a few chemicals present for bird and armyworm control). A closer examination of DLCO-EA's records would be needed to determine the donor and source of all of the obsolete and banned pesticides.

The only environmentally acceptable options for pesticide disposal at this time are sending the pesticide back to the manufacturer or to a firm that safely disposes of chemicals through treatment or destruction. These options, however, can be very expensive. Countries with toxic wastes may need to wait until less expensive alternatives are found. In the meantime the chemicals should continue to be stored properly and re-drummed if containers are leaking.

FAO has in recent years initiated a project to eliminate obsolete and unwanted pesticides in developing countries. USAID should seriously consider supporting options to be undertaken within the context of this project if such options are economically reasonable and environmentally acceptable.

4.0 ENVIRONMENT

4.1 CLIMATE

Several weather convergence zones collide over Somalia. The Intertropical Convergence Zone (ITCZ), bringing systems from the Atlantic and influencing the weather and locust situation across the Sahel, moves north from April to August. This movement brings a rain band north with it and into locust breeding areas. This ITCZ reaches Eritrea and northern Ethiopia and affects the weather in these areas.

There are three basic rainfall regimes in Somalia. These are:

1) Dry Western lowlands of the Ogaden Region;

2) Highlands affected both by westerlies from the Atlantic and easterlies from the Indian Ocean with one long wet season;

3) areas in the east only affected by easterlies from the Indian Ocean, with two short wet seasons.

In March and May rains from the Indian Ocean monsoon system come inland from the south-east, and again in October to November from the north-east. The effect of these systems is prolonged in the highlands from June to October. Atlantic Ocean cloud and rain effects reach all the way across Africa to the highlands.

Rainfall produces sufficient soil moisture for locust egg hatch. As of June 1993 rainfall was heavy in all of the locust breeding areas in the Horn of Africa, with forecasts of more rain in all of the winter locust breeding areas. In addition, there has been a north-to-south flow of wind coming from the Arabian peninsula upon which desert locusts ride to colonize coastal areas of the Horn of Africa.

4.2 CRITICAL HABITATS

Ethiopia is fortunate to have a newly completed Compendium of Wildlife Conservation Information. Many of the species would be present in Somalia as well. However, at this time of chaos in Somalia, areas that may once have been protected are no longer protected. DLCO-EA does attempt to avoid treatment of critical or fragile habitats (especially aquatic systems) to the extent possible though there are no Somali laws in effect to enforce such procedure.

4.2.1 Wetland Resources and Aquatic Habitats

This SEA identifies the following wetland resources as critical habitats:

1) Main river catchment basin: There are very few main river catchments in Somalia, and none in Northern Somalia. Uebi Giuba in the far South of Somalia.

2) Lakes and Swamps: Few or none.

3) Wadis: There appear to be about 10 major Wadis in Northern Somalia, including Wadi Durdur, Wadi Siul, Wadi Tugder, and Wadi Kabal.

4.2.2 Other Critical Habitats

Water holes and other areas with relatively high water tables are scattered throughout northern Somalia and application of pesticides in such areas should be closely monitored.

4.2.3 Migratory Bird Flyways

Each year birds from Europe migrate south to parts of Africa for the winter. Three major bird migration flyways cross over the Horns of Africa. Some of the birds stop over on their way further south to other East African countries, while others actually overwinter in the Horn of Africa. While it would be impossible to list all of the species involved and the general route that each takes, suffice it to say, birds do overwinter and large concentrations, and overwintering birds should be avoided while spraying. DLCO-EA involved with the locust control efforts in Somalia should be in touch with the Ethiopian Wildlife Conservation Organization (EWCO) to learn of any major concentrations of overwintering birds, the times that they are likely to be present, and their primary feeding and roosting areas. Locations that are sprayed should also be monitored for bird kills and intoxication.

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APPENDIX A

LIST OF PEOPLE CONTACTED FOR THIS SEA

DLCO-EA
Mr. Teshale, Deputy Director
Mr. Ahmed Ibrahim - Officer
Mr. Ronald Funa - Head of Inventory

Ministry of Agriculture
Ms. Haimanot Abebe - Head of Crop Protection & Regulatory Dept.
Mr. Asefa Admassu - Head of Dire Dawa Crop Protection

USAID/Ethiopia
Mr. Michael T. Harvey - Food and Humanitarian Assistance
Ms. Ashton Douglass - Program Office

USAID/Washington
Dr. Yeneneh Belayneh - Ecotoxicologist, AELGA Project, AFR/AA/DRCO
Dr. Walter Knausenberger - Entomologist, AFR/ARTS/FARA
Dr. Alan Schroeder - Entomologist on Contract with the AELGA Project

FAO
Dr. Ingo Loerbroks, Addis Ababa
Mr. Sissay Gebregiorgis, Addis Ababa

APPENDIX B

ANALYSIS OF PEA RECOMMENDATIONS

Note: Because this SEA was conducted for DLCO-EA operations in Somalia, all of which originate from Ethiopia, the Ethiopian Government and USAID/Ethiopia have greater relevance to DLCO-EA Locust Control operations in Somalia than USAID/Somalia and the Somali Government (which for now is in disarray). Therefore, the following recommendations apply directly to USAID/Ethiopia, the Ethiopian Government (where applicable), and to DLCO-EA.

BASIC PRE-CONDITION OF PROGRAM

1. USAID should continue its involvement in locust control. Operationally, the approach to be adopted should evolve toward Integrated Pest Management (IPM).

This recommendation should be applied in the context of the specific and immediate needs of Somalia. USAID/Ethiopia supports the use of IPM tactics in the management of locusts, as well as other insect pests. USAID/Ethiopia should encourage DLCO-EA to engage in the promotion and practice, to the extent possible, in IPM tactics which would involve:

1) Teaching pesticide safety
2) Supporting research on biological control of locusts
3) Teaching the principles of IPM

INVENTORY AND MAPPING PROCEDURES

2. An inventory and mapping program should be started to determine the extent and boundaries of environmentally fragile areas in Somalia.

In the present circumstances in Somalia, DLCO-EA will be unable to conduct such detailed activities, but USAID should encourage DLCO-EA to use maximum standard precautions in treating environmentally fragile habitats, especially aquatic systems. Areas that may have at one time been protected in Somalia are, due to the current state of armed conflict and absence of effective governance, essentially no longer protected. Nevertheless, DLCO-EA should make a concerted attempt to identify once-protected areas and to use extreme caution during application, or voluntarily decide to treat until the locusts move on to other areas that are less fragile.

3. A system for dynamic inventory of pesticide chemical stocks should be developed.

Poor pesticide management in Ethiopia in the past (by DLCO-EA and the Ethiopan Crop Protection Service) has resulted in an accumulation of degraded pesticides. Pesticides are sometimes transported, applied, and disposed of without proper caution. Improvements in the system for managing pesticide stocks must be

implemented to protect human health and the environment. Proper storage will reduce pesticide degradation. DLCO-EA and the Ethiopian Crop Protection Service should present updated lists of pesticides used and those on hand at each of the biweekly donor's meetings and locust situation reports. Most of the chemicals being held by DLCO-EA are known and labelled and stored properly, and were donated during the 1960s, 1970s and 1980s for locust control (there are a few chemicals present for bird and armyworm control). A closer examination of DLCO-EA's and the Ethiopian Crop Protection Service's records will be needed to determine the donor and source of all of the obsolete and banned pesticides.

4. USAID should take an active role in assisting host countries in identifying alternate use or disposal of pesticide stocks.

A plan for disposal of obsolete pesticide stocks should be drafted by the DLCO-EA with the support of USAID and FAO. Additional activities should include the periodic testing of stored pesticides stocks to insure that the material is usable. The future accumulation of unwanted pesticides should be minimized. The only environmentally acceptable options for pesticide disposal at this time are sending the pesticide back to the manufacturer or to a firm that safely disposes of chemicals through treatment or destruction. These options, however, are very expensive. Countries with toxic wastes may need to wait until less expensive alternatives are found.

At the very least, the outdated and banned (in the USA) pesticides should be stored under proper conditions until disposal options become available. Such conditions include a well ventilated, dry, shaded, cement-floored facility, with clear labelling of all pesticides.

Chemicals that are still usable should be used on a "first in, first out" basis, i.e., the chemicals that have been in storage the longest should be used first, before those most recently stored, given that the chemicals are still viable and safe to use. Pesticides can be stored in a pesticide bank, such as one centralized place in Europe or possibly at a place designated by DLCO-EA in East Africa. This minimizes the amount of inventory and oversight needed to control stocks of pesticides.

The FAO has begun an obsolete pesticide disposal project. Though an environmentally and economically acceptable method of pesticide destruction is yet to be identified, DLCO-EA stocks of obsolete pesticides should be linked into this project when obsolete stocks in the region are being dealt with.

5. FAO should be requested to establish a system for the inventory of manpower, procedures and equipment.

USAID/Ethiopia and USAID/Washington support this recommendation. An inventory of the equipment possessed by DLCO-EA is included in Appendix H. The CPD should be queried for a similar list of locust control equipment currently held by them, along with information on the state of the equipment. Types of equipment inventoried should include: vehicles and exhaust nozzle sprayers, backpack or knapsack sprayers, camping equipment, radios, pumps, safety equipment, batteries, airplane spray equipment, and spare parts.

FAO needs to take the lead on requesting more precise information on equipment and manpower inventories, since they are the donor coordinating agency. They need to be able to provide this information to donors, so that needs can be determined sensibly.

MITIGATION OF NON-TARGET PESTICIDE EFFECTS

6. There should be no pesticide applications in environmentally fragile areas and in human settlements.

Pesticides should only be donated to Ethiopia and to DLCO-EA with the understanding that pesticides cannot be used in certain areas, such as designated wetlands, national parks, national forests, and other fragile areas.

7. Pesticides should be those with the minimum impact on non-target species.

Pesticide recommendations in the PEA and USAID's Pest and Pesticide Management Guidelines should be followed until research indicates that safer pesticides are available. USAID/Ethiopia is encouraged to investigate traditional and cultural locust control methods. This SEA contains a list of approved pesticides in Appendix F.

DLCO-EA, usually uses fenitrothion for locust control. While fenitrothion is one of the pesticides approved for locust control in the PEA and in Appendix F, fenitrothion is not used for grasshopper control in the U.S. because other, safer pesticide options exist. Fenitrothion is highly toxic to birds and aquatic invertebrates, and moderately toxic to fish. Therefore, this SEA recommends that acephate, carbaryl, or malathion be used in preference to fenitrothion for locust control near aquatic habitats, and near large concentrations of birds in Somalia.

8. Pre- and post-treatment monitoring and sampling of sentinel organisms, water, and soils should be carried out as an integral part of each control campaign.

This recommendation should be implemented to the extent that it is possible in Ethiopia as stated in the SEA of Ethiopia. In the case of Somalia, however, the current security situation makes execution of this recommendation impossible. DLCO-EA is unprepared to conduct such extensive studies anyway, as these generally fall under the jurisdiction of the Ethiopian Crop Protection Service and/or the Department of the the Environment. As the Somali Government does not exist at all for now, results of such studies in Ethiopia should for the time being, be extrapolated to Locust operations that DLCO-EA conducts in Somalia. At some later time when a Somali Government emerges, such a sampling program could be initiated. The expense of sampling will make it difficult to implement this recommendation. A program of research monitoring is important both as a basis for design of operational monitoring and as a means of establishing statistically verifiable baseline data. In addition, periodic sampling of target and non-target mortality, population numbers, and behavior should be made at locations where pesticides are used.

APPLICATION OF INSECTICIDES

9. The minimum area should be sprayed.

To minimize the area to be sprayed:

1) Emphasis should be placed on an early and vigorous surveillance program. This allows early treatment applications on the earliest instar possible and reduces the amount of pesticide used.

2) Establish economic thresholds. If possible, though while Somalia is experiencing armed conflict, actual application of the economic threshold concept is quite impractical for the near future.

3) Identify non-treatment areas such national parks and minimum treatment areas such as game preserves and migratory bird concentrations.

4) Training of decision makers should emphasize restraint in pesticide use.

5) Include farmers and village brigades in pesticide training, survey, and application where possible. Though the situation in Somalia in the near future seems to preclude this.

6) Better targeting of aerial operations to allow more precise spraying.

7) A better strategic control program to monitor locust breeding areas, and use appropriate controls to prevent their buildup to a gregarious phase.

10. Helicopters should be used primarily for survey to support ground and air control units.

In the flat lowlands of Somalia, airplanes are best and less expensive for surveying and spraying. But in the rugged highlands it may be necessary to use helicopters.

11. Whenever possible, small planes should be favored over medium to large two- or four-engine transport types (for application of pesticides). In all cases, experienced contractors will be used.

Use of large aircraft would not only be unnecessary in terms of locust control in Somalia, but would also likely be particularly subject to ground fire from armed militias. DLCO-EA has only small aircraft (Beaver-Islanders). There were no medium or large size aircraft in DLCO-EA's repertoire in Ethiopia or elsewhere at the time of this assessment.

12. Any USG-funded locust control actions which provide pesticides and other commodities, or aerial or ground application services, should include technical assistance and environmental assessment expertise as an integral component of the assistance package.

Training should be a part of USAID assistance. FAO should begin to move the focus of their locust monitoring and control efforts to the central region of locust activities, that is the Horn of Africa, which includes Somalia. The AELGA Project will begin to focus increasing attention to this region and training activities will follow. DLCO-EA, however, does not really require training as they are the regional experts. Once the security situation in Somalia stabilizes, DLCO-EA should be encouraged to conduct appropriate training in Somalia.

13. All pesticide containers should be appropriately labeled.

This SEA urges the Ethiopian government and DLCO-EA to give high priority to pesticide legislation and to encourage, and adhere to laws requiring pesticide labels in the most appropriate language which, for DLCO-EA use in Somalia, would most likely be English and Amharic.

DISPOSAL OF PESTICIDES

14. USAID should provide assistance to host governments in disposing of empty pesticide containers and pesticides that are obsolete or no longer useable for the purpose intended.

USAID/W and FAO have developed guidelines on disposal programs for unwanted pesticides and empty containers. Several pilot disposal projects have been implemented by USAID and other donors. USAID should explore disposal options as needed, and should continue to assist with pesticide management to minimize the problem as it transpires with DLCO-EA. Disposing of empty pesticide barrels properly is especially important.

PUBLIC HEALTH AWARENESS

15. USAID should support the design, reproduction, and presentation of public education materials on pesticide safety.

USAID, DLCO-EA, and the Ethiopian Ministry of Agriculture should develop public and applicator education materials on pesticide safety, pesticide poisoning recognition, avoidance, and treatment. In addition, they should take advantage of the large amount of materials produced through the AELGA Project during the past 4 years, while locusts were in recession. These materials could be used in "Train the Trainer" programs, and in village brigade training courses. Many of the materials already prepared for West African countries should be readily transferable to Ethiopia and, when possible, Somalia.

16. Training courses should be designed and developed for health personnel in areas where pesticides are used frequently.

This SEA advocates intergovernmental collaboration in training programs.

17. Each health center should be provided with posters describing diagnosis and treatment of pesticide poisonings, as well as medicines and antidotes required for treatment of poisoning cases.

Posters in Ethiopia should be written in the local language(s). These posters should be made available to DLCO-EA.

18. Presently available tests for monitoring human exposure to pesticides should be implemented in the field.

This SEA supports the need to monitor the health of pesticide applicators and handlers during control operations.

PESTICIDE FORMULATION AND MANAGEMENT

19. Specifications for USAID purchase of locust insecticides should be adapted for all insecticides.

The PEA made this recommendation a high priority to be implemented as soon as resources can be allocated. This SEA supports that recommendation. USAID's pest management guidelines will help in the implementation of this recommendation.

20. Pesticide container specifications should be developed.

The PEA made this recommendation, and this SEA supports it. The agency pest management guidelines will help in the implementation of this recommendation. USAID has had a representative on the EPA's Pesticide Disposal Workgroup, and any changes in EPA's container regulations that are relevant to USAID will be incorporated into USAID policy. Recent attention has focused on the use of smaller, easier-to-handle barrels than the usual 50 gallon drums.

BIOLOGICAL CONTROL

21. Beauveria and other biological control agents such as plant extracts should be field tested under African and Asian conditions in priority countries.

USAID/W is currently supporting research on biological control in Africa. USAID/Ethiopia should promote and support local research on parasites, pathogens, and predators of locusts for eventual use by DLCO-EA.

TRAINING

22. A comprehensive training program should be developed for USAID Mission personnel who have responsibility for control operations.

There are no personnel at USAID/Ethiopia that have responsibility for pest control operations. Such a position should be developed. Once priorities in USAID/Somalia can shift from it's current preoccupation with security relief assistance to Somalia, USAID/Somalia should do the same.

23. Local programs of training should be instituted for pesticide storage, management, environmental monitoring and public health (see Recommendation 16).

This SEA recommends that high priority be given to supporting training of Ethiopian Crop Protection Service personnel involved in anti-locust activities on how to use pesticides safely and appropriately. DLCO-EA Personnel are well-trained in the handling and use of pesticides, and the continuation of this awareness should be continued.

