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SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT

OF THE

ERITREAN LOCUST CONTROL PROGRAM

United States Agency for International Development

Mission to Eritrea

In Cooperation with the Provisional Government of Eritrea

Asmara, Eritrea

March 1993

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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 an AID/W Technical Assistant with the support from the Provisional Government of Eritrea. Document Preparers and contact persons are listed in Appendix A.

This document has been reviewed by A.I.D./Ethiopia, the Provisional Government of Eritrea, and AID/W. It reflects the best current description of future options for the USAID assistance programs to the Eritrean Department of Agriculture (DOA) and to the Desert Locust Control Organization for Eastern Africa (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. Encouragement is given for the use of alternatives to chemical pesticides, along with prudent and environmentally sound use of pesticides when these materials are necessary. The commitments for any possible future program are contingent on the future needs for locust control, the capabilities of the DLCO-EA, and on a decision by A.I.D. to provide assistance.

LIST OF ACRONYMS AND ABBREVIATIONS

AChE	AcetylCholinesterase
AELGA	African Emergency Locust/Grasshopper Assistance Project - USAID/Washington
A.I.D./W	Agency for International Development, Washington, D.C.
APHIS	Animal and Plant Health Inspection Service of USDA
CFR	U.S. Code of Federal Regulations
CIDA	Canadian International Development Agency
DLCO-EA	Desert Locust Control Organization for Eastern Africa
DOA	Eritrean Department of Agriculture
EA	Environmental Assessment
EEC	European Economic Community
EPA	U.S. Environmental Protection Agency
EPLF	Eritrean People's Liberation Front
FAO	Food and Agriculture Organization of the United Nations
GTZ	German Technical Assistance Agency
ha	hectare (100 m x 100 m)
IFAD	International Fund for Agricultural Development
IPM	Integrated Pest Management
km	kilometer
mg/kg	milligrams per kilogram
ODA	Overseas Development Administration, United Kingdom

OFDA	Office of Foreign Disaster Assistance
OP	Organophosphate insecticide
PEA	Programmatic Environmental Assessment
PGE	Provisional Government of Eritrea
ppm	parts per million (ambient concentration)
SEA	Supplemental Environmental Assessment
SIDA	Swedish International Development Agency
USAID	United States Agency for International Development
USAID/Ethiopia	- USAID Mission to Ethiopia, head office located in Addis Ababa, field office in Asmara, Eritrea

1.0 EXECUTIVE SUMMARY

This assessment is a supplement to the Programmatic Environmental Assessment (PEA) for Locust and Grasshopper Control in Africa and Asia. It was developed to provide explicit, country-specific environmental details and guidance in Eritrea to allow A.I.D. assistance in regard to locust management. The material in this document considers the specific locusts and species in Eritrea, 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. Both documents should be consulted during planning and operational stages of implementation .

The information contained in this document is intended for use by USAID/Ethiopian Mission in Eritrea, the Eritrean Department of Agriculture (DOA), the Desert Locust Control Organization of Eastern Africa (DLCO-EA), and the Food Agricultural Organization of the United Nations (FAO/UN) to guide environmentally sound desert locust management in Eritrea. Additional relevant information should be added to this SEA in the future as appropriate, in the form of appendixes.

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

This document therefore, recommends that any U.S.-funded assistance concerning locust management should promote the development of preventive pest management program for locust control. An IPM program reduces pesticides usage by relying on effective monitoring, forecasting and a variety of locust control methods; using insecticides only when necessary. Non-chemical methods of locust control include: destroying locust eggs by turning the soil, burning abandoned fields in wadi areas to destroy potential locust breeding grounds, and applying micro-organisms (that are pathogenic to locusts, but not humans) to locust breeding ares. This SEA recommends that FAO take the lead in this area, as this organization has had considerable experience in Africa with such efforts.

Environmental awareness is emphasized. The fragile ecosystems surrounding rivers, the Red Sea coast, and the Dahlak Islands merit

special attention. Fragile ecological areas 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 protected areas should be observed in any U.S.-funded locust control operation.**

Training must be part of any USAID pest control assistance program. Pesticide safety and the environmental effects of pesticide use and misuse should be conveyed to DOA personnel, to DLCO-EA personnel, and to the general public through education and public awareness campaigns. Farmer training and Village Brigades can be an important part of management operations, and their use should be stressed.

Proper pesticide management must be a priority in locust control operations. Because misused pesticides affect both the environment and crop production in terms of increased costs, any locust control program must consider possible consequences carefully. Pesticide storage and application are important components of pesticide use. 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 Provisional Government of Eritrea to enforce Ethiopian regulations dealing with pesticides, until Eritrea drafts its own pesticide regulations. These issues must be fully considered and monitored in a USAID-funded activity.

Monitoring of pesticide effects on non-target species and the environment should be included as an integral part of any pesticide use program. Monitoring results should be used in the planning and operational phases of future locust control programs to adjust or curtail environmentally damaging operations.

This SEA suggests that Eritrea should monitor environmental pesticide residues. Analysis of blood acetylcholinesterase levels in organophosphate (OP) insecticide handlers and applicators is recommended, and should be part of a U.S.-funded program.

As of March 1993 the DLCO-EA in Eritrea had 10,000 liters of fenitrothion and 4,000 liters of malathion. DOA in Eritrea had a variety of pesticides, including 7000 kg of expired Actellic. DOA has four storage sites for pesticides: two of the facilities are buildings in the DOA compound; one site is at a shipping-container stock yard; and the final facility is a 10 m X 10 m X 5 m room in the Gwonderan district of Asmara. Families reside in the

rooms above and adjacent to the Gwonderan storage facility. The barrels of pesticides stored there are leaking. **Decontamination of the Gwonderan facility should begin as soon as possible.**

2.0 PURPOSE AND PROCEDURES

2.1 Background

2.1.1 The Purpose of this SEA

Due to an outbreak of locusts in Sahelian Africa in 1987, 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 provide assistance for procurement and use of pesticides for locust control without full compliance with the Agency's environmental procedures. The waiver expired on 15 August 1989. Since then, all USAID assistance for procurement and use of pesticides must fully comply with the Agency's environmental procedures. The 1989 Programmatic Environmental Assessment (PEA) and the country-specific Supplemental Environmental Assessments (SEAs) will serve as the basis for these regulatory procedures. The SEAs contain specific environmental information and provide guidance on environmentally sound pest management procedures for pesticide use against locusts and grasshoppers in a particular country. SEAs have been completed and approved for most of the Sahelian countries as well as for Morocco, Tunisia, 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, Publ. Series No. 91-7.

Locust and grasshopper control involves preventive intervention as well as emergency response. Ideally, locust management will negate the need for emergency response. The current outbreak of locusts in Eritrea requires rapid, coordinated preventive measures to avoid the development of a locust plague. Such a plague would certainly devastate Eritrea's and Ethiopia's agricultural production, and would threaten that of North Africa and parts of Western Asia.

Unfortunately the Desert Locust Control Organization for Eastern Africa (DLCO-EA) is severely limited in its preventive capacity due to funding problems and the civil strife. The most urgent task is to supply DLCO-EA with the necessary 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 Desert Locust outbreak areas. This SEA will describe both the immediate and long term measures necessary to achieve environmentally sound locust management in Eritrea.

2.1.2 The Unique Political Situation in Eritrea and its Relation to the Locust Problem

In May 1991, the Eritrean-Ethiopian war ended. A referendum on 24 April 1993 will determine whether or not Eritrea is an independent nation. Eritrea is no longer under Ethiopian rule, but it is not yet a fully independent nation. Eritrea is currently governed by a provisional government established by the Eritrean People's Liberation Front (EPLF). This SEA will apply to the pre- and post-referendum period of Eritrea, regardless of the outcome of the referendum.

Eritrea currently has no laws regulating the use, storage, or disposal of pesticides. The Provisional Government of Eritrea's Department of Agriculture (DOA) use DLCO-EA guidelines for pesticide usage in lieu of national regulations when treating for locusts.

Eritrea has no effective intrinsic capacity to deal with the locust outbreak. Access roads to northern Eritrea are land-mined, making access by land extremely dangerous. Land mines also prevent DLCO from surveying key areas by ground for locust outbreaks. The Provisional Government of Eritrea requested motorized and manual sprayers from the Food and Agriculture Organization (FAO) of the United Nations (UN). Spray aircraft were mobilized through the DLCO-EA (with a special allocation from the FAO) for aerial control operations.

2.1.3. Relation to USAID/Ethiopia Program

Should USAID/Ethiopia choose to provide chemical pesticides to Eritrea, 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 Eritrea.

2.2 Drafting Procedure

A.I.D. 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 produced in March 1993 by a consultant, Dr. Gary C. Jahn. The USAID/Ethiopia Mission and AFR/ONI/TPPI in AID/W assisted in the preparation of this draft by providing logistical support for needed field work, reference documentation, and contacts within the Eritrean government.

2.3. Previous Assessments

The previous assessment concerning this subject, and the primary supportive document is the Programmatic Environmental Assessment for Locust and Grasshopper Control in Africa/Asia (TAMS/CICP, 1989) (PEA). The PEA covers grasshopper and locust control operations in Africa and Western Asia. 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 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, and Madagascar;

(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) Needs Assessments of SEAs to be conducted in Botswana, Tanzania, and Zambia.

These documents, Internal USAID/Ethiopia data, and Internal USAID/Eritrea data were used in this SEA without citation. Other relevant documents are cited in section 5.0 and Appendix C.

2.4 Environmental Procedures

2.4.1 Eritrean Pesticide Regulations

Eritrea does not have procedures equivalent to the U.S. National Environmental Policy Act (NEPA) or USAID Environmental Procedures. The provisional government does not have any regulation governing pesticides. Instead, Eritrea is relying on the FAO guidelines established for DLCO-EA to govern pesticide usage. These guidelines are consistent with the USAID environmental regulations: 22 CRF Part 216, A.I.D. Environmental Procedures; Foreign Assistance Act, Section 117, Environment and Natural Resources; and the 1991 A.I.D. Pest and Pesticide Management Guidelines. Eritrea is also using Ethiopian pesticide regulations until Eritrean pesticide regulations can be enacted.

This SEA recommends that A.I.D. support FAO leadership in assisting Eritrea to develop national pesticide regulations. The FAO codes of conduct regarding pesticide safety may be a logical starting point for those concerned with creating Eritrean pesticide regulations.

2.4.2 Other Environmental Regulations in Eritrea

While Eritrea has national parks and forests where building of homes is prohibited, there are no restrictions on where pesticides can be applied. This SEA recommends that the Provisional Government of Eritrea establish designated zones, especially of fragile habitats, that are protected from pesticide use.

2.4.3 U.S. Regulations

It is USAID policy to ensure that any negative environmental consequences of an A.I.D.-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 pesticide use are recommended when appropriate, and considered to be part of an overall integrated pest management (IPM) program.

According to <u>Pest Management Guidelines of the Agency for International Development</u> (1991):

"A.I.D.'s regulations require that the potential environmental consequences of A.I.D.-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(c) of the 1991 Approbation 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 to Eritrea will be regulated by U.S. pesticide regulations 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 Appendix F). In a U.S. 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 and lindane.

3.0 LOCUST SITUATION IN ERITREA

3.1 Locust infestation of July 1992 to March 1993

The origins of the infestations are uncertain. Locust breeding occurred on the central Tihama of Saudi Arabia between April and June 1992. These locusts were presumably controlled, but survivors may have moved westward. In July 1992 a locust upsurge in the central and southern Red Sea coastal plains of Eritrea, Sudan, Saudi Arabia, Yemen, and Egypt was reported by DLCO. 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 latest infestation probably has multiple origins. This is typical of locust upsurges in the Red Sea trench in winter and spring.

Above average rainfall in September and October of 1992 led to an upsurge of desert locust in the winter breeding areas along the Red Sea Coast of Yemen, Sudan, and Eritrea (Map 1). Adult locust started breeding and two generations probably occurred before the first swarms 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, where they develop wings and start to swarm. Unfortunately, these efforts were not sufficient and the locusts produced a third generation of gregarious hoppers.

By January 1993 there were desert locust outbreaks in at least three separate areas of Eritrea, though the locusts were still in the desert. Locust outbreaks usually result in partially gregarised populations that die without producing hopper bands. In February 1993, however, fully gregarised populations produced hopper bands in Eritrea and Sudan. There were over 1000 adult desert locusts per hectare, and more than 5000 hoppers per hectare. All of the locusts in a band were at the same stage of development. Desert locusts infested a total area of approximately 1180 km^2. By late February 158.08 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.

The sprayed area included land mined areas from Masawa to Alg Ma'amas. The land-mines prohibited ground survey and ground spraying. Air surveys indicated that the conditions and vegetation in the mined areas were suitable for locust breeding. However, air surveys were not sufficient to indicate whether or not locusts were present. DLCO-EA assumed that locusts were in the mined areas and blanket sprayed ULV fenitrothion 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 wildlife, was high. Under these conditions it may 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. Bioaccumulation is also less of a problem with acephate and malathion than with fenitrothion. However, fenitrothion is one of the A.I.D.-approved insecticides. A complete list of pesticides approved by A.I.D. for locust control is given in Appendix F. 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 Appendix F can be found in the PEA.

As of 1 March 1993, 1022 km^2 of locust-infested desert remained to be treated. After assessing the pesticide inventory (section 3.6) of DLCO-EA and DOA-Eritrea, USAID determined that 25,000 liters of 96% ULV malathion were needed to prevent a locust outbreak.

If the desert locust infestation was not controlled

successfully, it could have spread into the northeastern and eastern parts of Ethiopia, the Ogaden, and Somalia in April and May. More rain was expected from late June through the beginning of September. Temperatures were expected to increase steadily from March until September. All of these factors tended to favor plague formation. It was possible that a plague could begin early enough to affect the 1993 main rainy season planting. The outbreak of locusts in Eritrea required rapid, coordinated preventive measures to avoid a locust plague. A plague cycle would have serious consequences for agriculture in Eritrea, Ethiopia, and Sudan, and possibly points further West to Sahel.

3.2 Agricultural Resources

The donor community and the Provisional Government of Eritrea expect food stocks to exceed those of the past 30 years which were extremely low due to war and drought. Whether or not Eritrea has adequate food stocks for it's expected needs is a source of controversy. First of all, there are no reliable statistics on the population of Eritrea. Estimates range from 2.7 to 4 million. The number of refugees that will return to Eritrea is unknown. Another problem in making these estimates is in determining crop production. Given the decades of drought and war that have ravaged Eritrea, there is no historical basis for estimating production in peace time with favorable weather conditions. USAID/Ethiopia estimates that undelivered 1992 food assistance and present food stocks will provide Eritrea with a 1993 surplus of 42,000 metric tons. However, a locust plague could result in losses of 150-170 thousand metric tons of food.

Due to unusually heavy rains in September 1992 (Map 2) and the end of the war in May 1991, Eritrea has an opportunity to achieve food self-sufficiency for the first time in 30 years. It would indeed be a tragedy if this opportunity were lost to a locust plague.

If the plague spreads to Ethiopia the situation could be even worse. Even without a locust plague the Food and Agriculture Organization/World Food Program (FAO/WFP) forecasts a structural food aid import need of 530,000 metric tons of cereal and an emergency food need of 340,000 metric tons for Ethiopia for 1993. These emergency requirements do not include the food needs of refugees and returnees. In 1991/92 Ethiopia produced approximately 7.1 million metric tons of cereals and pulses (Table 1). Thus, the estimated need for imported food is at least 12.4% of last year's production, without including the needs of refugees and returnees. According to FAO/WFP, approximately 4.5 million people in Ethiopia are at risk of not having enough food in 1993. A locust plague in

Ethiopia could place an additional 1 million people at risk of starvation.

3.3 Desert Locusts

The following plague species of locust are found in Eritrea: 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 northern highlands of Ethiopia (Tigray and Eritrea) slow the movements of desert locusts to the breeding areas of the Red Sea coast. This means that potential desert locust plagues originating in east Africa can be prevented if action is taken during or before localized outbreaks in Eritrea and Sudan.

Most of the crops grown in Eritrea are subject to desert locust infestation, including: bulrush millet, sorghum, maize, wheat, barley, fruit trees, and vegetables. 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. 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 grain, fruit, vegetables, meat, and dairy products. By destroying seeds, a locust plague can affect local crop production for years.

Eritrea hosts the spring, summer, and winter breeding areas of the desert locust. Egg incubation periods vary from region to region, and vary with the change in seasons due to differences in the weather. Below 1500 m eggs incubate for 15 to 17 days in June, 10 to 23 days in July, 10 to 20 days in August, and 10 to 12 days in September. Above 1500 m, eggs incubate for 13 to 23 days in July and 14 to 20 days in August. Along the Red Sea coast eggs incubate for 12 to 29 days in January, 11 to 22 days in February, 10-15 days in April, 15 days in June and July, 12 to 16 days in August, 10 to 16 days in September, 9 to 17 days in October, 1 to 18 days in November, and 9 to 25 days in December. Desert locust eggs are generally not found along the Red Sea coast in May. Hopper development to adulthood takes 24 to 48 days.