24. When technical assistance teams are provided, they should be given short-term intensive technical training (including language if necessary) and some background in the use and availability of training aids.

The AELGA Project has been very successful during it's life in fielding well-briefed and prepared short-term technical assistance, who were fully aware of the training aids available and their use. In addition, most technical assistance provided has been fluent in local languages, so language training was not needed.

ECONOMICS

25. Field research should be carried out to generate badly needed economic data on a country-by-country by basis.

Agricultural productivity analyses, combined with analyses of the losses sustained from locusts should be pursued by the agricultural economists in the Horn of Africa. Comparisons should be made among several options for control including the cost of not controlling and the costs of preventive and proactive controls versus emergency controls. Such analyses are not in DLCO-EA's mandate, and given the current state of armed conflict and lack of cohesive government in Somalia, this task will have to be postponed.

26. No pesticides should be applied unless the provisional economic threshold of locusts is exceeded.

Research should be conducted in the Horn of Africa to establish economic thresholds for the desert locust and the African migratory locust. Currently, no thresholds have been determined for locust damage. Work has been done on thresholds for other pests, including grasshoppers. The transfer of these findings to locust will take several years, due to all of the variables that will need to be taken into account, including crop type and phenology, and others. Results of such studies, once they are generated in the future, should be made available to DLCO-EA of their eventual use.

27. USAID should provide assistance to host countries in drawing up regulations on registration and management of pesticides and in drafting environmental policy.

USAID/W and USEPA have developed a program to assist LDCs with drafting pesticide regulations and policies.

PESTICIDE USE POLICY

28. A pesticide use inventory covering all treatments in both agricultural and health programs should be developed, on a country-by-country basis.

DLCO-EA and the Ethiopian Ministry of Agriculture should keep an up-to-date, accurate inventory of all of their pesticides. This inventory should be made available to any donor agency upon request.

PESTICIDE HANDBOOK

29. USAID should produce a regularly updated pesticide handbook for use by its staff.

USAID/W has produced two such handbooks, which are regularly up-dated: *Pesticide Handler's Guidebook* and the *Pest Management Guidelines of the Agency for International Development*. This SEA supports the continued up-dating of these handbooks.

SUPPORT AND TRAINING

30. Technical assistance, education and training, and equipment should be provided to crop protection services of host countries with a view to making the services eventually self-sustaining.

This SEA recommends the actual needs of DLCO-EA and the Ethiopian Ministry of Agriculture should be thoroughly assessed by USAID before providing assistance. USAID should support and encourage changes in DLCO-EA that promote the efficient use of donated equipment for use in Somalia.

"Train the Trainer" programs for village brigades are a potentially valuable contribution that A.I.D. can make. But this is an activity that can only be realistically supported in Somalia once a stable government is in place and a usable crop protection service is established. For now, supplying farmers with anti-locust pesticides given the current state of affairs in Somalia is not recommended until such time as a stable government.

STORAGE

31. More pesticide storage facilities should be built. Until that occurs, emergency supplies should be stored in the United States.

Establish a pesticide bank run by the United Nations, the EEC or another international organization to reduce the need for on-site storage and disposal of pesticides. DLCO-EA's Storage facility in Hargeisa, Somalia, was looted and destroyed several years ago. Construction of similar facilities at this point is not recommended until such time as a stable government and a viable Crop Protection Service in Somalia emerges. For the time being, DLCO-EA storage facilities in Eastern Ethiopia serve locust control efforts in Somalia, and these facilities should be constructed and managed in accordance with the recommendations found in AID's Pest and Pesticide Management Guidelines and in the SEA of Ethiopia.

FORECASTING

32. USAID should make the decision whether to continue funding forecasting and remote sensing or to use FAO's early warning program.

This SEA is in favor of continuing and improving forecasting as a FAO activity. USAID should support thorough field research programs for studying the ecology of outbreaks in East Africa and the Arabian Peninsula, so that plagues can be predicted with greater accuracy.

PUBLIC HEALTH MONITORING AND STUDY

33. A series of epidemiological case-control studies, within the countries involved in locust control, should be implemented in areas of heavy human exposure to pesticides.

While this is an appropriate activity for DLCO-EA, the organization lacks the necessary funds and expertise. Unless DLCO-EA is re-vitalized, FAO should support and facilitate this activity.

RESEARCH

34. Applied research should be carried out on the efficacy of various pesticides and insect growth retardants, as well as pesticide application.

The main function of DLCO-EA is currently locust control, not research. An international locust research facility is needed. One option is to co-fund the DLCO-EA with other donors and make it into an associate international research institute (perhaps linked closely with ICIPE which already conducts basic research on Locusts and other emergency outbreaks) with heavy operational functions. Research should focus on the following areas:

1) Improved aerial spraying. Coverage and drift are major problems.

2) Identify pathogens and parasites of locusts for each stage of the locust life cycle and develop systems to deliver and apply these natural enemies. By targeting each stage of the locust life cycle, it is unlikely that sufficient numbers of locusts could reach adulthood for swarms to develop. When a pesticide is sprayed it serves only to kill locusts at that particular place and time. A pathogen would have the advantage of spreading and multiplying to kill future generations of locusts.

3) Determine the conditions which cause solitary grasshoppers to become gregarious and swarm. Determine the physiological response of grasshoppers to those conditions. Finally, investigate ways to interfere with that response (e.g., through applications of synthetic hormones).

4) Develop safer pesticides. This would include "pesticide cocktails" that mix pyrethroids (or other chemicals) with organophosphates to promote rapid knockdown.

5) Find a safe, biodegradable dye or odorous compound (for ULV formulations) to mix with the insecticides, so that it would be obvious to farmers, shepherds, and nomads which plants and locusts are sprayed. A colored pesticide would also aid pesticide applicators evaluate the effectiveness of coverage and existence of contamination. Ideally the dye or odorous compound should be added at the factory that is producing the insecticides so that leaks and contamination would be obvious throughout operations. The dye or odorous

compound must not interfere with the efficacy of the pesticide.

35. Applied research should be carried out on the use of plant extracts as anti-feedants.

Small scale laboratory and field studies should be used to determine which botanical extracts are the most promising anti-feedants and repellents. A common error in research on repellents is to give the insect a choice of treated versus untreated food. If insects are seen to prefer the untreated food the repellent is declared effective. However, under field conditions, where an entire crop is treated, the insects may choose to consume the treated crop instead of starving. This is one of the reasons that neem tree extracts are so effective in laboratory choice tests, but frequently ineffective in field trials (Jahn 1992, N.R.C. 1992).

In 1993 the AELGA Technical Advisor discovered a plant in Eritrea on which the desert locust was not feeding; further questioning led to the discovery that the plant was a variety of sesame. AELGA will follow up on this discovery and extracts from these sesame trees may be tested for feeding repellency and toxicity to locusts. This is an excellent example of pioneering progress on the search for anti-feedant extracts being pursued by USAID and the AELGA Project.

36. Research should be carried out to determine the best techniques for assessing the environmental impact of organophosphates used for locust control.

Some of this research has been undertaken already and more is underway. The USAID Africa Bureau AELGA Project funded research through the Dynamac Corporation in 1987. The study was able to show that most of the chemicals being used break down rapidly in the environment well below those required the US-EPA.

In 1989 FAO began a multi-donor pilot ecotoxicological study of locust control pesticides in Senegal. The first year's results were successful in identifying deleterious effects of some pesticides on birds, aquatic life, beneficial and non-target arthropods, and soil microbial processes; as well they learned the amount of time needed for species and environmental recovery to occur. FAO followed up with a project named LOCUSTOX to screen more insecticides, test other factors such as area treated, develop methodologies relevant to Africa, and train local scientists in their use. Other donors and groups are expanding similar research into Chad, Mali, Mauritania, Morocco, and Niger.

Since other donors are funding ecotoxicological studies across west Africa, it may be prudent for the AELGA Project to focus on funding similar studies in East Africa, primarily Ethiopia, Eritrea, and Sudan making full use of local the MOA/CPDs, Ministries of Natural Resources and Environmental Protection, and University personnel. In better political circumstances, it may be possible that such studies could be conducted in Somalia as well.

ENHANCING AND ACCELERATING IMPLEMENTATION

37. USAID/W should provide guidance in locust control to missions in the field.

The AELGA Project has already provided technical assistance, situation reports, and guidance to field missions on appropriate actions to take in dealing with outbreaks. AELGA rapidly fielded technical assistance to complete this SEA, and the Eritrean and Ethiopian SEAs in 1993. The project intends to focus increasing attention on the Horn of Africa, including Somalia when this becomes practicable.

38. Detailed guidelines should be developed for USAID to promote common approaches to locust control and safe pesticide use among UN agencies and donor nations. Coordination of efforts is becoming increasingly important because of the increasing number and magnitude of multilateral agreements and follow up efforts in subsequent years by various donors.

This SEA recommends that the guidelines should include information on forming and training village brigades.

International cooperation must continue and should be strengthened. Suggestions that each country should only be concerned with their own locust problems are short-sighted. Nations that host breeding areas should not be expected to bear the entire burden of plague prevention. It is in the best interest of all nations effected by plagues to pool their resources in the campaign against locusts as an insurance policy. It is also in the best interest of donor agencies to coordinate their efforts so that assistance is used as effectively as possible.

If there is evidence of poor management or mismanagement of DLCO-EA, donors should not hesitate to withhold funding. The director and staff of DLCO-EA should be held accountable by FAO and other donors for the management and condition of the facilities, including:

1) Locust survey and control
2) Keeping well-organized, accurate, accessible records of all locust survey and control operations

3) Keeping well-organized, accurate, accessible records of inventory of pesticides, pesticide application equipment, and pesticide safety equipment
3) Research
4) Pesticide storage
5) Pesticide disposal
6) Pesticide drum disposal
7) Maintenance and proper use of equipment
8) Following all safety procedures for pesticide handling and application

39. The Future of DLCO-EA.

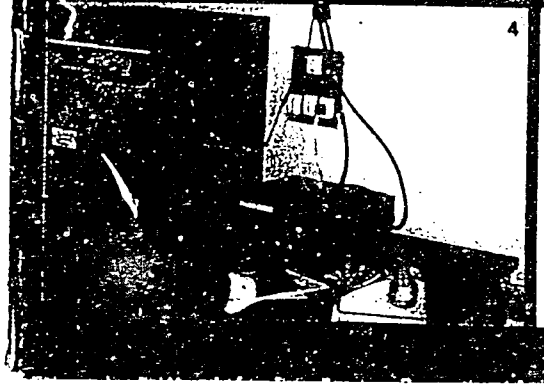
Though DLCO-EA is a very experienced and capable organization for conducting often indispensable aerial surveillance and control operations, it is clear that DLCO-EA's future in regional locust control is being seriously compromised by lack of funding from member countries. The inadequate funding provided to DLCO-EA not only hinder its ability to operate to its full capacity at times, and to, at times, be unable to meet certain recommendations above. USAID should support efforts to expore ways in which regional "migratory" or "outbreak" pest problems can operate in a more sustainable manner.

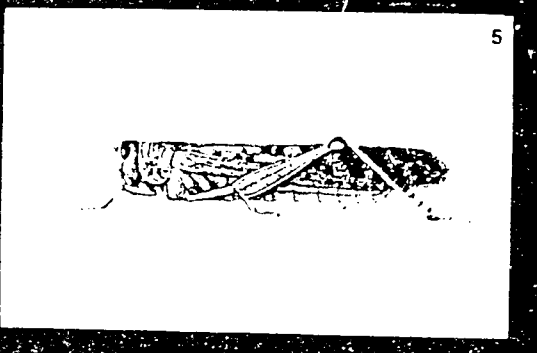
APPENDIX C

DLCO-EA: Organization and Mandate

DESERT LOCUST CONTROL ORGANIZATION FOR EASTERN AFRICA

STRUCTURE AND ACTIVITIES





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2. *Exhaust Nozzle Sprayer*
3. *Laboratory Activities — Culture Cages*
4. *Radio Communication at Headquarters*
5. *Mature Desert Locust*
6. *Nairobi Regional Office/Hangar*
7. *Spray Aircraft fitted with Pods*
8. *Radio Workshop*
9. *Quelea*
10. *Armyworm*

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A. STRUCTURE AND OBJECTIVES

1. Establishment/Convention of the DLCO-EA

The Desert Locust Control Organization for Eastern Africa (DLCO—EA) was established by an international convention signed in Addis Ababa on 22nd August 1962. Member countries are Djibouti, Ethiopia, Kenya, Somalia, Sudan, Tanzania and Uganda.

2. Objectives

According to the convention, the objectives are as follows:-

2.1 to promote the most effective control of the desert locust in the region

2.2 to offer its services in the coordination and reinforcement of national action against the desert locust in the region.

2.3 to assist member governments in the control of other major pests provided that the locust situation so permits and that the member governments requiring such services avail chemicals and ground logistics for such operations. The other major pests are Tsetse fly, *Quelea quelea* and Armyworm.

3. Resources

3.1 Manpower

The staff establishment of the DLCO—EA is composed of about 70 professional and 300 general service staff who serve under three specialised departments i.e. Operations, Scientific Research and Administration and Finance.

3.2 Finance

The DLCO-EA obtains its finances from annual contributions paid by member countries.

From time to time and during emergency locust outbreaks the DLCO—EA has obtained external assistance in the form of money, equipment and technical assistance from various donors such as ODA(UK), FAO, EEC, USAID, GTZ, SIDA, CIDA & IFAD.

3.3 Equipment

The DLCO—EA has a large quantity of equipment including aircraft, vehicles, scientific and radio equipment and camp equipment normally used during field operations.

4. Governing Council

The DLCO—EA is governed by a Council of Ministers who are usually Ministers of Agriculture of the contracting governments with one Council member (delegate from each country.

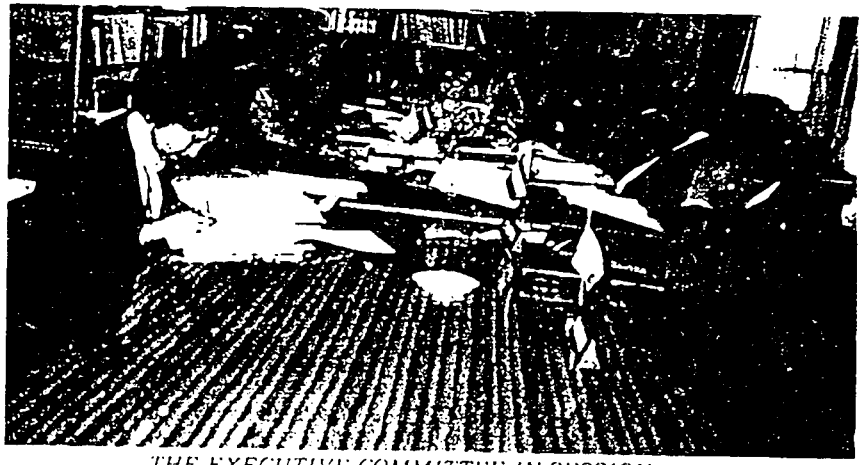
GOVERNING COUNCIL IN SESSION

The Governing Council is the overall policy maker of the organization and usually meets at least once a year to review the annual report of the Director General, audited statements of accounts and approve the programme of work and the budget for the following year.

The Council elects from its members a chairman and two vice chairmen who hold office for one year but may be re-elected. The Chairman may convene special sessions if circumstances require.

The Council is advised in policy matters by an Executive Committee composed of top level personnel from relevant ministries of member countries.

An Executive Committee session normally preceeds the Governing Council to prepare its agenda, consider and recommend to the Council for adoption budget proposals for ensuing financial year as well as the external audit reports for the previous year.



THE EXECUTIVE COMMITTEE IN SESSION

The Executive Committee is assisted by an Establishment Committee on staff matters and a Technical Committee on technical matters, both committees are appointed by the Executive Committee.

Appointments to fill posts of the Director General and the Directors are made by the Council through recruitment process within the region. Appointments to fill all other regional staff positions are made by the Establishment Committee.

DR. D.M. WAKO
PRESENT DIRECTOR GENERAL

5. **Management**

The Director General is the principal executive officer of the organization and is responsible to the Council of Ministers. He also represents the organization in relation to third parties. The organization's structure comprises three Departments i.e. Operations, Scientific Research and Administration and Finance each headed by a Director.

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The Department of Operations is charged with the responsibility for the overall organization and direction of operational activities.

The Department of Scientific Research has responsibility for the overall initiation, planning and direction of all approved applied scientific research relevant to DLCO–EA regional activities.

The Department of Administration and Finance has responsibility for administrative and financial matters of the organization.

The three directors are assisted by professional staff who assume technical responsibilities in their specific divisions and sections and provide the head of Department (Director) with the technical advice for decision making.