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.** Adult desert locusts and hoppers are found in Eritrea during recessions. If the locust population rapidly increases in a fairly localized area, this is known as an **outbreak.** If the population increase continues and gregarization spreads across regions while swarms move well beyond the initial outbreak areas, a **plague** may result. When there are many bands and swarms over large areas (perpetuated by large scale breeding, a plague is in process. Ideally, swarming should be prevented through locust management, rather than controlled as an emergency measure. Prevention is more economical and is less damaging to the environment than emergency response.

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. The locusts were not yet swarming when they were first detected, but during the Indian monsoon season swarms began to form in north-western India. These locusts invaded Persia (Iran) and the Arabian Peninsula where fresh breeding began. By the summer of 1941 the plague had spread to Egypt, Sudan, and Eritrea. Due to the 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. A complete account of the campaign has never been published. 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 operation. Emphasis was placed on military cooperation. Control operations began in Sudan in 1941, but the first major expedition to control the locusts was in 1943-4.

The plague temporarily subsided in 1947. Applications of sodium arsenate and BHC (used for the first time against locusts) had prevented major crop losses. 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. In Eritrea, the campaign cost 150,000 British pounds for one year

alone.

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 parts of Saudi Arabia that had received rain. 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.

In 1963, the plague's epicenter in Saudi Arabia died out. It is not know if the control efforts contributed to the end of the plague, or if weather conditions were sufficient to stop the plague. A period of recession followed until 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. Dieldrin and BHC were the main insecticides used. Dieldrin, BHC, and all other chlorinated hydrocarbon insecticides are no longer used for locust control, due to the environmental damage caused by these chemicals.

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 (Showler 1993). From 1986-89 DLCO coordinated a campaign against locust outbreaks in Eritrea, using fenitrothion (also called Sumithion, and Folithion). In spite of the war between Eritrea and Ethiopia, DLCO was given permission by both parties to fly spray planes from Ethiopia to Eritrea and return. Neither the Eritrean People's Liberation Front (EPLF), nor the Ethiopian military interfered with DLCO operations. In fact, some members of the EPLF and of the Ethiopian military worked for DLCO. Apparently weather conditions, and not crop protection tactics, caused a decline in desert locust activity in early 1989 (Potter and Showler 1990, Showler and Potter 1991).

3.4.2 Crop Loss Assessment

All crops in the region, except coffee and prickly pear cactus, are at risk. Based on the history of grain loss in Eritrea and Ethiopia during locusts 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, it is enough grain to feed 1 million people for a year. Eritrea does not have the financial resources to buy 150,000 metric tons of grain, or to pay for the transportation of it.

3.5 Locust Management Operations

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

The Desert Locust Control Organization for Eastern Africa (DLCO-EA) was established by an international convention signed in Addis Ababa on 22 August 1962. DLCO-EA headquarters were originally in Asmara, but were moved to Addis Ababa during the war. Headquarters remain in Addis Ababa. DLCO-EA has a branch office in each member nation, as well as an office in Asmara. Member nations are Ethiopia, Djibouti, Kenya, Somalia, Sudan, Tanzania, and Uganda. The objectives of DLCO-EA are:

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

2) to offer services in the coordination and reinforcement of national action against desert locust 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 quelea, and Armyworm.

The DLCO-EA staff consists of 60 professional and 290 general service staff who serve under three specialized departments: Operations, Scientific Research, and Administration and Finance. Finances are obtained from annual contributions paid by member countries. Only Ethiopia has paid its contribution in full. The

lack of steady funding has made
DLCO-EA difficult to operate. Salaries are often paid several months late. In addition to the contributions of member countries, DLCO-EA receives external assistance from a variety of donors including, FAO, the Swedish International Development Organization (SIDA), ODA(UK), EEC, GTZ, CIDA, and IFAD. The external assistance is generally given during emergency locust outbreaks. External assistance is in the form of money, equipment, and technical assistance.

On 10 March 1993 the capacity of DLCO-EA in Eritrea, prior to assistance from donor agencies, was as follows:

1) Aircraft: 2 Beaver airplanes in Eritrea, 5 Beaver airplanes total;

2) Ground transport: two land rover pickups in Eritrea;

3) Protective clothing: only a few respirators; immediate need for 25 suits of protective clothing/equipment;

4) Insecticides: (see section 3.6);

5) Spray equipment: Four exhaust-driven mist blowers and 40 hand operated sprayers;

6) Communication: DLCO-EA headquarters in Addis Ababa had radio linkages with DLCO offices in Eritrea, Sudan, and Kenya; planes were in communication with Asmara, but trucks could not communicate with planes or other trucks;

7) Camping equipment: 4 sets;

8) Salaries: staff of DLCO-EA had not been paid for the past three months.

Only fenitrothion was being applied by DLCO-EA and DOA for desert locust control when the drafter of this document arrived in Eritrea on 4 March 1993. USAID and DLCO-EA independently determined that there was an immediate need for 25,000 liters of ULV malathion in order to prevent a locust plague. USAID supplied the malathion to DOA (see 3.5.2). SIDA sent $70,000 to DLCO of Eritrea for vehicles. FAO sent $50,000 to DLCO-EA in Eritrea for aircraft parts and fuel. Helicopters for surveying and spraying were not an immediate priority, since the locusts were still in the lowlands where they are accessible by aircraft. In the event that locusts move into the highlands, helicopters could be leased by

USAID. Locust breeding generally does not occur in the highlands until July.

3.5.2 The Provisional Government of Eritrea Department of Agriculture (DOA)

DOA is officially under the direction of the Ethiopian Ministry of Agriculture although at times it had been functioning independently. During the last few years of the war, DOA was non-functional for all practical purposes. Since May 1991, when the war ended, DOA has functioned independently of the Ethiopian Ministry of Agriculture. Most of DOA's supplies were originally provided by the Ethiopian Ministry of Agriculture. This includes most of the pesticides (see section 3.6). The Provisional Government of Eritrea DOA received additional supplies in March 1993 from USAID and SIDA. USAID/OFDA sent 25,000 liters of ULV malathion, 25 sets of protective clothing and safety equipment, and 5 mobile radios for locust control operations in Eritrea at an approximate total cost of $300,000. SIDA donated $500,000 to DOA for vehicles, fuel, spare parts, and camping equipment.

3.5.3 Village Brigades

The staff of DOA is quite small, about 20 people, so DOA relies on volunteers for large scale operations. The volunteers are mainly local farmers. According to Mr. Bereke Ogbamichael, the assistant secretary of DOA, DOA gave 360 farmers one month of training in pesticide application and safety procedures in 1992. In 1993 DOA plans on training 600 more farmers. The trained farmers have already been utilized (though not all at once) for some locust control operations.

Farmers can play a major role in a desert locust control campaign: from reporting population levels to actively protecting crops from hopper infestations. Farmers that are enlisted to apply insecticides must first pass a training course on pesticide usage and safety. A.I.D. and FAO have had highly successful "Train the Trainer" pesticide use and safety programs. Since 1987, these programs have been implemented in some parts of Africa that are subject to locust infestations.

The drafter of this document did not observe any farmer brigades or any training programs in Eritrea. Given the lack of safety equipment at DOA, and that DOA personnel seemed unfamiliar with the correct way to wear and use a pesticide respirator, it seems unlikely that Eritrean village brigades are receiving

appropriate instruction (or equipment) for safe pesticide usage. Future A.I.D. trips to Eritrea should include an analysis of the effectiveness and adequacy of the DOA village brigade program (see Appendix B.9, 15, 23, 30, 37, and 38 for recommendations concerning village brigades).

3.5.4 Crop Protection versus 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 (Duranton et al. 1989, FAO 1989, Showler and Potter 1991). 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.

Integrated Pest Management (IPM) is an important part 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 are only used when necessary, thereby reducing the environmental impact of locust control operations.

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.

The DLCO-EA should ensure that each DLCO-EA station 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.

3.6 Pesticide Management

As of March 1993 the DLCO-EA in Eritrea had 10,000 liters of fenitrothion and 4,000 liters of malathion. These were stored outside under relatively safe conditions. There were an additional 14,600 liters of malathion and 7,600 liters of fenitrothion at the DLCO in Addis. The pesticides in Addis were available for desert locust control in Eritrea or any member nation of DLCO-EA. These pesticides were held in a large concrete, well-ventilated building. The pesticides at the DLCO storage facility in Addis were 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. Expired pesticides were not separated from useable pesticides. The problems with this facility were explained to Dr. Karrar, the director of DLCO-EA. 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.

The Eritrean DOA has the following stock of pesticides:

1)	Fenitrothion	1000 ULV	=	7,200	liters
2)	"	95 ULV	=	800	"
3)	"	98 ULV	=	600	"
4)	Basudin	60 ULV	=	5,800	"
5)	Cypermethrine	ULV	=	600	"
6)	Fenitrothion	50% E.C.	=	60,000	"
7)	Sumithion	50% E.C.	=	9,000	"
8)	Cypermethrine	5% E.C.	=	15,100	"
9)	Malathion	65% E.C.	=	13,000	"
10)	Actellic	50% E.C.	=	20,000	"
11)	Actellic	2% dust	=	7,000	kg (Expired)
12)	Propoxur	2% dust	=	5,000	kg
13)	Endosulfan/Thiodan	35% E.C.	=	20,000	liters
14)	2,4-D Amine	liquid	=	7,920	"
15)	DDT	dust	=	5,000	kg
16)	Dursban (Chlorpyrifos)	dust	=	6,500	kg

DOA-Eritrea keeps these pesticides in three storage facilities at their office and two shipment containers outside of Asmara.

In addition, there is another storage area in an abandoned factory in the Gwonderan district of Asmara. The Gwonderan facility is a public health hazard. The facility is a room of

approximately 10 m X 10 m X 5 m. located in the ground floor of a former factory. The factory has been converted into an apartment building. Families reside in the rooms above and adjacent to the storage facility. The barrels of pesticides stored there are apparently leaking, as the floor is oily and sticky. Dust and oil cover most of the drums of pesticide. Manufacturing dates and expiration dates are absent, or not visible, in most cases. The smell of the pesticides is extremely strong. Although the door to the room is always locked, the window to this facility is broken, and fumes are noticeable even when the garage-type door is closed.

Decontamination of the Gwonderan facility should begin as soon as possible:

First, powdered limestone should be placed on the floor to neutralize certain pesticides, hazard signs should be placed on the facility, and the broken window should be securely covered to prevent people and animals from entering the facility.

Second, all containers of pesticides should be removed from the area. Then, at an alternate storage location, the pesticides should be transferred to barrels which do not leak. If any of the pesticides are still viable they should be properly stored at the alternate site for future use. Otherwise, they should be stored at the alternate site until they can be properly disposed of. A possible storage location is a former Ethiopian military barracks, now held by the Eritrean People's Liberation Front (EPLF). The site is approximately 40 km. from the city of Asmara and is continuously guarded by the EPLF.

Third, the room must be completely decontaminated so that it can be put to a better use.A toxicologist should be consulted to determine the proper procedure for decontamination. A physician specializing in pesticide poisoning should examine the residents of the building.

The Gwonderan storage room contains these pesticides:

1) Ekatin (#27407 038)	13	(100 l)	drums =	1,300 liters
2) Malathion 75% in oil	61	(200 l)	drums =	12,200 liters
3) 2,4-D Amine (91/02)	371	(5 l)	bottles =	2,055 liters
4) Sumithion (Pharmecor)	13	(200 l)	drums =	2,600 liters
5) Diazonon	11	(100 l)	drums =	1,100 liters
6) Dieldrin	10	(200 l)	drums =	2,000 liters
7) DDTox 20%	71	(200 l)	drums =	14,200 liters
8) ULV Fenitrothion 96%	20	(200 l)	drums =	4,000 liters

3.7 Cultural and Biological Control Tactics

The major locust habitats in Eritrea are created by the practice of 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. Among the cultural practices which discourage locust plagues are: use of irrigation to avoid dependence on seasonal rains and floods for growing crops, weed control, and destroying abandoned fields (e.g., by burning). To prevent erosion, or maintain the water table it may be desirable to have plant cover in an abandoned area. In such cases, plants which locusts do not favor should be planted in the area. Coffee and most types of cactus are examples of plants that locusts generally will not feed on. These cultural practices could be part of an integrated pest management (IPM) program for desert locusts.

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 intervention thresholds, correct timing of sprays based on pest population dynamics, and biological control agents. Among the biological control agents with the potential for use in locust management are: the bacteria Coccobacillus acridiorum d'Herelle; the fungal pathogen Beauvearia bassiana, Metarhizium flavoviridae; various microsporidia in the genus Nosema; and nematodes. An important research project would be a search for local strains of egg parasites of locusts in Eritrea. Until such parasites are discovered or other exotic straines are screened against the desert locust eggs in Eritrea, the eggs can be destroyed by cultural control. When egg-laying sites are discovered the soil is turned to expose eggs to the sun and to predators. This practice is apparently quite effective for eliminating locust eggs. The difficulty lies in finding the eggs.

Missions to destroy locust eggs could utilize Village Brigades (section 3.5.3). Each Village Brigade could consist of a group of 5-10 or more interested and enthusiastic villagers, farmers, or nomads. The participants would receive intensive training for 3 or

more days and the training could 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, collection and egg-destroying techniques.

3.8 Safety and Human Health

3.8.1 Public Awareness

It is important that the Provisional Government of Eritrea monitor the effects of pesticides on human health and the environment. 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 Eritrean public must be informed that pesticides are dangerous and that empty pesticide containers should not be used for food or water storage. 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 (Potter and Showler 1990, Showler (in press)). 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) prevention of pesticide poisoning.

8) warnings against the use of empty pesticide containers for the purposes of storing water, feed, or animal feed

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

3.8.2 General Pesticide Safety Concerns

Pesticide misuse and improper storage presents hazards to the health of the general public and to the environment. Pesticides should be stored away from humans and animals. The situation at Gwonderan clearly violates this principle (section 3.6). Unwanted or leaking pesticide containers must be repackaged or disposed of as soon as possible. Until the Provisional Government of Eritrea drafts its own pesticide legislation, the Ethiopian pesticide regulations should be enforced.

3.8.3 Handler & Applicator Safety Training

A.I.D. supports pesticide safety training in Africa. Pesticide handlers and applicators working for DLCO-EA or DOA should be trained in pesticide safety. Every U.S.-funded pesticide donation should be overseen by a properly trained pesticide handler. A.I.D. can encourage the University of Asmara, College of Agriculture to include hands-on pesticide safety and application courses as an essential part of an agricultural degree if such courses are not currently offered.

Properly trained DOA and DLCO-EA personnel are encouraged to work with farmers and Village Brigades in "Train the Trainer" programs. This type of training allows essential information on pesticide safety and application to reach everyone working with pesticides. A.I.D. encourages this type of training.

3.8.4 Monitoring of Human Exposure

DLCO-EA and DOA probably do not have the capability to monitor either the behavioral or chemical symptoms of pesticide poisoning. Behavior symptoms include the loss of muscular control. Chemical symptoms include acetylcholinesterase (AChE) inhibition. Testing all pesticide handlers for blood AChE inhibition should be a part of the requirements for all U.S.-funded pesticide operations that use organophosphates (OP). This is a fairly simple and inexpensive test. It can be performed by trained health workers in the field. The background cholinesterase level for each person involved with organophosphate 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.

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4.0 ENVIRONMENT

4.1 Eritrea - Environmental Profile

An air and ground-based 8 hour field trip to northern Eritrea was undertaken as part of the preparation of this document. In addition to the locust bands and swarms, the drafter observed a tremendous variety of plant and animal life in the Eritrean desert. Among the animals observed were hawks, swallows, snakes, and jackals. There are also Nubian ibex found in the northern tip of Eritrea. Plants observed included cacti, wild melon, and various wild and domestic cereals. Eritrea and Ethiopia are also the home of the Abyssinian Rose, the only rose that is indigenous to Africa.

Even in very remote desert regions of Eritrea, nomadic people and their camels were seen. The desert is not a collection of lifeless sand dunes, but a unique and thriving ecosystem, rich in biological diversity, as well as supporting human life. This is why environmental protection, including human health protection, must be given due consideration during locust control operations.

4.2 Climate

Eritrea can be divided into three major climatic zones: the central highlands, the coastal region, and the western lowlands.

Highlands: the hottest month is May with highs around 85°F; coldest months are December through February with lows around 32°F. The difference between each day's high and low temperatures is about 33 degrees. There are two rainy seasons. The short rainy season is in March and April. The main rainy season is from late June through the beginning of September. Fog is common during the main rainy season and from December through February.

Coast: the hottest months are June - August when daily temperatures range from 72°F to 105°F. During the coldest season, December - February, the temperatures range from 65°F to 90°F. The northern coast has a rainy season from December through February. Rain is rare along the southern coast.

Western lowlands: high temperatures can reach 105°F during the hottest months, April - June. During the coldest month, December, the temperature falls to 55°F. The difference between each day's high and low temperatures is about 38 degrees. Rainy seasons are similar to the highlands.