Headquarters

Under the provisions of the convention establishing the organization, the headquarters of the DLCO–EA is situated in Addis Ababa, Ethiopia. All policy guidelines and directives emanate from the headquarters. The headquarters is linked to other base, by an efficient radio network covering all the operational areas of the DLCO–EA. The radio is used mainly for collecting reports on pest situation and control activities which are eventually taken to the operations room from where the information is disseminated to the member countries and other interested parties. It is also used for communicating urgent administrative matters between the headquarters and the stations and from station to station. The headquarters is also the centre of the organization's research activities.

Operational Bases

There are nine control reserve bases in the region i.e. Djibouti (Djibouti), Asmara and Dire Dawa (Ethiopia), Nairobi (Kenya), Hargeisa and Mogadiscio (Somalia), Khartoum (Sudan), Arusha (Tanzania) and Kampala (Uganda).

7.1 Nairobi Regional Office

Over the years Nairobi office has been the focal point for the organization's activities being the centre for the deployment of aircraft and crew to all aerial operations throughout the region.

The organization's role of locust control has been expanded to include the control of other major pests namely the african armyworm, quelea birds and tsetse fly.

This change has increased the operational and administrative responsibilities of the Nairobi office due to the fact that most of the control activities of the quelea and armyworm are carried out in the East African countries i.e Kenya, Tanzania and Uganda.

The new hangar and offices complex, built with funds donated by the fifth European Development Fund (EDF) of the EEC, has the following facilities:-

7.1.1 Hangar which can accommodate [illegible] aircraft with maintenance facilities consisting of airframe, engines and radio workshop including aircraft stores.

7.1.2 Offices

There are 35 offices including operations room, library, radio communications office, Remote Sensing room and a conference room.

7.1.3 Laboratories

7.1.3.1. Insectary.
7.1.3.2. Insect ecology laboratory.
7.1.3.3 Insecticide laboratory.

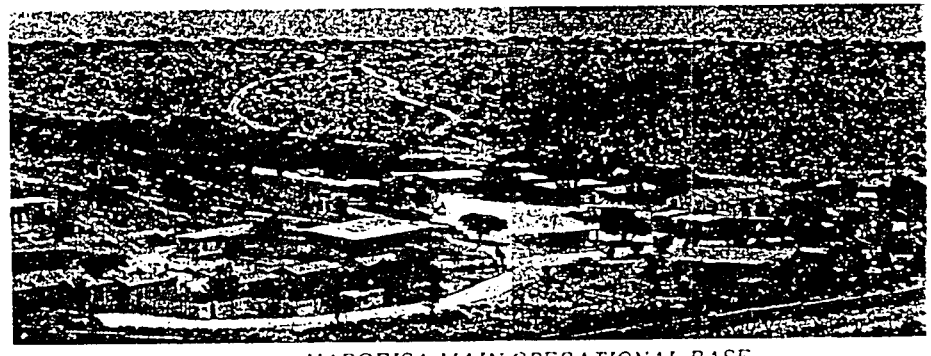
7.1.4 Motor Transport workshop complete with machine shop and fuel filling point.

7.1.5 General stores for field equipment, vehicle spare parts ground spraying equipment and miscellaneous stores.

7.1.6 Canteen with modern catering and cooking facilities enough to serve about 50 people.

7.2 Main Operational Base (MOB)

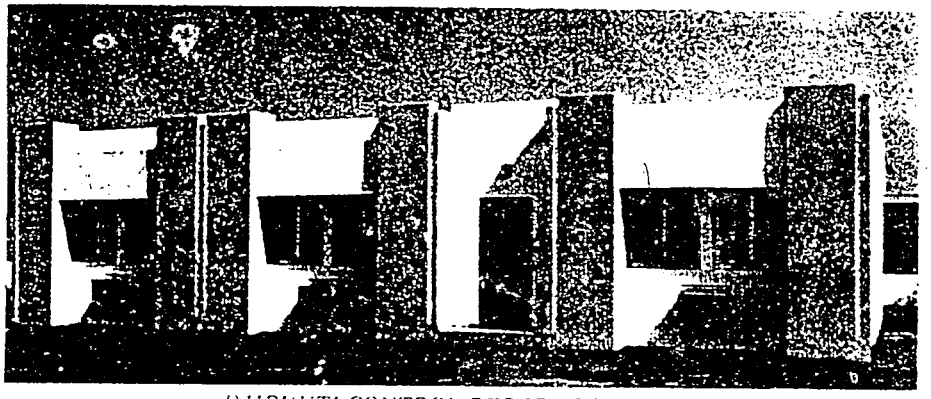
The MOB was established in Hargeisa, Somalia by Council Resolution of the special session held in Entebbe in September, 1963. The DLCO–EA was formed purely for the control of the Desert Locust *(Schistocerca gregaria F.)* and since its main breeding areas are located in Djibouti, Ethiopia, Somalia and Sudan it was decided to establish the MOB in Hargeisa to facilitate control activities in the four countries which are referred to as "front line states" in our fight against the pest. The East African States will only be threatened if the operational activities fail to put the situation under control in the "front line states". Therefore, Hargeisa MOB maintains its importance and remains the centre of locust survey and control operations.



HARGEISA MAIN OPERATIONAL BASE

7.3 Other Control Reserve Bases

In addition to the two main bases at Nairobi and Hargeisa the other bases located within each member country are for coordination and implementation of DLCO–EA projects and operational activities and are run by managers.



DJIBOUTI CONTROL RESERVE BASE

B. ACTIVITIES OF THE ORGANIZATION

1. Operational Activities

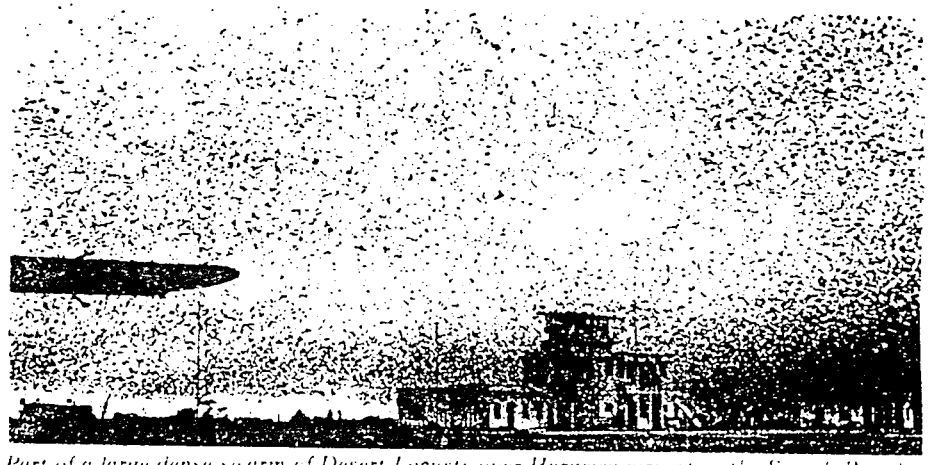
The Department of Operations has responsibility for advising the Director General on all the field operations of the organization. The operational activities of the DLCO–EA are the main function of the organization. Field operations consist of aerial and ground survey and control of the desert locust, and aerial control of *Quelea quelea*, Armyworm and Tsetse fly within the region.

1.1 Pest Control

1.1.1 The Desert Locust *(Schistocerca gregaria F.)*

As the name (DLCO–EA) implies and as reflected in the objectives the operational activities are primarily directed towards the survey and control of the Desert Locust in the DLCO–EA region. The Desert Locust is a well known devastater of everything green and is described in some texts as the "Hungry Thief". It has the ability to migrate across countries in swarms comprising several millions to billions of individual locusts per swarm. Each individual locust in the swarm can eat its own weight everyday which is approximately two grams. A study made on a medium sized swarm a few years ago estimated the swarm to eat 80,000 tons of food per day. This amount of food was enough to support a human population of 100,000 for a period of one year.

The threat of the Desert Locust to food security dictated the creation of this organisation and since its inception in 1962, up to date, the organization maintains a continuous survey and control programme for the Desert Locust using air and ground facilities which are being progressively improved by developing new techniques through time. The Desert Locust swarms that used to inflict serious damages to the agricultural crops every year a quarter of a century ago, have now been markedly suppressed and only two outbreak seasons were recorded during the last two decades.



Part of a large dense swarm of Desert Locusts over Hargeisa airport in the Somali Republic. Aircraft could not land or take off.

1.1.2 The Grain Eating Birds *(Quelea quelea)*

The production of food grains, in many African countries, is handicapped by the grain eating birds (weaver birds). In Eastern Africa, the species of most economic importance are the red billed and the red-headed *Quelea quelea*. They attack cereal crops almost at any stage of development and the extent of their damage is considerable.

Quelea have a gregarious nature, moving in hundreds of thousands of flocks and inflict heavy damage to crops like millet, sorghum, rice and wheat. It has been estimated that each bird is capable of eating 2 to 4 grams of grain daily and wastes about 10 times this amount.

In non-cultivated grasslands these birds feed on seeds of wild grasses and thus reduce nature and potential of certain pasture

QUELEA BREEDING COLONY

After successful suppression of the Desert Locust during the first decade of its inception, the organization was called upon to assist member states in the control of Quelea which has become increasingly a menace to grain crops.

Quelea cannot be sprayed during the day while feeding. Furthermore, because of their habits of night roosting and away from their feeding grounds, their aerial control is a complicated and dangerous task since it has to be carried out at dusk.

Since 1976 to date the DLCO-EA aircraft have utilized about 16,000 hours in survey and spray operations against quelea. The control operations carried out so far have been reported as satisfactory but still there is room for further improvement.

1.1.3 The Tsetse Fly *(Glossina spp)*

The tsetse fly is a vector of animal and human trypanosomiasis. The disease in livestock reduces the meat and dairy products, while in people it causes sufferings and death. The DLCO-EA Governing Council has at its 25th regular session (April 1980) underlined the need for the organization to step up control operations in emergency sleeping sickness epidemic areas. Since then, the organization has undertaken spray control activities against tsetse flies in Kenya and Uganda.

The tsetse problem in Eastern Africa is quite complex and requires much more effort and resources than the present undertaking. The DLCO-EA at the request of its member countries provided a Forum for discussion on this problem by experts from member countries, International Organizations, Institutions and donor Agencies.
The recommendations of the Forum are in the process of being implemented.

1.1.4 The African Armyworm *(Spodoptera exempta)*

The African Armyworm is an acknowledged ravager of pasture and a variety of cultivated crops in areas which can ill afford to lose. Although precise assessments of damage have yet to be made, in years of high infestation, most farmers are under threat of serious attack to their often hard won harvest. Periodically their damage rivals those of locusts in their severity.

The current involvement of DLCO-EA is the provision of a spray aircraft during the outbreak seasons. The Armyworm project which started in 1977 is aiming at strategic control based on a forecast which is now about to materialize. Probably by then the DLCO-EA will apply the improved technique and strategic control operations similar to that of the Desert Locust (see also under Research).

1.1.5 Banana Leaf Spot Disease *(Cercospora musae)*

By special consent of the Council, the organization undertakes aerial control of Banana leaf spot disease in Somalia on repayment of overhead costs. Banana is one of the main cash crops in Somalia and is seriously threatened by the leaf spot disease. Normally two control operations are undertaken annually.

1.2 The Air Unit

This comprises two divisions, i.e. Pilot division and Aircraft Engineering.

1.2.1 Pilot Division

Presently the office has seven operational pilots. The Chief Pilot who is heading this division and the other pilots are spray pilots with extensive experience and high professional standards.

The spray technique developed for Desert Locust is generally used to control the other pests using ultra-low-volume formulations.

The division actively participates in the research on spray gear development, testing new pesticides formulations in cooperation with the concerned division/section under the direction of the Department of Scientific Research.

1.2.2 Aircraft Engineering Division

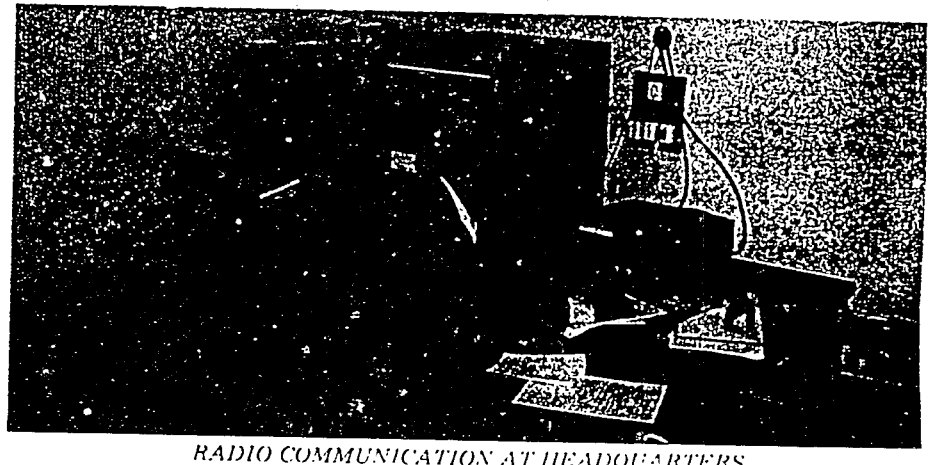
The Engineering Division is charged with the responsibility of maintaining the fleet of aircraft airworthy, ready for field operations. In this respect the DLCO-EA maintains a fleet of 7 DHC2 Beavers, 4 BN2A Islanders and one Beech Baron 58. The Beavers form the main control aircraft for the organization having been in use within DLCO—EA and its predecessor organization, the Desert Locust Survey, since 1956. They have been modified over the years by DLCO—EA engineers to the present standard whereby they can safely fly through a swarm of locusts or quelea without any damage to the engines or the airframe. All the Beavers are fitted for spraying.

The islanders enjoy a dual purpose of control and survey as well as transport. Two of the Islanders are fitted for spraying mainly tsetse and armyworm, while the remaining two are used for transport and communications.

The Beech Baron 58, being a very fast aeroplane, is used for communications and transport to back up field operations away from the Nairobi aviation centre.

BEST AVAILABLE COPY

The DLCO—EA maintains a high frequency (HF) communication system between its HQ, Nairobi Regional Office, Hargeisa MOB, and all the remaining seven control reserve bases scattered throughout the DLCO--EA region. In addition, mobile ground stations and the aircraft are also equipped with radio sets. This facilitates an easy transmission of information to all personnel concerned on operations thereby enhancing the efficiency of operations as well as prompt action against pest outbreaks. All the radio sets including those in aircraft are centrally maintained by DLCO--EA radio engineers within the Air Unit.



RADIO COMMUNICATION AT HEADQUARTERS

1.3 Equipment and services

In order to accomplish these field operations, the DLCO—EA:-

1.3.1 Maintains an Air Unit in Nairobi Regional office to operate aircraft for aerial survey and control.

1.3.2. Maintains a comprehensive fleet of field vehicles for ground survey and control, as well as to back-up aerial operations.

1.3.3 Maintains at strategic areas sufficient amounts of pesticides to be used for the control of locust and the other pests.

1.3.4 Maintains a radio network system between all its control reserve bases and field teams so that reports on outbreaks and other related information, on-going control missions, can quickly be transmitted to office of the Director of Operations.

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1.4 Other Activities

The organization also exchanges reports with the FAO and other Locust Organizations and Institutions on locust situation. Assists in locust control operations in the Arabian Peninsula since the situation there may affect the DLCO-EA region if not properly contained. The application of remote sensing technique and the forecasting of armyworm and quelea is still at research stage but is expected to be fully operational in the near future.

For the purpose of the above mentioned operational activities, the organization allocates fifteen hundred flying hours and 1533 Man-days annually earmarked to the various operations as follows:-

I. Distribution of Flying Hours.

DESERT LOCUST	QUELEA	TSETSE FLY	LEAF SPOT	ARMY WORM	TEST FLYING	REMOTE SENSING	MISC	TOTAL
400	400	400	100	50	50	50	50	1500

II Distribution of Man-days

DESERT LOCUST	QUELEA	TSETSE FLY	LEAF SPOT	ARMY WORM	TEST FLYING	REMOTE SENSING	MISC.	TOTAL
414	414	414	107	46	46	46	46	1533

However this distribution of the flying hours and Man-days varies according to the prevailing situation during the season. Under all circumstances top priority is given for the control of desert locusts.

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2 Research Activities

The Department of Scientific Research has responsibility for advising the Director General on scientific matters. It is made up of the following units: Insecticide Research, Spray Technology, Quelea Research, Remote Sensing and the Armyworm project.

The Armyworm project is a joint undertaking involving the Tropical Development Research Institute (UK), European Economic Community, and the Desert Locust Control Organization for Eastern Africa.

2.1 Insecticide Research Unit

2.1.2 Maintains an insecticides research laboratory at the headquarters where formulation and residue studies in the soil, vegetation and water in sprayed areas as well as the blood of the spray operators and of domestic animals are carried out regularly in the region to determine pollution levels.

2.1.2 Tests new compounds against the desert locust and other pests to determine their potential as possible replacements for safer and cheaper insecticides.

2.1.3 Maintains a thriving culture of locusts for experimental purposes.

The laboratory at the HQ is equipped with among other things, gas chromatographs (GLC), liquid scintillation counters, spectrophotometers and spray towers

DOSING LOCUSTS WITH NEW INSECTICIDES TO DETERMINE LD_{50}

2.2 Spray Technology Unit

The unit in its research and development programme include the following activities:

2.2.1 Development of pesticide application equipment and techniques for use on aircraft and ground based devices.

2.2.2 Development of simple instruments for monitoring spray application parameters such as meteorology, spray droplet dispersal and aircraft flight conditions.

2.2.3 Calibration of aircraft and ground-based equipment for pesticide application as well as planning and evaluation of spray missions.

2.2.4 Monitoring of secondary hazards associated with spraying to ensure that pesticide application is not only efficient and effective but environmentally safe.

2.3 **Quelea Research Coordinating Unit**

The Quelea research unit has been established within DLCO—EA to take over and maintain activities formerly performed by the terminated FAO/UNDP Regional Quelea Project RAF/81/023. These activities are:-

2.3.1 Coordination and support of research on damage and control. The unit follows up research recommendations with member countries and carries out additional operational research whenever necessary to solve any arising problem.

2.3.2 Monitoring of quelea control activities in the region and provision of technical advice whenever required so that the organization can plan and deploy its resources meaningfully.

2.3.3 Organization of training workshops and seminars and publication of a monthly newsletter on the quelea situation in the region. The activities act as a forum for exchange of views and information on new research findings.

2.4 **Remote Sensing Unit**

This unit is under Research and Development. Its establishment will be effected through FAO technical assistance. Two officers have already been trained for running the Unit.

2.5 Operational Research

In conjunction with the Department of Operations, the Scientific Department also carries out the following operational research activities:

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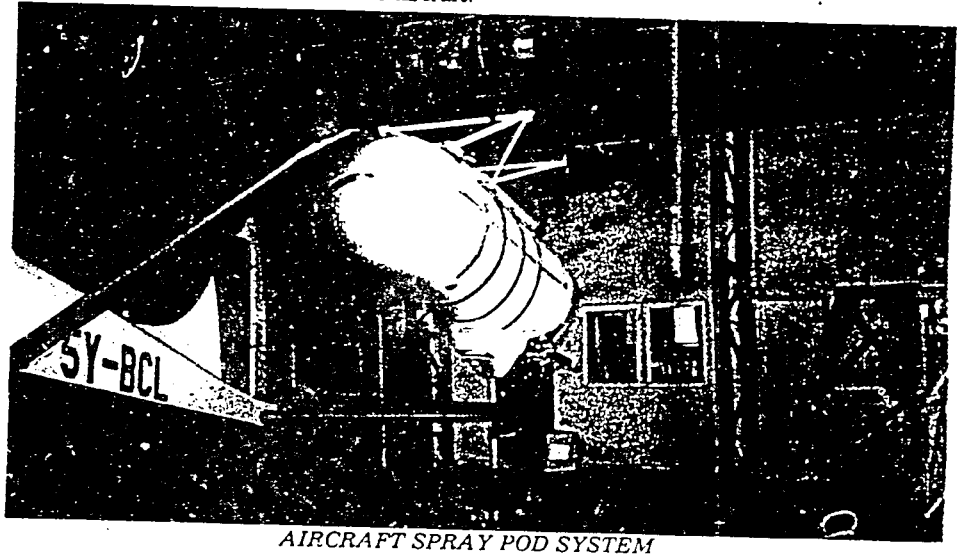
2.5.1 Development of Aircraft Spray Gear

The spray systems used by the DLCO-EA aircraft have been developed by its scientists and engineers to suit the control requirements against the various pests. This is so because DLCO-EA aerial spraying is peculiar requiring special equipment different from those used in conventional crop spraying. Research and development is therefore a continuous process within the organization and does not only confine itself to the spray system but also the aircraft as a whole to eliminate damage by impinging birds and locusts.

Among the latest achievement in the aircraft spray gear development is the spray pod system which now removes the spray tank from inside the aircraft and therefore limits the danger of chemical fumes inside the aircraft.



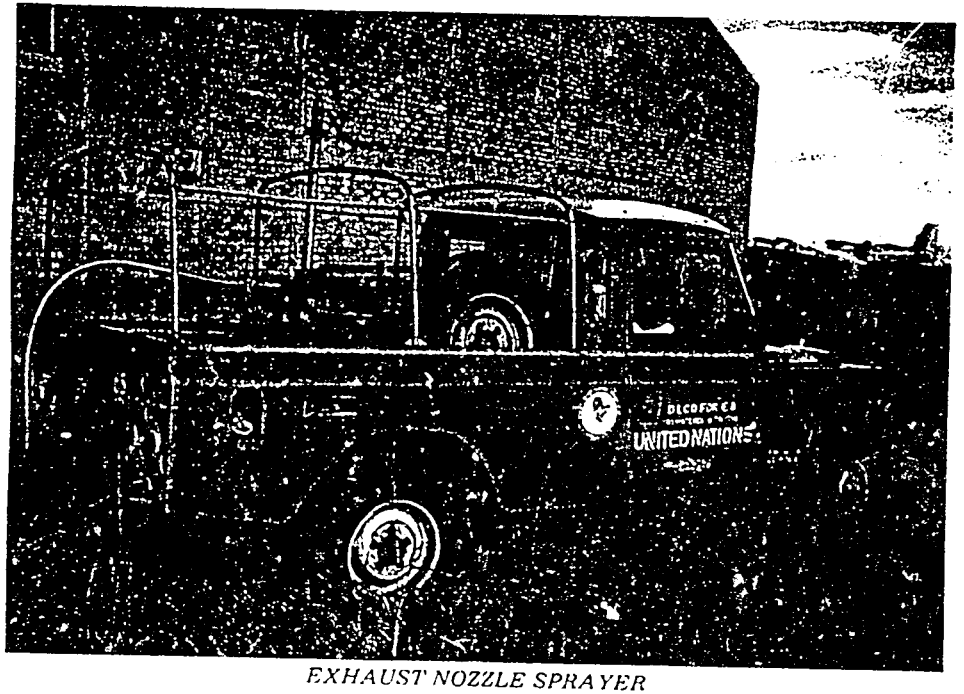
AIRCRAFT SPRAY POD SYSTEM

This is the spray system developed by ideas from DLCO—EA and built by the Micronair Aerial Limited. This pod is a self-contained unit which can be suspended from a hard point under the wing of any available aircraft and consists of 50 Imp. gall fibre glass tank carrying underneath one Stuart Tunner Electric Pump, a line filter, flow meter turbine and a controlled flow bypass system. Behind the pod is one AU 3000 or 4000 rotary atomiser which incorporates an electric brake and a VRU to vary the flow rate. A *shut off valve* is also incorporated in the line to eliminate drip.

There is no flow control valve and the spray is controlled by switching the pump on and off. The entire system is controlled electrically by only one switch and flow rates, atomiser RPMs and total chemical discharged are displayed electronically to the pilot on a control panel. The system is extremely variable and accurate being capable of giving ULV flow rates from 0.4 to 40 litres per minute as well as droplet sizes of 30 to 500 um. Five pod systems are already in use within DLCO-EA, 4 on Beavers and one on the Islanders. The same system is now being used worldwide for various pesticide applications.

2.5.2 Development of the Exhaust Nozzle Sprayer (ENS)

DLCO—EA scientists and engineers have also developed a spray system capable of handling small outbreaks which are uneconomical for aerial spraying, but can be controlled by ground vehicles. The Exhaust Nozzle Sprayer is such a system and the exhaust gasses of a vehicle are used to atomise the chemical, while the vehicle can be driven through the target for efficient control.



EXHAUST NOZZLE SPRAYER

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2.6 The DLCO—EA Armyworm Control Programme (Incorporating TDRI/EEC/DLCO—EA Project)

Armyworm caterpillars often occur suddenly in very large numbers over wide areas feeding on maize, wheat, other local crops and pastures; and if they are not controlled serious losses may occur particularly if poor rains prevent replanting of crops. Outbreaks of armyworm in one country give rise to the huge numbers of moths which may invade another country to cause further infestations. Because of this, all member countries of the Desert Locust Control Organization have agreed that a regional approach should be taken to improve control. Firstly, a regional armyworm forecast service has been developed, and this is co-ordinated by the DLCO-EA armyworm forecast officer. Djibouti, Ethiopia, Kenya, Somalia, Tanzania and Uganda have a wide network of pheromone and light traps to capture and record flying moths daily. These data, together with meteorological data and information about early caterpillar outbreaks, are used to prepare a weekly forecast of probable time and place of future outbreaks. This is sent by DLCO-EA radio network to all member countries.

Secondly, research is carried out to improve understanding of the causes of the outbreaks, and to improve their control. Reasons for the upsurges of plague of armyworm are beginning to be understood; and the ways in which moths are carried on dominant winds to places where the moths are concentrated to lay eggs has been closely investigated. This has been done by using radar and infra-red methods to follow moth flight at night, meteorological techniques to understand wind patterns, and marking and capturing moths. Population upsurges are favoured by rain at times of moth flight and by hot dry weather whilst caterpillars are feeding. Moths are concentrated by wind patterns and rainfall and early in the season this leads to the first outbreaks.

Evidence suggests that if the first, usually small, outbreaks of the season could be successfully eradicated, spread of later more serious outbreaks will be significantly reduced.

Cooperation between the DLCO-EA armyworm control officer, DLCO-EA scientists and the National Crop Protection staff of the member countries in developing and effecting control measures, which includes aerial spraying by DLCO-EA of large outbreaks, is making a significant contribution to reducing crop losses throughout the region.

3. Administrative Activities

The Department of Administration and Finance has responsibility for advising the Director General on administrative and financial policy. It also maintains close relationship with the Directors of Operations and Scientific Research, and the managers of all the Control Reserve Bases within the region. The activities of the department of Administration and Finance include:-

3.1 Laying down administrative and financial procedures for the Desert Locust Control Organization and proper implementation of procedures as laid down in the DLCO-EA Service Regulations, Accounting and Strores Hand-Books.

3.2 General Administration, including Financial and Personnel Management.

3.3 Procurement and property management including insurance of all DLCO-EA property.

3.4 Organizing and servicing of DLCO—EA meetings.

3.5 Public relations and protocol matters.

To carry out its activities, the Department of Administration and Finance has two divisions, one responsible for Administration and the other for Finance.

C. GENERAL

1. Training

Over the last two decades, the organization has accumulated considerable experience in the control of desert locusts, armyworms, quelea birds and tsetse flies.

This experience has been passed to the technical staff of the member countries and visiting FAO and GTZ Fellows from all over the world through training programmes under the East African conditions. The specific courses have included survey and control methods, both air and ground, on the desert locust and the armyworm; locust and armyworm breeding; laboratory tests of new insecticides against the locust and the armyworm; formulation and residue analysis of insecticides as well as spray physics.

2. Visits to the Organization

Activities of the organization are of great interest internationally. The organization has an observer status at all the relevant FAO meetings. It is also represented on a reciprocal basis at the Council meetings of other Locust Organizations in Africa and the Middle East. It attracts visits of outstanding international scientists and personalities each year.

DIRECTOR GENERAL OF FAO MR. EDOUARD SAOUMA VISITING DLCO—EA HEADQUARTERS

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For further information please contact:

1. The Director General
DLCO—EA
P.O. Box 4255
ADDIS ABABA
Ethiopia
Telephone Nos: 181475/77/64
Telex No: 21510
Telegrams: "DESLOC ADDIS"

2. The Officer-in-Charge
DLCO—EA
P.O. Box 30023
NAIROBI
Kenya
Telephone Nos: 501719/04/94
Telex No: 25510
Telegrams: "DESLOC NAIROBI"

3. The Chief, Main Operational Base
DLCO—EA
P.O. Box 36
HARGEISA
Somalia
Telephone No: 2317

4. The Manager
DLCO—EA
P.O. Box 231
ASMARA
Ethiopia
Telephone Nos: 110474/112624

5. The Manager
DLCO—EA
P.O. Box 48
DIRE DAWA
Ethiopia
Telephone No: 113454

6. The Manager
DLCO—EA
P.O. Box 1987
DJIBOUTI
Djibouti
Telephone No: 353271

7. The Manager
DLCO—EA
P.O. Box 328
KHARTOUM NORTH
Sudan
Telephone Nos: 3344/33862/34516

8. The Manager
DLCO—EA
P.O. Box 412
MOGADISCIO
Somalia
Telephone No: 80900

9. The Manager
DLCO—EA
P.O. Box 593
ARUSHA
Tanzania
Telephone No: Duluti 72

10. The Manager
DLCO—EA
P.O. Box 9134
KAMPALA
Uganda
Telephone No: 259907

APPENDIX D

Somalia: Agricultural Statistics

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External Debt, 1984, 1986, and 1988
(in millions of United States dollars)

Debtor	1984	1986	1988
Long-term debt			
Central Bank (including IMF credit) *	112.1	155.6	164.9
Central government	1,226.2	1,522.3	1,731.9
Nonfinancial public enterprises	11.6	20.3	21.9
Private sector (including nonguaranteed)	44.8	16.5	n.a.
Short-term debt	92.1	87.8	116.0
TOTAL	1,486.8	1,802.5	2,034.7

n.a.—not available.

* IMF—International Monetary Fund

Source: Based on information from World Bank, *World Tables, 1989*, Baltimore, 1990, 499

Principal Crops, 1987, 1988, and 1989
(in thousands of tons)

Crop	1987	1988	1989
Bananas	108	115	116*
Corn	296	353	302
Sorghum	244	235	291
Sugarcane	390	450	450

* Estimate from Food and Agriculture Organization of the United Nations.

Source: Based on information from "Somalia—Economy," *Africa South of the Sahara, 1992*, London, 1991, 899.

Principal Livestock, 1987, 1988, and 1989
(in thousands of head)

Kind of Livestock	1987	1988 *	1989 *
Camels	6,601	6,680	6,700
Cattle	4,770	5,000	5,200
Goats	19,705	20,000	20,300
Sheep	13,195	13,500	13,800

* Estimate from Food and Agriculture Organization of the United Nations.

Source: Based on information from "Somalia—Economy," *Africa South of the Sahara, 1992*, London, 1991, 899.

APPENDIX E

Maps: Administrative Divisions of Somalia, 1992
Bird Migration Routes
Weather Patterns