4.3 Restricted Habitats

Under current Eritrean law there are no protected areas, though the Dahlak Islands are being considered. Until the referendum in April 1993 (to vote on the issue of Eritrean independence), there will be no legislation concerning national parks or other forms of protected land.

Based on aerial and land surveys, and on discussions with DOA, DLCO, and the Eritrean Dept. of Marine Resources and Inland Fisheries this SEA identifies the following areas as critical habitats (Map 2):

1) Red Sea coast: the Red Sea is a major source of seafood for the Middle East. The Red Sea coast provides a unique habitat for a variety of wildlife, including birds. The migration routes of storks pass through this area. Acacia and fig trees are grown in the human settlements along the coast. The Dahlak Islands are off the Eritrean coast. It has been proposed that some of these islands be protected as the Dahlak Marine National Park. There are unspoiled coral reefs and multitudes of brightly colored fish surrounding the 200 islands. Some of the islands are occupied by dwarf Soemmerring gazelles. Turtles, porpoises, dugongs, ospreys, Arabian buzzards, and a variety of sea birds occupy these islands. There is tremendous potential for wildlife tourism in these islands. But care must be taken so that tourism, pollution, or pesticide run-off do not destroy this precious wildlife sanctuary.

2) Tekeze River: between Eritrea and Ethiopia, this is the major source of fresh water for many people and animals in Eritrea and Ethiopia. According to the DOA this area is rich in wildlife, including a colony of baboons and a herd of about 80 elephants, the only elephants in all of Eritrea. The drafter of this document was not able to visit the area to confirm that these animals are there.

3) Gash River: passes through Tessani. Antelopes, hawks, swallows, and snakes have been reported near this river in the rainy season. Wild melons, cacti, and cereals grow along the banks.

4) Barka River: passes through Tokhar. Jackals, small rodents, snakes, hawks, insects, and cacti live along the banks of this river.

5) Anseba River: nomadic tribes rely on this river as a source of fresh water for themselves and their domestic animals, including camels, mules, goats, and sheep. Cereals are grown along the banks.

It is recommended that no pesticides be applied within 2.5 to 5 km of these areas. Large portions of Eritrea remain unexplored by biologists. Future scientific expeditions may identify additional critical habitats.

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APPENDIX B. ANALYSIS OF PEA RECOMMENDATIONS

BASIC PRE-CONDITION OF PROGRAM

1. A.I.D 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 needs of Eritrea. USAID/Ethiopia & Eritrea support IPM in the management of locusts, as well as other insect pests. USAID should also encourage the Peace Corps to get involved in locust control in Eritrea. Peace Corps Volunteers in Eritrea could:

1) Keep organize village brigades
2) Teach pesticide safety
3) Conduct research on biological control of locusts
4) Teach nomads agricultural techniques that would reduce the number of locust habitats
5) Teach cultural locust control techniques
6) Teach 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 Eritrea.

A.I.D. should encourage the Provisional Government of Eritrea to define and establish areas where pesticide use is banned or limited, and to designate such areas on official maps.

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

Poor pesticide management in Eritrea has resulted in an accumulation of old and degraded pesticide stocks. Pesticides are often transported, applied, and disposed of carelessly. Improvements in the system for managing pesticide stocks must be implemented to protect human health and the environment. Proper storage and record-keeping will reduce pesticide degradation.

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

A plan for disposal of obsolete or excess pesticide stocks

should be drafted by the Eritrean DOA and DLCO-EA with the support of USAID and FAO. Additional activities should include the periodic testing of stored pesticide stocks to insure that the material is usable. The future accumulation of unwanted pesticides should be minimized.

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

USAID/Ethiopia-Eritrea and AID/Washington support this recommendation. It should be implemented by the DOA with the assistance of the DLCO-EA and FAO, during and following the control campaign.

MITIGATION OF PESTICIDE EFFECTS ON NON-TARGETS

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

Pesticides should only be donated to Eritrea with the understanding that pesticides cannot be used in certain areas, such as protected wetlands (if any), national parks, national forests, and fragile areas and in human settlements.

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

Pesticide recommendations in the PEA should be followed until research indicates that safer pesticides are available. USAID/Ethiopia & Eritrea is strongly encouraged to investigate traditional and cultural locust control methods. This SEA repeats the list of preferred pesticides given in the PEA and the recently up-dated list (see Appendix F).

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 as appropriate to the local conditions in Eritrea. The expense of sampling and the lack of supportive infrastructure will make it difficult to implement this recommendation in Eritrea. A program of research monitoring is important both as a basis for design of operational monitoring and as a means of establishing statistically verifiable base line 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.

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

2) Establish economic thresholds.

3) Identify non-treatment areas and minimum treatment areas.

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

5) Include farmers and village brigades in pesticide training, survey, and application.

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

In the flat lowlands of Eritrea, airplanes are sufficient for surveying and spraying. But in the rugged highlands it is necessary to use helicopters.

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

This SEA supports this recommendation. However, medium sized aircraft may be needed in Eritrea to spray areas far from supportive infrastructure.

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.

This SEA agrees with this recommendation. Training should be a part of USAID assistance.

13. All pesticide containers should be properly labeled.

This SEA agrees with this recommendation and urges the EPLF to

give high priority to pesticide legislation and implementation of laws requiring pesticide labels in the regional language Tigrinya. EPLF should follow the FAO pesticide label guidelines.

DISPOSAL OF PESTICIDES

14. A.I.D. 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.

A.I.D. Washington and FAO have developed guidelines on disposal programs for unwanted pesticides and empty containers. Several pilot disposal projects have been implemented. USAID/Ethiopia & Eritrea should follow such disposal guidance, and should continue to assist with pesticide management. Disposing of empty pesticide barrels properly is especially important.

PUBLIC HEALTH AWARENESS

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

USAID, DLCO-EA, and ministries of agriculture should develop public and applicator education materials on pesticide safety, pesticide poisoning recognition, avoidance, and treatment. These materials could be used in "Train the Trainer" programs, and in village brigade training courses.

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

This SEA supports this recommendation and 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.

This SEA supports this recommendation. Posters in Eritrea should be in Tigrinya.

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 A.I.D. purchase of locust insecticides should be adapted for all insecticides.

This is an AID/W activity that should be implemented through a revision of A.I.D's Pest Management Guidelines. No Eritrea-specific recommendation is included in this SEA, since it is an AID/W activity.

20. Pesticide container specifications should be developed.

This is an AID/W activity that has been implemented through a revision of A.I.D's Pest Management Guidelines.

BIOLOGICAL CONTROL

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

AID/W is currently supporting research on biological control in Africa. USAID/Eritrea should support local research on parasites, pathogens, and predators of locusts.

TRAINING

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

Currently, USAID/Eritrea is a branch of USAID/Ethiopia. There are no personnel at USAID/Ethiopia that have responsibility for pest control operations. Such a position should be developed.

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

This SEA support this recommendation, and recommends that priority be given to teaching on how to use pesticides safely and appropriately, especially in village brigade programs.

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.

This SEA supports this recommendation as an AID/W activity.

ECONOMICS

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

This SEA supports this recommendation. Implementation in Eritrea should begin with agricultural productivity analysis.

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

Research should be conducted in Eritrea to establish an economic threshold for the desert locust.

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

This SEA supports this recommendation. AID/W and EPA have developed a program to assist LDCs with drafting pesticide regulations and policies. Dr. Allan Showler (AID/AFR/ONI), Mr. Bill Douglas (AID/AFR-EA), and Dr. Gary Jahn (AID/R&D) met with Mr. Hagos Ghebrehiwet the Chief Delegate of the Provisional Government of Eritrea (i.e., Eritrean People's Liberation Front (EPLF)) to inform him that AID/W, EPA, and FAO have documents that would be useful guidelines for writing environmental regulations for Eritrea. The Chief Delegate was also told about the public health hazard at the Gwonderan pesticide storage facility (see section 3.6). He was given AID guidelines on safe pesticide storage.

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.

This SEA supports this recommendation and considers this to be a topic appropriate for EPLF action. In addition, DLCO-EA should keep an up-to-date, accurate inventory of all of their pesticides. This inventory should be made available to any donor agencies upon request.

PESTICIDE HANDBOOK

29. A.I.D. should produce a regularly updated pesticide handbook for use by its staff.

AID/W has produced a number of documents, which are regularly up-dated: Integrated Pest Management and Pesticide Management, Pest Management Guidelines of the Agency for International Development, pesticide training manuals in Arabic, English, French and Portuguese, which can be made available on request from the Bureau for Africa, Office of Operations and New Initiatives, Technical Projects Program Implementation. 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 supports this recommendation, but the actual needs of DLCO-EA and DOA 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 example, if the DLCO-EA head-quarters were moved back to Asmara, less time, money, and fuel would be spent on sending people and equipment from Addis Ababa to Eritrea. Originally DLCO-EA headquarters were in Asmara since Eritrea contains the major locust breeding grounds. Due to the war, the head office was re-located to Addis Ababa. Now that the war is over, there is no logical reason for the head office to remain 700 to 1000 km from the locust breeding grounds.