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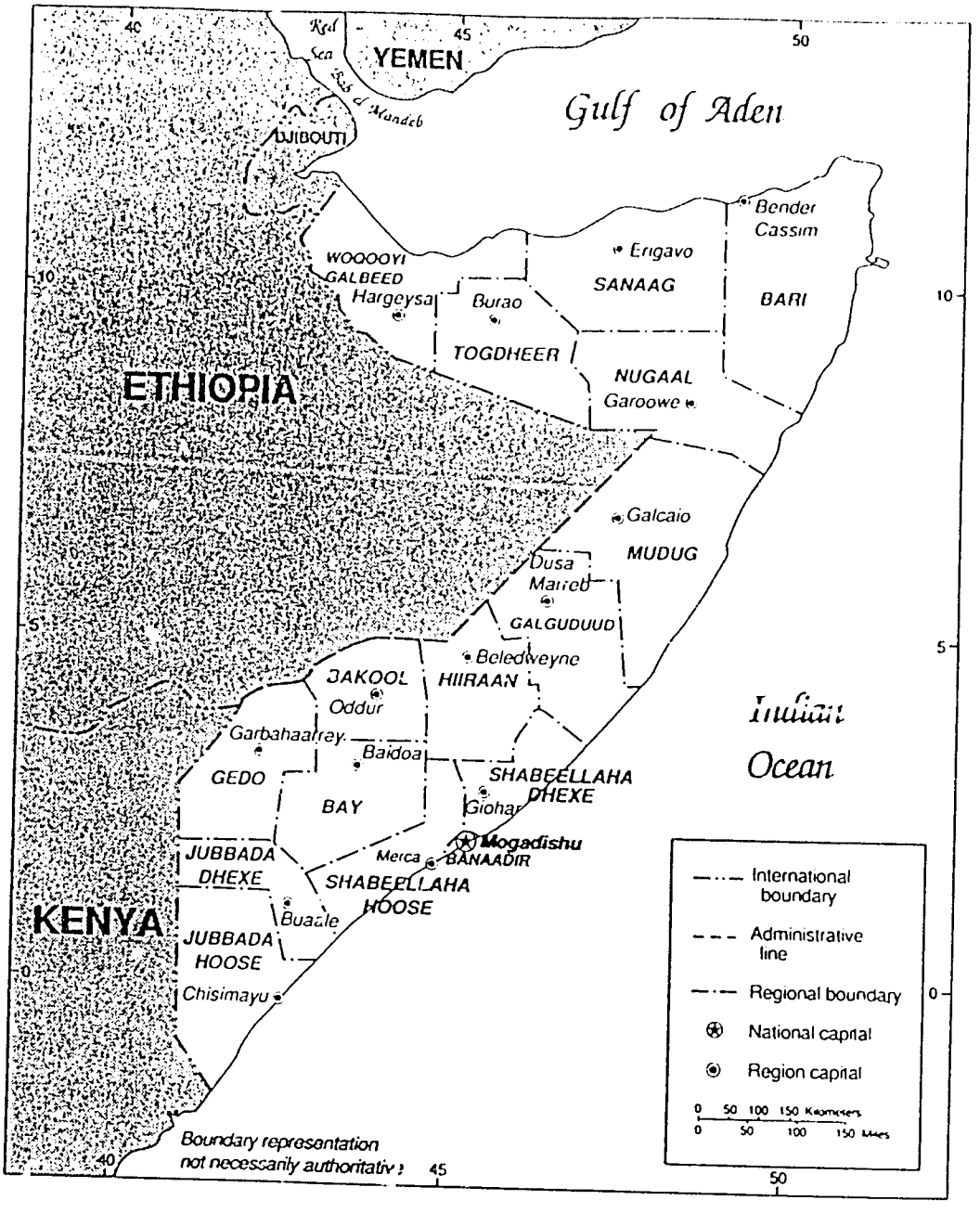
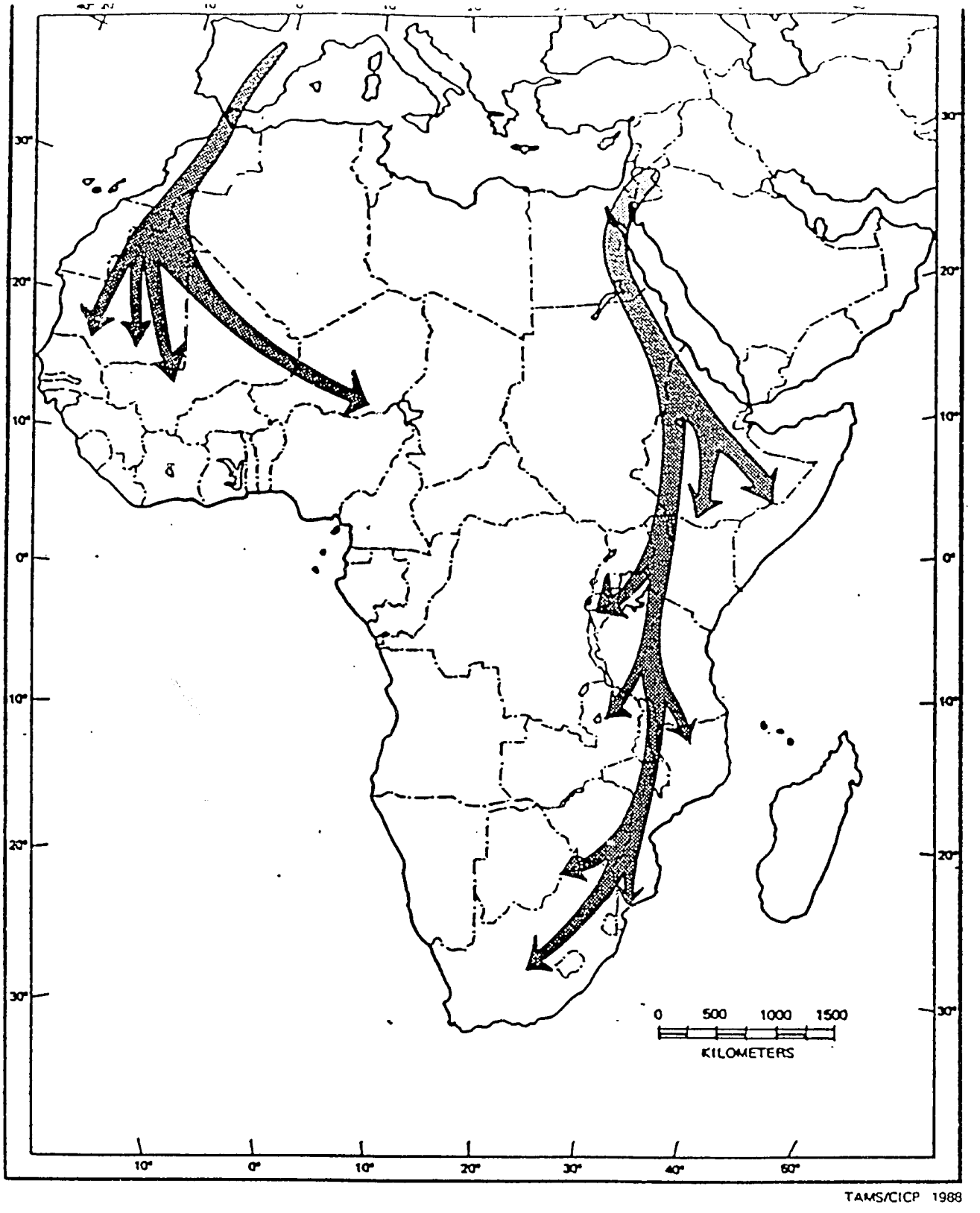
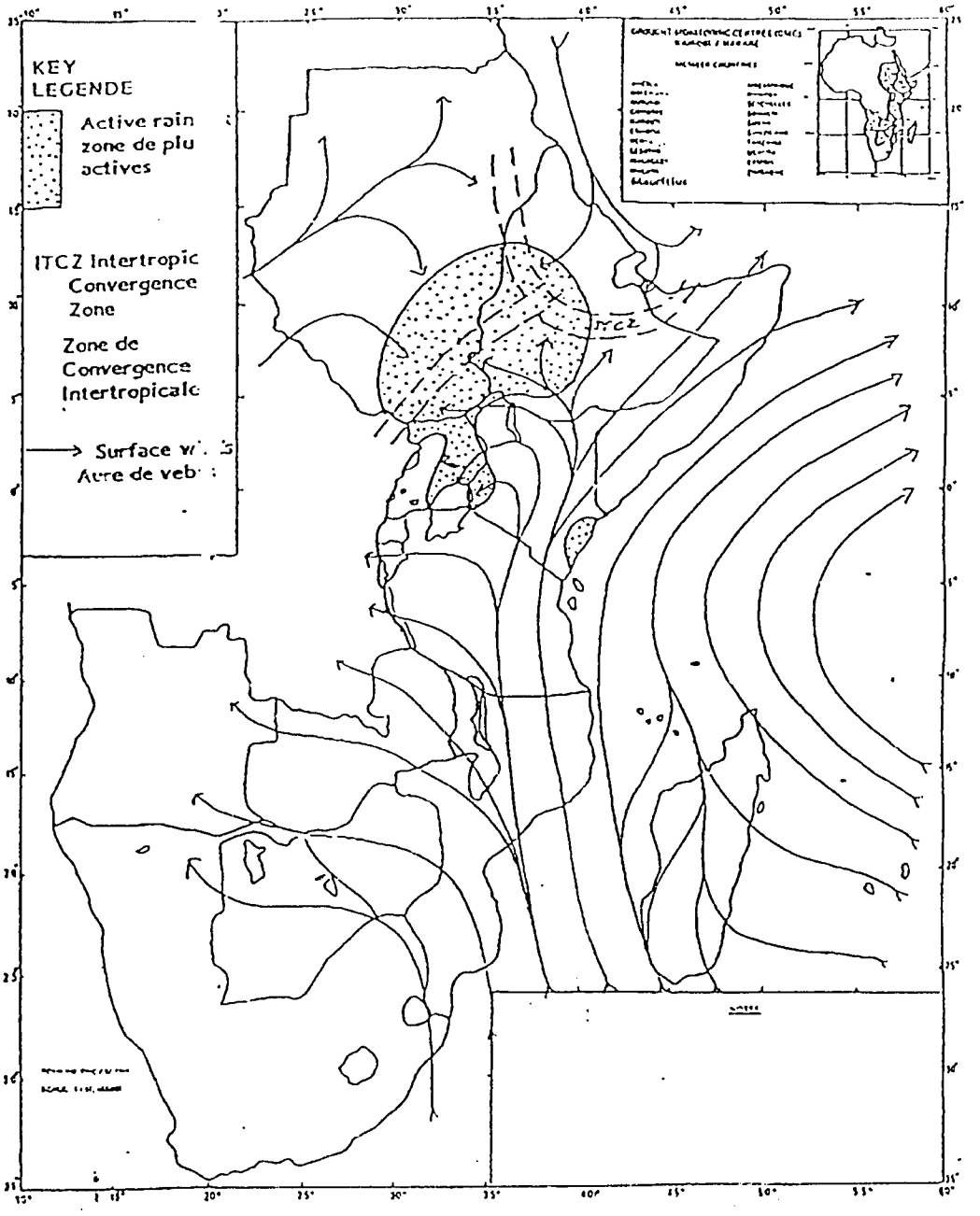


Administrative Divisions of Somalia, 1992



Major bird migration flyways. Diagram shows typical flyways as drawn from many sources.



ACTIVE RAINBELT AND DOMINANT SYNOPTIC SYSTEMS IN JUNE 1993

ZONES DES PLUIES ACTIVES ET DES SYSTEMS SYNOPTIQUES DOMINANTS AU COURS DU MOIS DE JUIN 1993

Weather map for East Africa for June 1993

APPENDIX F

USAID-Approved Pesticides for Locust/Grasshopper Control

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USAID APPROVED PESTICIDES

APPR: ZH ( )
DRAFT: YB ( )
CLEAR: ( )
CLEAR: ( )
CLEAR: ( )
CLEAR: ( )
CLEAR: ( )

UNCLASSIFIED

AID/AFR/ONI/TPPI:YBELAYNEH:YB
04/08/93 (703) 235-5411
AID/AFR/ONI/TPPI:ZHAHN

AID/AFR/ONI/TPPI:VDREYER(DRAFT)
AID/NE:GJACKSON(DRAFT)
AID/AFR/ARTS:JGAUDET(DRAFT)
AID/GC/AFR:ESPRIGGS(DRAFT)
AID/AFR/ONI/TPPI:ASHOWLER(DRAFT)
AID/POL:JHESTER(DRAFT)
AID/AFR/FHA/OFDA:GHUDEN(DRAFT)
AID/ASIA/DR/TR:MKUX(DRAFT)

ROUTINE AIDAF

AIDAC NAIROBI FOR REDSO/ESA; ABIDJAN FOR REDSO/WCA;
NE/ENA

E.O. 12356: N/A

TAGS:

SUBJECT: UPDATE ON A.I.D.-APPROVED LIST OF PESTICIDES FOR LOCUST/GRASSHOPPER CONTROL

1. SUMMARY: AID/AFR/ONI IS IN THE PROCESS OF REFINING THE LIST OF PREFERRED PESTICIDES PRESENTED IN THE 1989 PROGRAMMATIC ENVIRONMENTAL ASSESSMENT (PEA) FOR LOCUST AND GRASSHOPPER CONTROL IN AFRICA AND ASIA. THE INFORMATION IN THIS CABLE UPDATES SIMILAR TABULAR DATA IN THE PEA, AND SUPERCEDES SIMILAR DATA IN A.I.D.'S 'REVIEW OF ENVIRONMENTAL CONCERNS IN A.I.D. PROGRAMS FOR LOCUST AND GRASSHOPPER CONTROL, PUBL. SERIES NO. 91-7'. THE INFORMATION ON PESTICIDES IN THIS CABLE SHOULD BE CONSIDERED TO BE AN AMENDMENT TO THE PEA. THE TABLE LISTING PESTICIDES IN THE ENVIRONMENTAL CONCERNS DOCUMENT WAS ONLY MEANT TO INDICATE PESTICIDES THAT CAN BE PURCHASED WITH A.I.D. FUNDS, BUT IT SHOULD NOT BE CONSIDERED AS GUIDANCE FOR PESTICIDE SELECTION, END SUMMARY.

2. WITH MORE AND MORE INFORMATION ON PESTICIDES BEING GENERATED, AID/AFR FINDS IT NECESSARY TO REFINE ITS LIST OF A.I.D.-APPROVED ANTI-LOCUST/GRASSHOPPER PESTICIDES.

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THE FOLLOWING IS AN ALPHABETICAL LISTING OF THE PESTICIDES APPROVED IN THE PEA. THE LIST INCLUDES RELEVANT INFORMATION ON TOXICITY, BIO-ACCUMULATION AND SIGNAL WORDS (TO INDICATE THE RELATIVE TOXICITY OF EACH INSECTICIDE). THIS INFORMATION PROVIDES A SKETCH OF PROPERTIES OF THE A.I.D.-APPROVED ANTI-LOCUST/GRASSHOPPER PESTICIDES. ALL OF THE CHEMICALS LISTED BELOW ARE CURRENTLY REGISTERED EITHER BY THE U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) OR ITS EQUIVALENT IN OTHER COUNTRIES FOR LOCUST AND GRASSHOPPER CONTROL.

	TOXICITY TO						
	FISH	INVER	BIRD	MAMML	BIOAC	PERS	SIGNW
1. ACEPHATE	L	L	L	M	L	L	C
2. BENDIOCARB	M	M	M	M	M	M	W
3. CARBARYL	L	L	L	L	L-M	L	C
4. CHLORPYRIFOS	M	H	M	M	M	L	C-W
5. DIAZINON	M	H	M-H	L	M	M	C-W
6. FENITROTHION	L	H	H	L	M	L	W
7. LAMBDA-CYHALOTHRIN	H	H	L	H	H	M	D
8. MALATHION	L	L	M	L-M	L	L	C
9. TRALOMETHRIN	H	H	L	L	H	M	D

LEGEND:

NON-TARGET ORGANISMS: FISH, INVERTEBRATES (INCLUDING HONEYBEES), BIRDS, MAMMALS

BIOAC = BIO-ACCUMULATION, PERS = PERSISTENCE,

L = LOW; M = MODERATE; H = HIGH (APPLY TO TOXICITY LEVELS TO NON-TARGET ORGANISMS, BIO-ACCUMULATION AND PERSISTENCE; RELATIVE TOXICITY IS ALSO A FUNCTION OF FORMULATION AND ACTIVE INGREDIENT CONCENTRATION)

SIGNW = SIGNAL WORD: C = CAUTION; W = WARNING; D = DANGER (POISON); (APPLIES TO THE RELATIVE TOXICITY OF PESTICIDES IN ASCENDING ORDER; RELATIVE TOXICITY IS ALSO A FUNCTION OF FORMULATION AND ACTIVE INGREDIENT CONCENTRATION)

SPECIFIC DOSAGES MUST BE WORKED OUT BY HIGHLY EXPERIENCED PERSONNEL FAMILIAR WITH THE APPLICATION EQUIPMENT, PESTICIDE FORMULATION, ETC., TO BE USED. FOR ELABORATION ON THE PROPERTIES OF A.I.D.-APPROVED ANTI-LOCUST/

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GRASSHOPPER PESTICIDES, CONSULT THE PEA AND COUNTRY-SPECIFIC SUPPLEMENTARY ENVIRONMENTAL ASSESSMENTS (SEAS).

3. IT IS IMPORTANT THAT ALL PRECAUTIONS INDICATED ON THE PESTICIDE LABELS, E.G., APPLICATION DOSAGES, SAFETY MEASURES, INSTRUCTIONS ON HANDLING AND STORAGE PROCEDURES, DISPOSAL OPTIONS, ENTRY BY UNPROTECTED PERSONS INTO TREATED AREAS, EMERGENCY GUIDELINES, ETC., BE CAREFULLY OBSERVED, AS OUTLINED IN THE COUNTRY-SPECIFIC SEAS.

4. AID/W WILL KEEP MISSIONS INFORMED OF FUTURE UPDATES ON THE LIST OF A.I.D.-APPROVED ANTI-LOCUST/GRASSHOPPER PESTICIDES. YY

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ADDITIONAL CLEARANCES:

AID/AFR/EA:PGUEDET(INFO)
AID/AFR/CCWA:MGOLDEN(INFO)
AID/AFR/SWA:JGILMORE(INFO)
AID/AFR/SA:KBROWN(INFO)
AID/AFR/ARTS/FARA:WKNAUSENBERGER(DRAFT)
AID/RD/AGI:RHEDLUND(INFO)

APPENDIX G

DLCO-EA Provisions and Stocks

QUANTITIES OF PESTICIDES HELD BY DLCO IN ETHIOPIA

LIST OF PESTICIDES STORED BY DLCO-EA IN DIRE DAWA

JUNE, 1993

Pesticide, formulation	# Containers x # Liters	Total Amount Present		Condition
BHC gamma isomer 15%	216 x 200	43,200	liters	Leaking
BHC gamma isomer 20%	202 x 200	40,400	liters	Leaking
BHC Mixed Dust 5%	50 x 50kgs	2,500	kilograms	?
Diazinon 95%	20 x 12.5	2,250	liters	?
Ensidil 20% (D.20)	30 x 200	6,000	liters	?
Dieldrin 10% (D.10)	1 x 120, and 33 gal x 5	285	liters	?
Dieldrin ULV 200gr/l	107 x 25, and 2.5 big drums	3,175	liters	?
Dieldrin 20% ULV	45 x 200	9,000	liters	?
Malathion 50%	3.5 x 200	690	liters	?
Malathion 95%	7 x 200	1,400	liters	?
Sumithion	2.75 x 200	420	liters	?