"Train the Trainer" programs for village brigades are a potentially valuable contribution that A.I.D. can make in Eritrea. The current village brigade program in Eritrea should be evaluated by A.I.D..

PESTICIDE 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 to reduce the need for on-site storage and disposal of pesticides.

FORECASTING

32. A.I.D. 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 an AID/W or FAO activity. USAID should support thorough field research programs for studying the ecology of outbreak areas in northeastern Africa and Arabia, 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 desirable, it seems far fetched even under ideal conditions, to conduct case-control epidemiological studies on a continuous bases. However, this SAE agrees that routine monitoring activities should be carried out to determine pesticide related-toxicities in areas where heavy human exposure to pesticides and residues are suspected. This could be done in collaboration with FAO and DLCO-EA.

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. 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 with organophosphates to promote rapid knockdown.

5) Find a safe, biodegradable dye 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 should be added at the factory that is producing the insecticides so that leaks and contamination would be obvious throughout operations. The dye 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.

Plant species which desert locusts in Eritrea do not eat should be identified. Next, investigators should determine why certain plants are not eaten by locusts. In some cases, such as certain types of cactus, thorns and other physical barriers will be found to deter locusts. In other cases, such as coffee, a physical explanation may not suffice and research should focus on a finding the chemical deterrents in the plant. If such chemicals can be identified and isolated, they may be useful in locust control.

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 repellant research is to give the insect a choice of treated vs. 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).

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

organophosphates used for locust control.

This research is an appropriate activity for AID/W to fund.

ENHANCING AND ACCELERATING IMPLEMENTATION

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

This guidance to Eritrea should include a program for training village brigades, and should encourage the following agricultural practices:

1) Develop irrigation systems if possible so that crops are not entirely dependent on local rainfall. Growing crops in accordance with local rainfall insures that locust and crops will be in synchrony.

2) Nomadic farmers that shift agricultural sites should be encouraged to weed their fields.

3) After harvest, nomads should burn their old fields to destroy weeds and any remaining crop which could serve as locust habitat.

38. Detailed guidelines should be developed for A.I.D. 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 supports this recommendation. 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

APPENDIX C. RELEVANT DOCUMENTATION

FAO Pesticide Management Documents:

a) International Code of Conduct for Distribution and Utilization of Pesticides.

b) Guidelines for safe pesticide distribution, storage, and handling.

c) Guidelines for pesticide disposal and container disposal.

d) List of FAO approved pesticides.

e) Pesticide storage and packaging guidelines.

f) Guidelines for pesticide approval and management.

g) Ecotoxicological guidelines.

h) Ground and aerial application guidelines.

i) Insecticide poisoning: prevention, diagnosis, and treatment.

j) Guidelines for effective labeling.

k) Efficacy requirements for pesticide approval.

Other Documents on Pesticides and Locust Control

a) Guidelines for selection, procurement, and use of pesticides in World Bank-financed projects.

b) Crop protection Service Organization (D.310) T. 1. PRIFAS. Dec. 1988.

c) Effectiveness of localized pesticide treatment. (D.309) T. 2. PRIFAS - Dec. 1988.

d) Effects of locust and control on the environment. (D. 308) T. 3. PRIFAS - Dec. 1988.

e) Locust and Control - Inter-ministerial Instruction No. 3 related to protection of man and environment. Algerian doc. - March 1989.

f) First aid in cases of poisoning by locust and control products. CIBA-GEIGY.

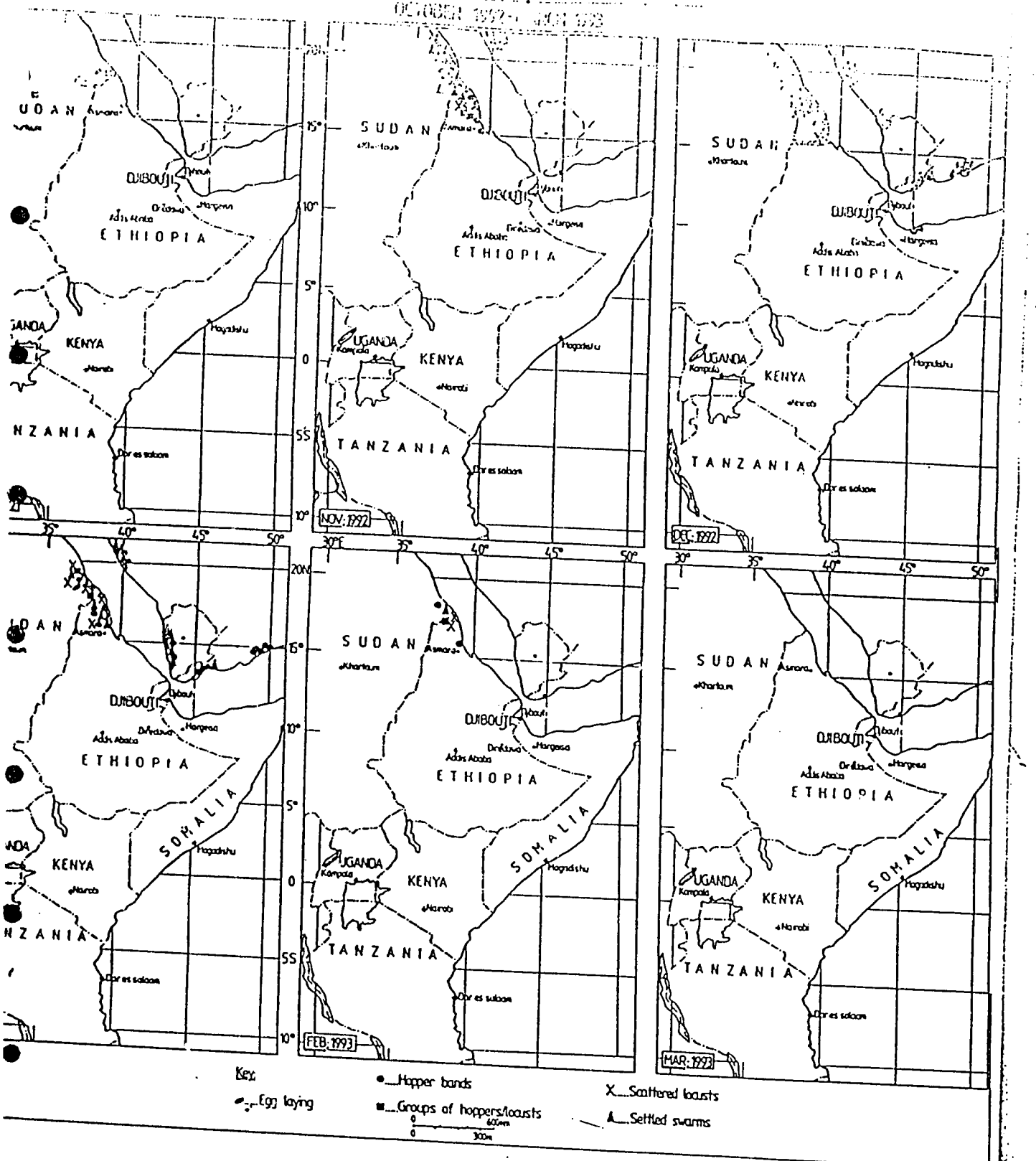
USEPA Pesticide Fact Sheets:

Acephate	# 140	October	1987
Bendiocarb	# 195	June	1987
Carbaryl	# 21	March	1984
Chlorpyriphos	# 37	September	1984
Diazinon	# 96.1	December	1988
Fenitrothion	# 142	July	1987
Malathion	# 152	January	1987
Lindane	# 73	September	1985

These are some of the many Pesticide Fact Sheets issued by the U.S. Environmental Protection Agency, selected for relevance to locust and grasshopper control. The Pesticide Fact Sheets summarize data, including information on acute and chronic toxicity to humans and other non-target organisms, handling precautions, and instructions for use. They are available from:

Office of Pesticide Programs
US Environmental Protection Agency
401 M Street, SW
Washington, DC 20460 USA

APPENDIX D.



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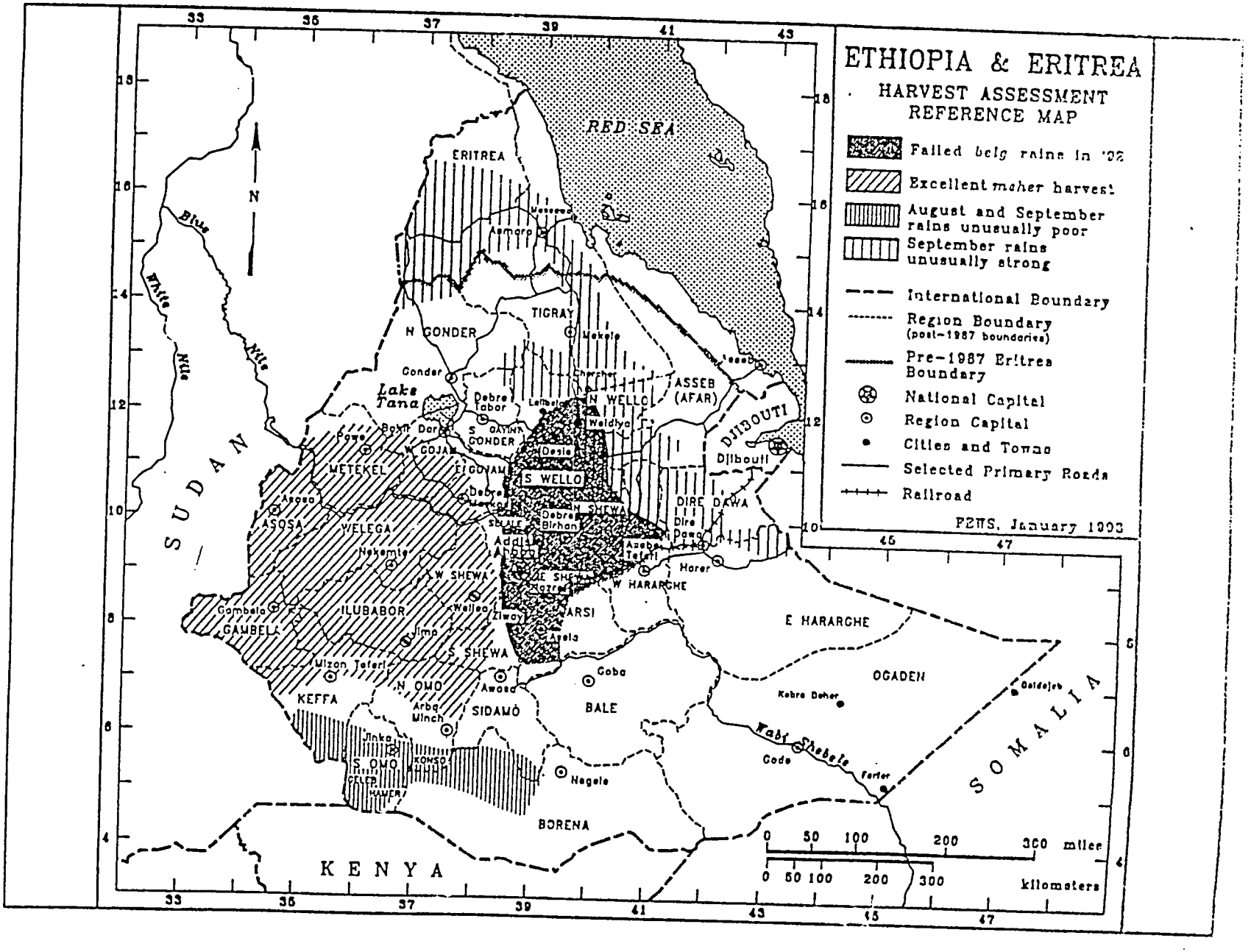

Map 10: Ethiopia & Eritrea Reference Map

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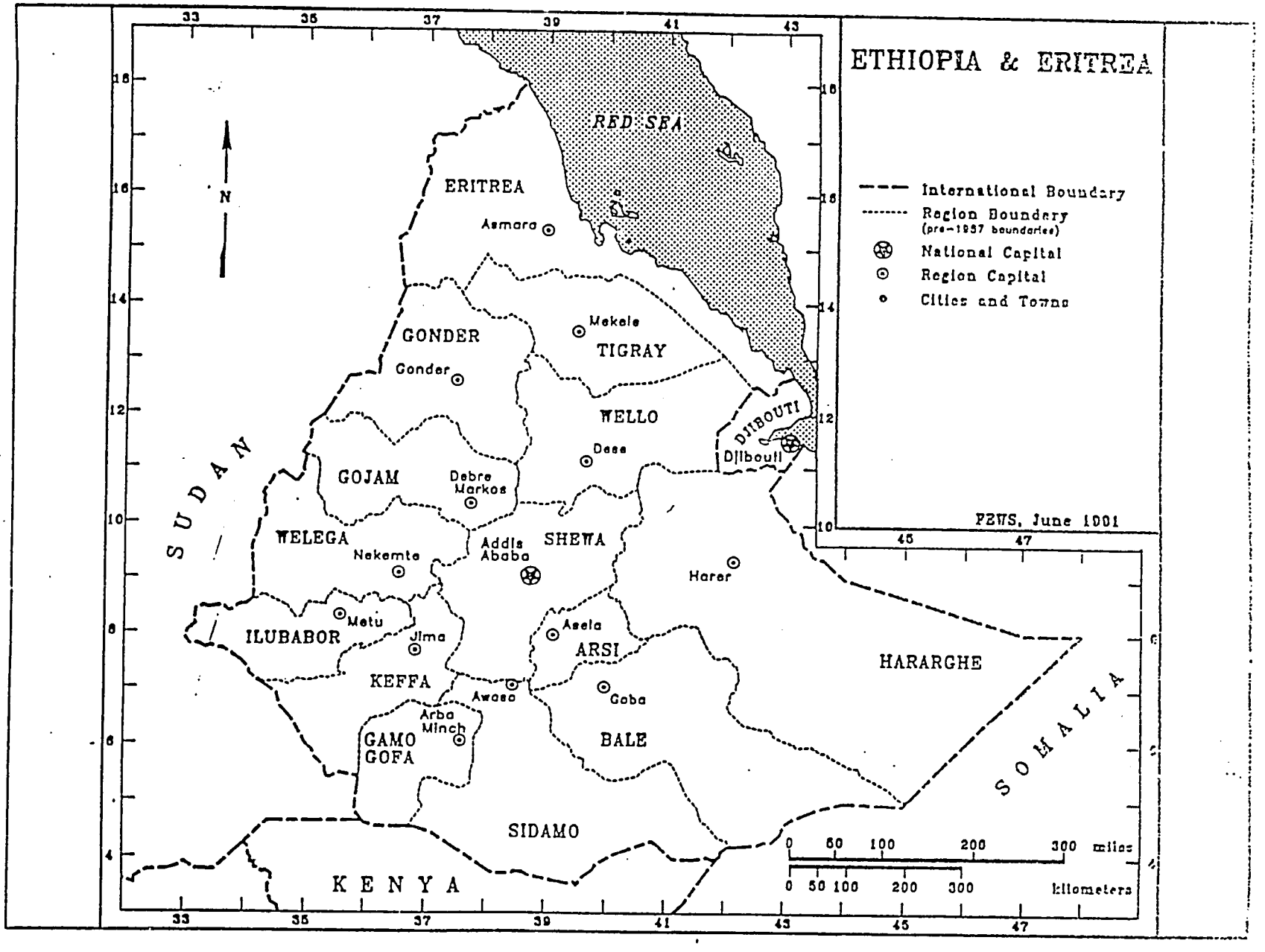
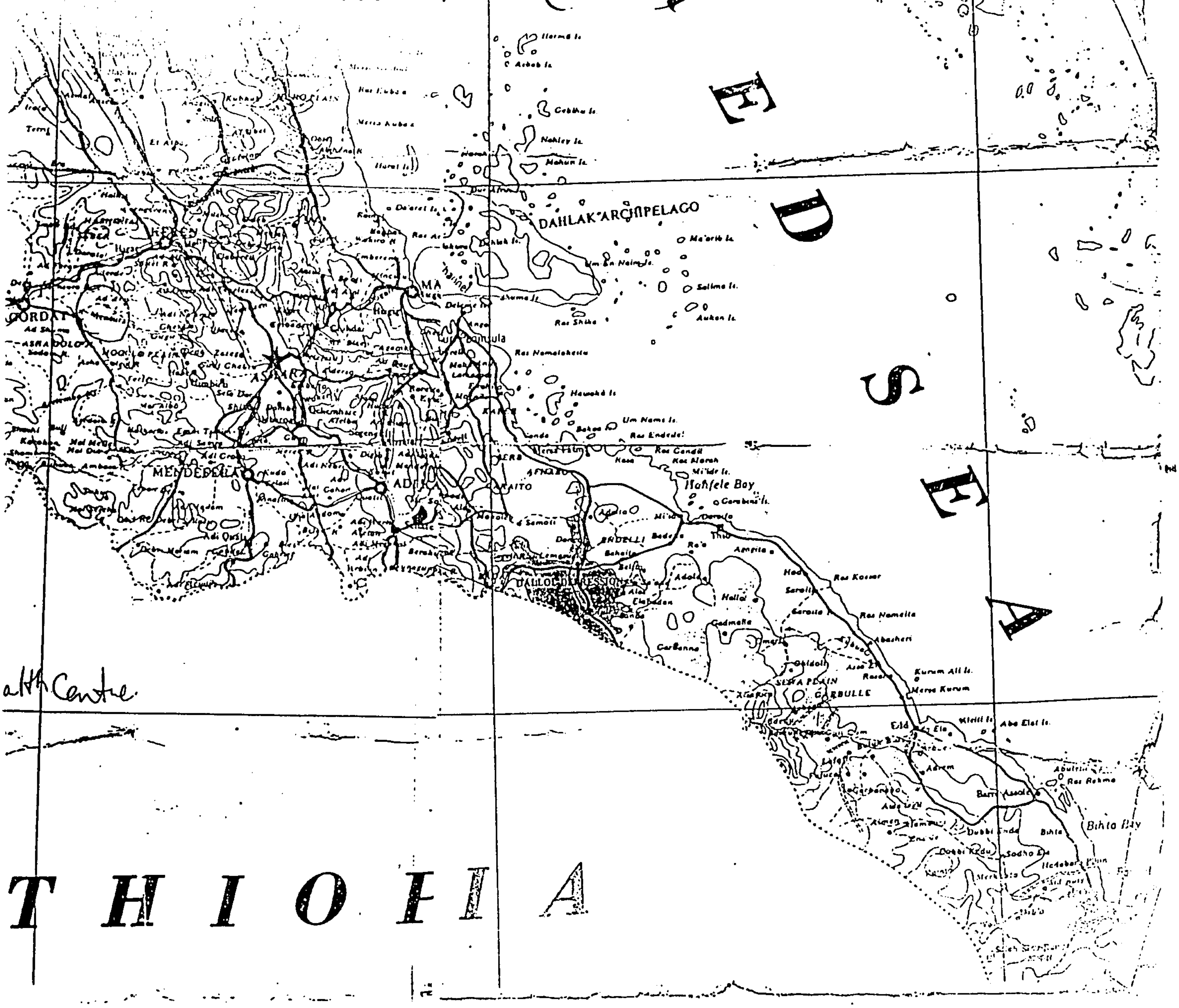