*Empty Barrels also stored in this facility
**None of the barrels in this facility stored on palates

LIST OF PESTICIDES STORED BY DLCO-EA IN ADDIS ABABA*

JUNE, 1993

Pesticide, formulation	# Containers x # Liters	Total Amount Present		Condition**
Dieldrin	28 x 200	5,600	liters	OK
Unknown*	14 x 200	2,800	liters	OK
Insidil	2 x 200	400	liters	OK
Malathion	42 x 200	8,400	liters	OK
Fenitrothion	54 x 200	10,800	liters	OK
Fenthion 640g/l 60%	2 x 200, and 17 sm. barrels	?		OK
DDT 25% Oil	4 x 22.5	90	liters	?
DDT WP	1 Tin	?		?

*Many bags and containers of experimental research chemicals also stored here
**Most of the barrels at this facility stored on palates
NB, Warehouse also contains wood for making palates, safety equipment, sprayers, spare auto parts.

INVENTORY OF EQUIPMENT POSSESSED BY DLCO

STATION : KHARTOUM CRB
ACCOUNT CODE : 6806-008
ASSET GROUP : RADIOS AND ACCESSORIES

CURRENCY : UNI
FINANCIAL YEAR : END

Asset Reg. No.	Description	Aquisition Date/ Year	COST			DEPRECIATION						
			As at 01-07-88	Additions (Disposals) 01-07-88 to 30-06-89	As at 30-06-89	Rate %	As at 01.07.88	Additions (Disposals)	Current	Accumulated As at 30-06-89	NBV	REMARKS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
R-166	Radio Fye SSB 130 M	13.7.79	3541.90		3541.90	10	3187.71		353.19	3540.90	1.00	
R-167	" " "	"	3541.90		3541.90	10	3187.71		353.19	3540.90	1.00	
R-168	" " "	"	3541.90		3541.90	10	3187.71		353.19	3540.90	1.00	
R-170	" " "	"	3541.90		3541.90	10	3187.71		353.19	3540.90	1.00	
R-171	" " "	"	3541.90		3541.90	10	3187.71		353.19	3540.90	1.00	
R-172	" " "	"	3541.90		3541.90	10	3187.71		353.19	3540.90	1.00	
R-173	" " "	"	3541.90		3541.90	10	3187.71		353.19	3540.90	1.00	
R-174	Radio Intercontinental	24.6.79	8727.00		8727.00	10	7051.41		872.70	7924.11	802.89	
R-138	Radio Fye 130M SSB	1970	1078.00		1078.00	10	1077.00		-	1077.00	1.00	
	TOTAL		34598.30		34598.30		30442.38		3345.03	33787.41	810.89	

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STATION : NAIROBI CRB
ACCOUNT CODE : 6807-005
ASSET GROUP : PUMPS AND SPRAYING EQUIPMENT

CURRENCY
FINANCIAL YEAR

Asset Reg. No. (1)	Description (2)	Aquisition Date/ Year (3)	COST As at 01-07-88 (4)	COST Additions (Disposals) 01-07-88 to 30-06-89 (5)	COST As at 30-06-89 (6)	Rate % (7)	DEPRECIATION As at 01.07.88 (8)	DEPRECIATION Additions (Disposals) (9)	DEPRECIATION Current (10)	DEPRECIATION Accumulated As at 30-06-89 (11)	NBV (12)	REMARKS (13)
P-2*	Pump, BSA/Gilker	1966	26.66		26.66	10	25.66			25.66	1.00	B.O.S.
P-10*	Pump, Tap Model 80	"	13.33		13.33	10	12.33			12.33	1.00	" TENDERS FROM S
P-101*	Sprayer Exhaust L/Rover	"	40.00		40.00	10	39.00			39.00	1.00	"
P-110*	" " "	"	40.00		40.00	10	39.00			39.00	1.00	"
P-111*	" " "	"	40.00		40.00	10	39.00			39.00	1.00	"
P-112*	" " "	"	173.33		173.33	10	172.33			39.00	1.00	"
P-115*	" " "	"	173.33		173.33	10	172.33			172.33	1.00	"
P-117	" " "	"	173.33		173.33	10	172.33			172.33	1.00	"
P-119*	" " "	"	173.33		173.33	10	172.33			172.33	1.00	"
P-120*	" " "	"	40.00		40.00	10	39.00			39.00	1.00	"
P-125	Sprayer, Micron "	1961	586.66		586.66	10	585.66			585.66	1.00	" TENDERS FROM ST
P-134*	Pump, Insecticide, Winsconsin	1965	533.33		533.33	10	532.33			532.33	1.00	"
P-137*	Pump, Refuellling, Finsbury	1969	113.33		113.33	10	112.33			112.33	1.00	"
P-162	Sprayer Exhaust L/Rover	"	190.00		190.00	10	189.00			189.00	1.00	"
P-163*	" " "	"	190.00		190.00	10	189.00			189.00	1.00	"
P-165*	" " "	"	342.66		342.66	10	341.66			341.66	1.00	"
P-173*	" " "	"	342.66		342.66	10	341.66			341.66	1.00	"
P-188*	Pump Refuelling, Finsbury	1972	173.33		173.33	10	172.33			172.33	1.00	MISSING
P-190	" " "	1973	240.00		240.00	10	239.00			239.00	1.00	"
P-208*	Exhaust Nozzle Sprayer II	1978	800.00		800.00	10	786.40		12.60	799.00	1.00	
P-209*	" " "	"	800.00		800.00	10	786.40		12.60	799.00	1.00	
P-210*	" " "	"	800.00		800.00	10	786.40		12.60	799.00	1.00	
P-211	" " "	"	800.00		800.00	10	786.40		12.60	799.00	1.00	
P-212	" " "	"	800.00		800.00	10	786.40		12.60	799.00	1.00	
P-213	" " "	"	800.00		800.00	10	786.40		12.60	799.00	1.00	
P-214	" " "	"	800.00		800.00	10	786.40		12.60	799.00	1.00	
P-230*	Pump Refuelling Finsbury	1980	766.66		766.66	10	613.34		76.67	690.01	76.65	LOST
P-226	Semi Rotary Pump	18.10.84	223.68		223.68	10	82.02		22.37	104.39	119.29	
P-229*	Micronair Pod Spray System	25.5.87	23512.20		23512.20	10	2547.16		2351.22	4898.38	18613.82	
P-227*	" " " "	07.6.88	18340.53		18340.53	10	152.84		1834.05	1986.89	16353.64	
P-228*	" " " "	"	18340.53		18340.53	10	152.84		1834.05	1986.89	16353.64	
	GRAND TOTAL		70388.88		70388.88		12639.28		6206.56	18845.84	51543.04	

BEST AVAILABLE COPY

STATION : KHARTOUM CRB
ACCOUNT CODE : 6806-008
ASSET GROUP : RADIOS AND ACCESSORIES

CURRENCY : UNI
FINANCIAL YEAR : END

Asset Reg. No.	Description	Aquisition Date/ Year	COST				DEPRECIATION					
			As at 01-07-88	Additions (Disposals) 01-07-88 to 30-06-89	As at 30-06-89	Rate %	As at 01.07.88	Additions (Disposals)	Current	Accumulated As at 30-06-89	NBV	REMARKS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
R-166	Radio Pye SSB 130 M	13.7.79	3541.90		3541.90	10	3187.71		353.19	3540.90	1.00	
R-167	" " "	"	3541.90		3541.90	10	3187.71		353.19	3540.90	1.00	
R-168	" " "	"	3541.90		3541.90	10	3187.71		353.19	3540.90	1.00	
R-170	" " "	"	3541.90		3541.90	10	3187.71		353.19	3540.90	1.00	
R-171	" " "	"	3541.90		3541.90	10	3187.71		353.19	3540.90	1.00	
R-172	" " "	"	3541.90		3541.90	10	3187.71		353.19	3540.90	1.00	
R-173	" " "	"	3541.90		3541.90	10	3187.71		353.19	3540.90	1.00	
R-174	Radio Intercontinental	24.6.79	8727.00		8727.00	10	7051.41		872.70	7924.11	802.89	
R-138	Radio Pye 130M SSB	1970	1078.00		1078.00	10	1077.00		-	1077.00	1.00	
	TOTAL		34598.30		34598.30		30442.38		3345.03	33787.41	810.89	

BEST AVAILABLE COPY

STATION : NAIROBI CRB
ACCOUNT CODE : 6806-005
ASSET GROUP : RADIOS & ACCESSORIES

CURRENCY : UNITED
FINANCIAL YEAR : ENDING

Asset Reg. No.	Description	Aquisition Date/ Year	COST As at 01-07-88	COST Additions (Disposals) 01-07-88 to 30-06-89	COST As at 30-06-8	DEPRECIATION Rate %	DEPRECIATION As at 01.07.88	DEPRECIATION Additions (Disposals)	DEPRECIATION Current	DEPRECIATION Accumulated As at 30-06-89	NBV	REMARKS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	TOTAL B/F		11742.40		11742.40		11703.40			11703.40	39.00	
R-159	Radio Ground AEL 3090/105/ 15.	1977	1160.00		1160.00	10	1159.00			1159.00	1.00	
R-160	" " "	"	1265.33		1265.33	10	1253.[illegible]			1264.33	1.00	
R-178	" " SSB 130M	1979	3541.90		3541.90	10	3155.83		354.19	3510.02	31.88	
R-179	" " "	"	3541.90		3541.90	10	3155.83		354.19	3510.02	31.88	
R-180	" " "	"	3541.90		3541.90	10	3155.83		354.19	3510.02	31.88	
R-182	" " "	"	3541.90		3541.90	10	3155.83		354.19	3510.02	31.88	
R-183	" " "	"	3541.90		3541.90	10	3155.83		354.19	3510.02	31.88	
R-184	" " "	"	8727.00		8727.00	10	7854.30		871.70	8726.00	1.00	
R-50	Radio Ground Pye Air	1964	253.33		253.33	10	252.33			252.33	1.00	
R-55	" " Pye SSB 125	1963	928.00		928.00	10	927.00			927.00	1.00	
R-121	" " " "	1968	980.53		980.53	10	979.53			979.53	1.00	
R-126	" " " "	1969	1033.33		1033.33	10	1032.33			1032.33	1.00	
R-82	Transistor Radio, Philips	1966	13.33		13.33	10	12.33			12.33	1.00	
R-169	D.C.Power Supply for G/Radios Workshop	01.4.86	732.60		732.60	10	164.84		73.26	238.10	494.50	
	GRAND TOTAL		44545.35		44545.35		41128.54		2715.91	43844.45	700.90	

BEST AVAILABLE COPY

STATION : NAIROBI CRB
ACCOUNT CODE: 6806-005
ASSET GROUP : RADIOS AND ACCESSORIES

CURRENCY : UNITE
FINANCIAL YEAR : ENDIN

Asset Reg. No. (1)	Description (2)	Aquisition Date/ Year (3)	COST As at 01-07-88 (4)	Additions (Disposals) 01-07-88 to 30-06-89 (5)	As at 30-06-89 (6)	Rate % (7)	DEPRECIATION As at 01.07.88 (8)	Additions (Disposals) (9)	Current (10)	Accumulated As at 30-06-89 (11)	NBV (12)	REMARKS (13)
R-31	Radio Ground AWA	1964	336.00		336.00	10	335.00			335.00	1.00	
R-32	Radio Ground AWA	"	336.00		336.00	10	335.00			335.00	1.00	
R-41	" " Marconi	1963	1165.33		1165.33	10	1164.33			1164.33	1.00	
R-48	" " Pye Bantam	1964	253.33		253.33	10	262.33			262.33	1.00	
R-59	" " Pye SSB 125	1963	928.00		928.00	10	927.00			927.00	1.00	
R-79	Transmitter, Marconi	1962	2640.00		2640.00	10	2639.00			2639.00	1.00	
R-80	Receiver, National NC 190	1966	213.33		213.33	10	212.33			212.33	1.00	
R-84	Amplifier Linear NC 12000	1966	530.67		530.67	10	529.67			529.67	1.00	
R-86	Generator Audio	1966	93.33		93.33	10	92.33			92.33	1.00	
R-87	" "	1966	93.33		93.33	10	92.33			92.33	1.00	
R-88	" VHF-UHF Marconi	"	253.33		253.33	10	252.33			252.33	1.00	
R-94	Meter, Frequency BC221	"	50.67		50.67	10	49.67			49.67	1.00	
R-95	Meter, Output Marconi	"	40.00		40.00	10	39.00			39.00	1.00	
R-96	Oscelloscope 058	"	48.00		48.00	10	47.00			47.00	1.00	
R-97	Power Unit AC/DC Westinghouse	"	80.00		80.00	10	79.00			79.00	1.00	
R-98	Power Unit Multi Output	"	40.00		40.00	10	39.00			39.00	1.00	
R-101	Transreceiver SOS	"	32.00		32.00	10	31.00			31.00	1.00	
R-102	" "	"	32.00		32.00	10	31.00			31.00	1.00	
R-103	" "	"	32.00		32.00	10	31.00			31.00	1.00	
R-104	Value Tester, AVO MKT	"	80.00		80.00	10	79.00			79.00	1.00	
R-105	VTVM AVD	1966	58.67		58.67	10	57.67			57.67	1.00	
R-111	Radio Ground Pye SSB 125	"	928.00		928.00	10	927.00			927.00	1.00	
R-113	Wattmeter	1967	248.00		248.00	10	247.00			247.00	1.00	
R-114	Resistor Coaxial Load	"	68.67		68.67	10	67.67			67.67	1.00	
R-119	Transreceiver SOS	1968	240.93		240.93	10	239.93			239.93	1.00	
R-125	Radio Ground Pye SSB125T	1969	1033.33		1033.33	10	1032.33			1032.33	1.00	
R-132	Osalloscope	"	347.47		347.47	10	346.47			346.47	1.00	
R-133	Counter Timer	"	600.00		600.00	10	599.00			599.00	1.00	
R-134	Frequency Dvider	1970	430.00		430.00	10	429.00			429.00	1.00	
R-141	Osalloscope DART	1972	40.00		40.00	10	39.00			39.00	1.00	
R-142	VTNM Electrical Insturment	"	66.67		66.67	10	65.67			65.67	1.00	
R-143	" " Simposon	"	66.67		66.67	10	65.67			65.67	1.00	
R-144	Soladron Capacity	1971	80.00		80.00	10	79.00			79.00	1.00	
R-145	Relay Tester, Weston	"	26.67		26.67	10	25.67			25.67	1.00	
R-146	Wattmeter	"	20.00		20.00	10	19.00			19.00	1.00	
R-147	Valve Tester	"	40.00		40.00	10	39.00			39.00	1.00	
R-148	Sanwa-370E Multimeter	"	36.67		36.67	10	35.67			35.67	1.00	
R-149	GMP Dip Meter	1966	40.00		40.00	10	39.00			39.00	1.00	
R-150	Test Panel ADF	1973	93.33		93.33	10	92.33			92.33	1.00	
	TOTAL C/F		11742.40		11742.40		11703.40			11703.40	39.00	

BEST AVAILABLE COPY

STATION : DJIBOUTI CRB
ACCOUNT CODE : 6807-004
ASSET GROUP : PUMPS AND SPRAYING EQUIPMENT

CURRENCY
FINANCIAL YEAR

Asset Reg. No.	Description	Aquisition Date/ Year	COST			DEPRECIATION						
			As at 01-07-88	Additions (Disposals) 01-07-88 to 30-06-89	As at 30-06-89	Rate %	As at 01.07.88	Additions (Disposals)	Current	Accumulated As at 30-06-89	NBV	REMARKS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
P-197*	Exhaust Nozzle Sprayer Twin	30.8.76	800.00		800.00	10	799.00			799.00	1.00	B.O.S. IV/88-89 dd 30.
P-198*	" " " "	27.7.77	800.00		800.00	10	799.00			799.00	1.00	" "
P-221*	" " " "	"	40.00		40.00	10	39.00			39.00	1.00	" IV/88-89 dd 30.6
P-222*	" " " "	"	40.00		40.00	10	39.00			39.00	1.00	" " "
P-224	" " " single	19.6	40.00		40.00	10	39.00			39.00	1.00	
P-225	" " " "	"	40.00		40.00	10	39.00			39.00	1.00	
GRAND TOTAL			1760.00		1760.00		1754.00			1754.00	6.00	

BEST AVAILABLE COPY

STATION : DJIBOUTI
ACCOUNT CODE : 6806-004
ASSET GROUP : RADIOS

CURRENCY : UNITED
FINANCIAL YEAR : ENDING

Asset Reg. No.	Description	Aquisition Date/ Year	COST				DEPRECIATION					REMARKS
			As at 01-07-88	Additions (Disposals) 01-07-88 to 30-06-89	As at 30-06-89	Rate %	As at 01.07.88	Additions (Disposals)	Current	Accumulated As at 30-06-89	NBV	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
R-124	Radio Ground Pye SSB 125T	Dec.'68	1136.66		1136.66	10		1135.66		1135.66	1.00	
R-177	Radio Ground Pye SSB 130M	13.7.79	3732.16		3732.16	10		3358.96	372.20	3731.16	1.00	
R-195	Radio Ground Pye SSB 130M	"	3732.16		3732.16	10		3358.96	372.20	3731.16	1.00	
R-197	Radio Intercontinental 1000	"	8727.00		8727.00	10		7784.48	872.70	8657.18	69.82	
	TOTAL		17327.98		17327.98			15638.06	1617.10	17255.16	72.82	

BEST AVAILABLE COPY

STATION : DIRE DAWA CRB
ACCOUNT CODE : 6007-003
ASSET GROUP : PUMPS AND SPRAYING EQUIPMENT

CURRENCY : UNITY
FINANCIAL YEAR: ENDI

Asset Reg. No.	Description	Acquisition Date/ Year	COST As at 01-07-88	Additions (Disposals) 01-07-88 to 30-06-89	As at 30-06-89	Rate	DEPRECIATION As at 01-07-88	Additions (Disposals)	Current	Accumulated As at 30-06-89	NBV	REMARKS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
P-5	Pump Hathway Villers	1966	80.00		80.00	10	79.00			79.00	1.00	
P-34	Sprayer Exhaust L/R Single	"	40.00		40.00	10	39.00			39.00	1.00	
P-47	" " "	"	40.00		40.00	10	39.00			39.00	1.00	
P-48	" " "	"	40.00		40.00	10	39.00			39.00	1.00	
P-49	" " "	"	40.00		40.00	10	39.00			39.00	1.00	
P-50	" " "	"	40.00		40.00	10	39.00			39.00	1.00	
P-51	" " "	"	173.33		173.33	10	172.33			172.33	1.00	
P-52	" " "	"	173.33		173.33	10	172.33			172.33	1.00	
P-53	" " "	"	173.33		173.33	10	172.33			172.33	1.00	
P-54	" " "	"	173.33		173.33	10	172.33			172.33	1.00	
P-55	" " "	"	173.33		173.33	10	172.33			172.33	1.00	
P-56	" " "	"	173.33		173.33	10	172.33			172.33	1.00	
P-57	" " "	"	173.33		173.33	10	172.33			172.33	1.00	
P-58	" " "	"	173.33		173.33	10	172.33			172.33	1.00	
P-59	" " "	"	173.33		173.33	10	172.33			172.33	1.00	
P-121	" " "	"	173.33		173.33	10	172.33			172.33	1.00	
P-132	Pump Bernard/Rotos	"	[illegible]		[illegible]	10	39.00			[illegible]	[illegible]	
P-135	Pump Refuelling Finsbury	1968	291.46		291.46	10	290.46			290.46	1.00	
P-172	Sprayer Exhaust L/R Twin	May 1969	113.33		113.33	10	112.33			112.33	1.00	
P-175	" " "	"	342.66		342.66	10	341.66			341.66	1.00	
P-179	Pump Reggerini/Guscenti Borkoly	1970	342.66		342.66	10	341.66			341.66	1.00	
P-180	Pump Refuelling Finsbury	17.10.72	300.00		300.00	10	299.00			299.00	1.00	
P-223	Pump Submisible Elect.	03.03.07	173.33		173.33	10	172.33			172.33	1.00	
			2940.58		2940.58	10	392.08		294.06	686.14	2254.44	
	GRAND TOTAL		6510.12		6510.12		3947.62		294.06	4241.68	2276.44	

BEST AVAILABLE COPY

[illegible] : [illegible] CRB
ACCOUNT CODE : 6806-003
ASSET GROUP : RADIOS AND ACCESSORIES

CURRENCY
FINANCIAL YEAR : ENDING [illegible]

Asset Reg. No.	Description	Aquisition Date/ Year	COST As at 01-07-88	Additions (Disposals) 01-07-88 to 30-06-89	As at 30-06-89	Rate %	DEPRECIATION As at 01.07.88	Additions (Disposals)	Current	Accumulated As at 30-06-89	NBV	REMARKS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
R-38	Radio Ground Marconi	1963	1165.33		1165.33	10	1164.33			1164.33	1.00	
R-53	Radio Ground Pye SBB 125	"	1266.66		1266.66	10	1265.66			1265.66	1.00	
F-54	" " " "	"	1266.66		1266.66	10	1265.66			1265.66	1.00	
R-57	" " " "	"	1266.66		1266.66	10	1265.66			1265.66	1.00	
R-66	Radio Redifon GR49	"	1266.66		1266.66	10	1265.66			1265.66	1.00	
R-67	Radio Redifon GR 49	"	1266.66		1266.66	10	1265.66			2165.66	1.00	
R-109	Radio Ground Pye SSB 125	"	928.00		928.00	10	927.00			927.00	1.00	
R-136	" " "	1970	1078.80		1078.80	10	1077.80			1077.80	1.00	
R-139	" " "	1979	1078.80		1078.80	10	970.92		106.88	1077.80	1.00	
R-164	" " "	"	3732.16	(3732.16)		10	3358.96	(3358.96)				TO HQ TRANSFER)
R-51	Radio Ground Pye SSB 125	1963	1266.66		1266.66	10	1265.66			1265.66	1.00	
R-65	Radio Redifon GR 49	1966	1266.66		1266.66	10	1265.66			1265.66	1.00	
R-162	Radio Ground SSB 130 M	1979	3732.16		3732.16	10	3358.96		372.20	3731.16	1.00	
	GRAND TOTAL		20581.87	(3732.16)	16849.71		15717.59	(3358.96)	479.08	16837.71	12.00	

BEST AVAILABLE COPY

CODE ASHURA CRB
9-07-002
PUMP AND SPRAYER [illegible]

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
[illegible]	Pump Electric Totase	[illegible]	72.00		72.00	10	71.00			[illegible]	1.00	
P-2[illegible]	Pump Simmond/tap	"	53.33		53.33	10	52.33			[illegible]	1.00	
P-2[illegible]	Sprayer Exhaust L/Rover		173.33		173.33	10	172.33			[illegible]	1.00	
P-[illegible]	" " "		173.33		173.33	10	172.33			[illegible]	1.00	
P-[illegible]	" " "	"	173.33		173.33	10	172.33			[illegible]	1.00	
P-[illegible]	" " "	"	173.33		173.33	10	172.33			[illegible]	1.00	
P-[illegible]	" " "	"	173.33		173.33	10	172.33			[illegible]	1.00	
P-[illegible]	" " "		60.00		60.00	10	39.00			[illegible]	1.00	
P-[illegible]	" " "	"	60.00		60.00	10	39.00			[illegible]	1.00	
P-[illegible]	" " "	"	60.00		60.00	10	39.00			[illegible]	1.00	
P-[illegible]	" " "	"	60.00		60.00	10	39.00			[illegible]	1.00	
P-[illegible]	" " "		60.00		60.00	10	39.00			[illegible]	1.00	
P-[illegible]	" " "		60.00		60.00	10	39.00			[illegible]	1.00	
P-13[illegible]	Pump Refuelling /Finsbury	19[illegible]	113.33		113.33	10	112.33			[illegible]	1.00	
P-1[illegible]	Sprayer Exhaust L/Rover	"	190.00		190.00	10	189.00			[illegible]	1.00	
P-1[illegible]	" " "	19[illegible]	342.66		342.66	10	341.66			[illegible]	1.00	
P-1[illegible]	" " "	"	342.66		342.66	10	341.66			[illegible]	1.00	
P-1[illegible]	" " "	"	342.66		342.66	10	341.66			[illegible]	1.00	
P-1[illegible]	" " "	"	342.66		342.66	10	341.66			[illegible]	1.00	
P-1[illegible]	" " "	"	342.66		342.66	10	341.66			[illegible]	1.00	
P-1[illegible]	" " "	"	342.66		342.66	10	341.66			[illegible]	1.00	
P-1[illegible]	" " "	"	342.66		342.66	10	341.66			[illegible]	1.00	
P-1[illegible]	" " "	"	342.66		342.66	10	341.66			[illegible]	1.00	
P-1[illegible]	Pump Refuelling Finsbury	Oct 1[illegible]72	325.00		325.00	10	325.00			[illegible]	1.00	
			173.33		173.33	10	172.33			[illegible]	1.00	
	TOTAL		3917.93		3917.93		3895.93			[illegible]	22.00	

BEST AVAILABLE COPY

STATION : ASMARA
ACCOUNT CODE : 6806-402
ASSET GROUP : RADIOS AND ACCESSORIES

CURRENCY
FINANCIAL YEAR

Asset Book No (1)	Description (2)	Aquisition Date/Year (3)	COST As at 01-07-88 (4)	Additions (Disposals) 01-07-88 to 30-06-89 (5)	As at 30-06-89 (6)	Rate % (7)	DEPRECIATION As at 01.07.88 (8)	Additions (Disposals) (9)	Current (10)	Accumulated As at 30-06-89 (11)	NBV (12)	REMARKS (13)
R-36	Radio Ground Marconi HSR21	1963	1165.33		1165.33	10	1164.33			1164.33	1.00	
R-63	Radio Ground [illegible]fon GP 49	1966	1266.67		1266.67	10	1265.67			1265.67	1.00	
R-64	Radio Ground Madifon GR40	"	1266.67		1266.67	10	1265.67			1265.67	1.00	
R-112	Handset Radio Marconi	1965	58.67		58.67	10	57.67			57.67	1.00	
R-130	Receiver Radio Facsimile	Mar.'69	1884.11		1884.11	10	1883.11			1883.11	1.00	
R-137	Radio Pye SSB 130M	Aug'70	1078.80		1078.80	10	1077.80			1077.80	1.00	
R-161	Radio Pye SSB 130M	13.7.79	3732.16		3732.16	10	3358.96		372.20	3731.16	1.00	
R-165	Radio Pye SSB 130M	Mar'79	3732.16		3732.16	10	3482.12		249.04	3731.16	1.00	
R-121	Radio Ground Pye SSB 125	1958	980.53		980.53	10	979.53			979.53	1.00	
	SUB-TOTAL		15165.10		15165.10		14534.86		621.24	15156.10	9.00	
	Additions:- [illegible] Stocktaking											
R-115	Transceiver Sarch	Unknown.	-	1.00	1.00						1.00	
R-116	" "	"	-	1.00.	1.00						1.00	
R-117	" "	"	-	1.00	1.00						1.00	
R-118	" "	"	-	1.00	1.00						1.00	
			15165.10	4.00	15169.10		14534.86		621.24	15156.10	13.00	

(2) Items R-115-118 found due to stocktaking count on 30/6/89 but not listed in 1987/88 as the date of acquisition is not available and also their value, a nominal value of US$1.00 is given for record purpose as the said radios are very old.

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2

STATION : DDIA .BAB.(HO)
ACCOUNT CODE: 5507-001
ASSET GROUP : PUMPS AND SPRAYING EQUIPMENT

CURRENCY : UNITED STA
FINANCIAL YEAR : ENDING 30TH

Asset No	Description	Acquisition Date/ Year	COST As at 01.07.68	Additions Disposals 01.07.68 to 30.06.69	As at 30.06.69	Rate %	DEPRECIATION As at 01.07.68	Additions (Disposals)	Current	Accumulated As at 30.06.69	NBV
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
P-133	Exhaust Precision	1967	453.33		453.33	10	452.33			452.33	1
P-150	Sprayer Exhaust (L/R)	1958	190.00		190.00	10	189.00			189.00	1
P-150	Sprayer Exhaust	"	190.00		190.00	10	189.00			189.00	1.
P-151	Sprayer, Knapsack	1966	50.00		50.00	10	49.00			49.00	1.
P-196	Pump, Refuelling, Finsbury	1972	173.33		173.33	10	172.33			172.33	1.
P-199	Exhaust Nozzle Sprayer T/Tank	30.08.76	800.00		800.00	10	799.00			799.00	1.
P-199	" " "	"	800.00		800.00	10	799.00			799.00	1.
P-199	" " "	"	800.00		800.00	10	799.00			799.00	1.
P-200	" " "	"	800.00		800.00	10	799.00			799.00	1.
P-201	" " "	27.07.77	800.00		800.00	10	799.00			799.00	1.
P-202	" " "	02.07.77	800.00		800.00	10	799.00			799.00	1.
P-203	" " "	"	800.00		800.00	10	799.00			799.00	1.
P-204	" " "	"	800.00		800.00	10	799.00			799.00	1.
P-205	" " "	"	800.00		800.00	10	799.00			799.00	1.
P-206	" " "	"	800.00		800.00	10	799.00			799.00	1.
P-207	" " "	"	800.00		800.00	10	799.00			799.00	1.
P-208	" " "	"	800.00		800.00	10	799.00			799.00	1.
P-209	" " "	"	800.00		800.00	10	799.00			799.00	1.
P-149	Sprayer Exhaust, L/Cover	1960	190.00		190.00	10	189.00			189.00	1.
P-150	Exhaust Nozzle Sprayer	1977	800.00		800.00	10	799.00			799.00	1.
P-151	Pump Submersible Rotors 3 phase	1973	840.00		840.00	10	839.00			839.00	1.
P-229	" " "	1980	3335.00		3335.00	10	2628.00		328.50	2956.50	328.5
	TOTAL		14971.66		14971.66		14295.66		328.50	14624.16	347.

BEST AVAILABLE COPY

STATION : ADDIS ABABA(HQ)
ACCOUNT CODE: 6607-001
ASSET GROUP : PUMPS AND SPRAYING EQUIPMENT

CURRENCY : UNITED STA
FINANCIAL YEAR : ENDING 3011

Asset Reg No	Description	Acquisition Date/ Year	COST As at 01.07.68	Additions (Disposals) 01.07.68 to 30.06.69	As at 30.06.69	Rate %	DEPRECIATION As at 01.07.68	Additions (Disposals)	Current	Accumulated As at 30.06.69	NBV
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
P-133	Exhaust Precision	1967	453.33		453.33	10	452.33			452.33	1
P-18[illegible]	Sprayer Exhaust (L/R)	1968	180.00		180.00	10	180.00			180.00	1
P-[illegible]	Sprayer Exhaust	"	180.00		180.00	10	169.[illegible]			180.00	1
P-151	Sprayer, Knapsack	1966	50.00		50.00	10	49.[illegible]			49.00	1.
P-18[illegible]	Pump, Refuelling, Finsbury	1972	173.33		173.33	10	172.33			172.33	1.
P-19[illegible]	Exhaust Nozzle Sprayer T/Tank	30.08.76	800.00		800.00	10	799.00			799.00	1
P-195	" " " "	"	800.00		800.00	10	799.00			799.00	1.
P-196	" " " "	"	800.00		800.00	10	799.00			799.00	1.
P-200	" " " "	27.07.77	800.00		800.00	10	799.00			799.00	1.
P-201	" " " "	02.07.77	800.00		800.00	10	799.00			799.00	1.
P-202	" " " "	"	800.00		800.00	10	799.00			799.00	1.
P-203	" " " "	"	800.00		800.00	10	799.00			799.00	1.
P-204	" " " "	"	800.00		800.00	10	799.00			799.00	1.
P-205	" " " "	"	800.00		800.00	10	799.00			799.00	1.
P-206	" " " "	"	800.00		800.00	10	799.00			799.00	1.
P-207	" " " "	"	800.00		800.00	10	799.00			799.00	1.
P-190	Sprayer Exhaust, L/Rover	1968	180.00		180.00	10	180.00			180.00	1.
P-19[illegible]	Exhaust Nozzle Sprayer	1977	800.00		800.00	10	799.00			799.00	1.
P-191	Pump Submersible Motors 3 phase	1973	840.00		840.00	10	839.00			839.00	1.
P-229	" " " "	1980	3285.00		3285.00	10	2628.00		328.50	2956.50	328.[illegible]
	TOTAL		14971.66		14971.66		14295.66		328.50	14624.16	347.[illegible]

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DESERT LOCUST CONTROL ORGANIZATION FOR EASTERN AFRICA

CAMP EQUIPMENT ANNUAL STOCK RETURN

AS AT 30TH JUNE, ~~XXXX~~ 1992

STATION: HQS

Description	Qty. In Stock	Unit Price In US$	Total Cost In US$
Letter Balance	1	10.00	10.00
Hand Pump u/s	1	702.40	702.40
Aprons Boiler Suits	380	9.50	3610.00
Cavas Water Jank	4	417.28	1669.12
Board Notice	21	30.00	630.00
Boot Rubber	5	6.55	32.75
Drums VMROS	193	22.14	4273.02
Hood	120	0.34	40.80
Guage Rain Messuring	10	28.57	285.70
Pump Semitotory	1	25.00	25.00
			22697.49
Total:			

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90

PROTECTIVE CLOTHING & CAMPING EQUIPMENT

DESERT LOCUST CONTROL ORGANIZATION FOR EASTERN AFRICA

CAMP EQUIPMENT ANNUAL STOCK RETURN

AS AT 30TH JUNE, 1992

ACCOUNTS

STATION: HQS

Description	Qty. In Stock	Unit Price In US$	Total Cost In US$
Lamp Preuure	5	35.00	175.00
Camp Chair	14	1.76	~~24.64~~ 24.64
Kalamazoo Leoger	5	25.00	125.00
Matal Camp Table	10	19.00	190.00
Camp Table Wooden	2	20.00	40.00
Tent With Varandah	13	579.71	7536.23
Jerican Matal	7	7.00	49.00
Overals	77	10.59	815.43
Cartridge (Glass)	131	1.08	141.48
Sickle	2	2.50	5.00
Gloves (Set)	11	2.55	28.05
Basins Plattic Cavas	10	2.50	25.00
Net Mosaqito	7	17.10	119.70
Water Filter	13	18.46	239.98
Helmet	27	1.00	~~27.00~~ 27.00
Visors	30	5.50	165.00
Mask	7	5.27	36.89
Stove Primus	7	20.00	140.00
Camp Kit	7	62.50	437.50
Thermos Flask	7	7.00	49.00
Basins Canvas Stamd	11	5.00	55.00
Apron	132	1.24	163.68
Strecher	10	63.33	633.30
Fitting M/Net	7	5.00	35.00
Candel Witer/Filter	12	9.00	108.00
Cash Box	2	10.00	20.00
Camp Bed	2	16.91	33.82
Total C/F			11,418.70

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TABLE 15

ALLOCATION OF VEHICLES AND EXHAUST NOZZLE SPRAYER AS AT 30TH JUNE, 1992

Station	Pick-up 4x4	S/Wagon 4x4	Crew Cab 4x4	Buses	Saloon	Motor Truck	Cycle	Total	Exhaust Nozzle Sprayer		
									Serviceable	Unserviceable	Total
Addis Ababa	9	1	3	3**	4	5	-	25	8	5	13
Nairobi	8	-	-	2	4	3	1	18	4	15	19
Asmara	4	1*	-	1	1	3	-	10	5	5	10
Djibouti	5	-	1	1	1	2	-	10	-	2	2
Dire Dawa	7*****	1	-	1	-	3	-	12	10	7	17
Arusha	3	-	-	1	1	2	-	7	-	-	-
Kampala	3	-	-	1	1	1	-	6	-	2	2
Khartoum	7	-	3	1	1	6	-	18	-	10	10
Hargeisa	4+	-	-	-	-	-	-	4	-	-	-
Mogadiscio	-	-	-	-	-	-	-	-	-	-	-
Total	**50**	**3**	**7**	**11**	**13**	**25**	**1**	**110**	**27**	**46**	**73**

N.B.:

+ - Stored in Djibouti
* - One vehicle boarded
** - Two vehicle boarded
*** - Three vehicles boarded
**** - Four vehicles boarded
***** - Five vehicles boarded

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STOCK OF INSECTICIDES AS AT 30TH JUNE, 1992

Description	STATIONS										Total
	Addis Ababa	Asmara	Dire Dawa	Djibouti	Hargeisa	Mog.	Nairobi	Arusha	Kampala	Khartoum	
Fenitrothion (ULV)95%	5,400	-	2,600	-	-	-	-	-	-	-	8,8000
Fenitrothion 100%	26,000	12,000	-	-	-	-	-	-	-	-	38,000
Sumithion	7,200	-	420	-	-	-	-	-	-	-	7,620
Malathion (ULV)	-	-	-	-	-	-	-	-	-	-	-
Malathion 95%	13,000	-	12,000	21,600	-	-	-	-	-	-	46,600
Malathion 50%	-	4,760	1,420	-	-	-	-	-	-	-	6,180
Diazinon 95%	-	575	2,250	-	-	-	-	-	-	-	2,825
BHC (ULV)	-	-	-	-	-	-	-	-	-	-	-
BHC 20%	4,400	-	40,400	-	-	-	-	-	-	-	44,800
BHC 11%	-	4,500	-	-	-	-	-	-	-	-	4,500
BHC 15%	-	6,800	43,200	-	-	-	-	-	-	-	50,000
BHC 16%	-	1,400	-	-	-	-	-	-	-	-	1,400
Dieldrin	475	-	-	-	-	-	-	-	-	-	475
Dieldrin 20%	-	5,070	18,185	-	-	-	-	-	-	-	23,255
D.D.T. 25% in oil	-	6,785	-	-	-	-	-	-	-	-	6,785
Grand Total											241,130

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AERIAL OPERATIONS (AUGUST TO END OF SEPTEMBER 1993)

1. Dire Dawa Control Centre

	US$
• One fixed wing spray aircraft	
• Fuel for aircraft, 70 hrs survey/control x US$120/hr	8,400
• Daily subsistance allowance	
- One pilot, 60 days x $90/day	5,400
- One engineer, 60 days x $90/day	5,400
- One locust officer, 60 days x $80 /day	4,800
- One Scientist, 30 days x $80/day	2,400
- Flying Allowance, 70 hrs x 15 p.hr	1,050
Total Aerial	**27,450**

Ground Support

• Fuel for M/vehicles	
- 2 vehicles at 160 kms p.d. for 60 days = 3840 litres x $0.40 p.lt.	1,536
• Labour	
- 3 labourers x $8 p.d. x 60 days (Refueling crew)	1,440
• Daily subsistance allowance	
- 2 drivers, 60 days x $20 p.d.	2,400
- 2 Field Supervisors x $ 20 p.d.	2,400
Total Ground Support	**7,776**
Grand Total Aerial Operation Dire Dawa Centre	**35,226**

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AERIAL OPERATIONS (AUGUST TO END OF SEPTEMBER 1993)

2. Jigjiga Control Centre

	US$
• One fixed wing spray aircraft	
• Fuel for aircraft, 70 hrs survey/control at a cost of US$120/hr	8,400
• Daily subsistance allowance:	
- one pilot, 60 days, $80 p.d.	4,800
- one engineer (a/c), 60 days, $80 p.d.	4,800
- one locust officer, 60 days, $80 p.d	4,800
- one scientist, 30 days, $80 p.d.	2,400
- Flying allowance, 70 hrs @ $15 per hr	1,050
Total Aerial	**26,250**

Ground Operations

• Fuel for m/vehicles	
- 2 vehicles at 160 litres/day for 60 days at 5 km/litre - 1920 litres x $0.40 = $768 x 2	1,536
• Labour	
- 3 labourer x $8 p.d. x 60 days (Refueling Crew)	1,440
• Daily subsistence allowance	
- 2 drivers, 60 days x $20 p.d.	2,400
- 2 Field Supervisor x $20 p.s. x 60 days	2,400
Total Ground Support	**7,776**
Grand Total Aerial Operations Jigjiga Control Centre	**34,026**

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AERIAL OPERATIONS (AUGUST TO END OF SEPTEMBER 1993)

3. Asmara Control Centre

	US$
• One fixed wing spray aircraft	
• Fuel for aircraft, 70 hrs survey/control at a cost of US$120/hr	8,400
• Daily subsistance allowance:	
- one pilot, 60 days, $80 p.d.	4,800
- one engineer (a/c), 60 days, $80 p.d.	4,800
- one locust officer, 60 days, $80 p.d	4,800
- one scientist, 30 days, $80 p.d.	2,400
- Flying allowance, 70 hrs @ $15 per hr	1,050
Total Aerial	**26,250**

Ground Operations

• Fuel for m/vehicles	
- 2 vehicles at 160 litres/day for 60 days at 5 km/litre - 1920 litres x $0.40 = $768 x 2	1,536
• Labour	
- 3 labourer x $8 p.d. x 60 days (Refueling Crew)	1,440
• Daily subsistence allowance	
- 2 drivers, 60 days x $20 p.d.	2,400
- 2 Field Supervisor x $20 p.s. x 60 days	2,400
Total Ground Support	**7,776**
Grand Total Aerial Operations Asmara Control Centre	**34,026**

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APPENDIX H

DLCO-EA Aerial Operations 11/92 - 7/93

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DESERT LOCUST CONTROL AERIAL OPERATIONS - DLCO-EA INPUTS

Month	Location	Aircraft	Hours				Area Sprayed (HA)	Chemical Used (Lts)
			Route	RECCE	Spray	Total		
Nov. 1992	**Sudan** Khartoum Elobeid Nyala Kassala Demazin	5Y-BCS	10:10	-	-	10:10	-	-
Dec. 1992	**Sudan** Port Sudan	5Y-BCS	0:50	4:10	18:45	23:95	4150	2075
	Tokar Khartoum	5Y-BCL	11:10	2:05	10:15	23:30	5050	2525
Jan. 1993	**Sudan** Port Sudan	5Y-BCS	0:45	1:25	15:50	18:00	15600	3900
	Tokar	5Y-BCL	0:50	0:50	31:50	33:30	21040	5260
	Eritrea Algeina	5Y-DLD	1:10	15:30	13:50	30:30	13600	3400
Feb. 1993	**Sudan** Tokar	5Y-BCL	9:25	-	8:25	17:50	5360	1340
	Eritrea Massawa Algeina	5Y-DLD	3:20	7:10	9:40	20:10	18400	4600

Month	Location	Aircraft	Hours				Area Sprayed (HA)	Chemical Used (Lts)
			Route	RECCE	Spray	Total		
Mar. 1993	**Eritrea**							
	Asmara	5Y-BCL	12:30	15:15	3:55	31:40	2400	600
	Massawa							
	Algeina	5Y-DLD	0:30	28:4	3:50	33:00	2400	600
Apr. 1993	**Eritrea**							
	Asmara	5Y-BCK	1:35	-	-	1:35	-	-
	Assab							
	Algeina	5Y-BCL	11:45	-	-	11:45	-	-
		5Y-DLD		2:15	-	2:15	-	-
May 1993	**Eritrea**							
	Asmara	5Y-BCK	2:45	9:30	-	12:15	-	-
		5Y-KRD	7:55	-	-	7:55	-	-
	Ethiopia							
	Dire Dawa/ Jigjiga	5Y-DLD	9:55	13:00	12:05	35:00	26600	6400
June 1993	**Ethiopia**							
	Combolcha	5Y-BCK	14:30	6:30	9:35	30:35	6200	1800
	Dire Dawa							
	Mekele							
	Jigjiga	5Y-DLD	5:45	11:10	24:25	41:20	43040	10760
July 1993	**Ethiopia**							
	Dire Dawa	5Y-DLD	4:00	11:25	2:25	17:50	1640	360
	Jigjiga	5Y-KRD	14:10	3:15		17:25		

Month	Location	Aircraft	Hours				Area Sprayed (HA)	Chemical Used (Lts)
			Route	RECCE	Spray	Total		
July 1993	**Eritrea** Asmara	5Y-BCK	7:45	2:45	10:30		800	400
	Sudan Western, Khartoum, Central	5Y-BCS	21:55	32:35	-	54:30		
Total			150:25	172:30	167:35	490:30	186280	44020

Average Spray Dosage	-	0.27 l/ha.
Average Coverage per hour	-	990 ha.
Estimated cost of Aerial Operation at US$ 500/hr.	-	US$245,250

DESERT LOCUST OPERATIONS FROM NOVEMBER 1992 - JULY 1993

Month	Location	Type of Infestation	Area (ha.)	Aerial Control		Ground Control		Aircraft Deployed	Remarks
				Area(ha.)	Pesticides(lts.)	Area(ha.)	Pesticides(lts.)		
Nov. 1992	Sudan Red Sea Coastal Area	Mature adults Hoppers 9 swarms	11,810 4,453 4,106	3,228	1,614	1,225	230 kg.	Hired a/c	1. Not all infestations were controlled due low densities 2. Light to medium density infestations controlled at the rate of 0 25 lt/ha ULV Formulations. 3. Heavy infestations controlled at 0.5-1.00 lt/ha ULV Formulations 4. Ground application at 0 5-1 lt/ha ULV Formulations 5 Dusting carried using a 1-2% active ingredient mixtures
Dec. 1992	Sudan Red Sea Coastal Area	Adult Groups Hoppers 13 Swarms	11,631 4,483 1,825	9,200	4,600 Mal./Fenit.	-	-	DLCO-EA	
	Eritrea Red Sea Coast	Hoppers and fledlings	54,600			5,400	540 Fenit/Mal.		
Jan. 1993	Sudan Red Sea Coast	Adult Groups Hoppers 17 Swarms	13,100 21,800 15,800	34,000	17,000 Fenit.	17,000	8000 kg	DLCO-EA & Hired a/c	
	Eritrea Red Sea Coast	Hoppers 5 Swarms	155,600 2,200	13,600	3,400 Fenit.			DLCO-EA	
Feb. 1993	Sudan Red Sea Coast	Hoppers Fledglings 16 swarms	47,160 40,680 3,970	53,658	37,274 Fenit.	36,122	11,875 kg Dursban 17,256 kg Propxur 8,227 kg Ficam	DLCO-EA & Hired a/c	

Month	Location	Type of Infestation	Area (ha.)	Aerial Control		Ground Control		Aircraft Deployed	Remarks
				Area(ha.)	Pesticides(lts.)	Area(ha.)	Pesticides(lts.)		
	Eritrea Red Sea Coast	Adult Groups Hoppers 15 Swarms	2,800 5,800 7,300	15,900	5,200 Fenit.			DLCO-EA	
Mar. 1993	Sudan Red Sea Coast	Adult Groups Hoppers 27 Swarms	85,081 81,209 13,500			89,000	22,000 Fenit/Mal. 4,200kg		
	Eritrea Red Sea Coast	Adult Groups Hopper Bands 1 Swarm	1,400 1,500 400	3,400	800 Fenit.			DLCO-EA	
Apr. 1993								DLCO-EA surveys only	1. General situation improved in Sudan & Eritrea due to effective aerial control 2. Unconfirmed reports from Eastern Ethiopia & Somalia during this period
May 1993	Ethiopia Eastern Region	Hoppers 8 Swarms	12,170 12,240	24,410	6,090 Fenit.			DLCO-EA	
June 1993	Ethiopia Eastern Region	Hoppers Groups 23 Swarms	19,215 800 13.700	33,715	12,860 Sum.+ Fenit.	6,000	3,000 Sum. + Fenit.	DLCO-EA	

Month	Location	Type of Infestation	Area (ha.)	Aerial Control		Ground Control		Aircraft Deployed	Remarks
				Area(ha.)	Pesticides(lts.)	Area(ha.)	Pesticides(lts.)		
	Eritrea Red Sea Coast	Hoppers 1 Swarm	575 200			775	400 Mal.		
	Sudan N. Central, Khartoum, Kordofan States	32 swarms	4,400	-	-	-	-	DLCO-EA Survey	1. These swarms are believed to have crossed the Red Sea from the Arabian Penis. 2. DLCO-EA a/c and ground teams were carrying out surveys.
July 1993	Ethiopia Eastern Region	4 Swarms	1,628	1,628	454 Fenit.	-	-	DLCO-EA + Hired a/c	1. Extensive surveys in progress with 2 DLCO-EA a/c & ground teams.
	Somalia North Coastal Area	23 Swarms Hopper	8,500 400	- -	- -	- -	- -	- -	1. Preparation underway to deploy one DLCO a/c & hired helicopter
	Sudan Central, Khartroum, Kordofan States	53 swarms	151,966	-	-	-	-	-	1. Extensive surveys undertaken by DLCO a/c. Spray a/c en-route to Sudan.
	Eritrea Red Sea Coast	Hopper 2 swarms Groups	2,00 800 2,040			4,800	3000 Fenit.		Aerial survey and control by DLCO a/c continuing supplemented by ground teams.

SUMMARY FOR 9 MONTHS OPERATIONS, NOVEMBER 1992 TO JULY 1993

1.	Total infestations (ha.)	Hopper	410,965
		249 swarms	242,535
		Groups	169,342
	Total area (ha.)		**822,842**
2.	Controlled Area (ha.)	Air	192,739
		Ground	160,362
	Total (ha.)		**353,101**
3.	Insecticides - ULV,	Fenitrothion/ Sumthion/ Malathion (lts.)	118,232
		Poisoned Baits/ Dust (kgs.)	49,788
4.	DLCO-EA Inputs		
	- No. of aircraft	5 (5Y-DLD, 5Y-BCK, 5Y-KRD, 5Y-BCL, 5Y—BCS)	
	- Hours flown	490:30	
	- Man-days (crew)	1138	

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AGENCY FOR INTERNATIONAL DEVELOPMENT
BUREAU FOR AFRICA
Disaster Response Coordination Office
AFR/AA/DRCO

COUNTRY SPECIFIC SUPPLEMENTARY ENVIRONMENTAL ASSESSMENT (SEA)
TO THE PROGRAMMATIC ENVIRONMENTAL ASSESSMENT (PEA)
FOR LOCUST/GRASSHOPPER CONTROL IN AFRICA AND ASIA

FINAL ACTION FORM

COUNTRY: SOMALIA

DATE: November 1993

Recommendation:

ACTION TAKEN:

Approved: ✓ Date 3/17/94

Disapproval: _____ Date _____

Bureau Environmental Officer, John Gaudet: _____

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