Map 11: Ethiopia & Eritrea, Pre-1987 Administrative Units

APPENDIX D (CONT'D)



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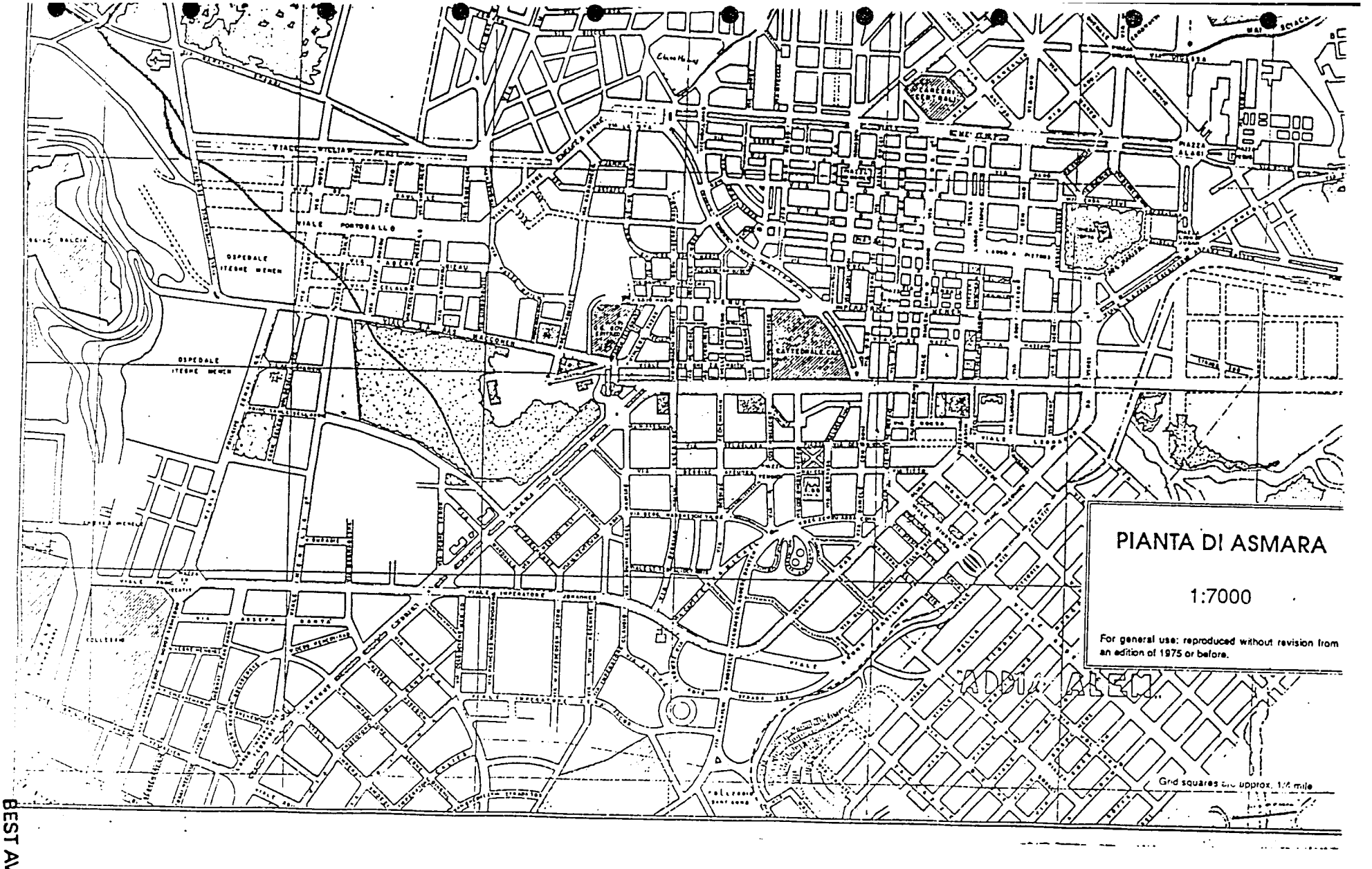

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APPENDIX E

Table 14: 1993 Preliminary Emergency Food Requirements as Estimated by FAO/WFP Mission

Region	Affected by Natural Factors	Internally Displaced	Ex-soldiers Dependents	Total
Addis Ababa	0.0	7.0	23.7	30.7
Afar (Asseb)	5.6	0.0	0.0	15.6
Arsi	0.0	18.6	0.0	18.6
Asosa	0.0	1.1	0.5	1.6
Bale	10.2	0.5	4.7	15.4
Borena	25.4	14.9	2.8	43.1
Dire Dawa	4.6	9.6	3.3	17.5
Gambela	0.0	2.9	0.5	3.4
Gojam	0.0	0.1	1.1	1.1
Gondar	32.0	1.1	6.1	39.2
E. Hararghe	29.6	10.2	5.6	45.4
W. Hararghe	10.5	2.4	1.3	14.3
Ilubabor	1.7	0.0	0.8	2.5
Keffa	0.0	0.0	2.7	2.7
Metekel	0.0	3.1	2.6	5.6
Ogaden	33.8	7.6	0.0	41.5
Omo (N&S)	14.7	0.0	1.7	16.4
Sidamo	0.0	5.4	4.0	9.4
Shewa	0.0	5.6	5.5	11.1
Tigray	126.9	24.7	7.2	158.8
Welega	2.9	0.1	4.0	6.9
Wello	12.9	34.9	14.0	1.8
TOTAL	320.8	149.7	91.9	562.0

Calculation of Food Requirements

Food needs have been calculated on the following basis: i)Basic daily ration at 450 g cereal plus 20 g edible oil. ii)Affected populations (all categories) in Borena, Ogaden and Eastern Hararghe require 12 months assistance. iii)Affected populations in Gojam, Ilubabor, Welega and Keffa require assistance for six months. iv)Affected populations in all other regions require nine months assistance. v) Supplementary food ration of 150 g *faffa*/CSB is required for some 15 percent of all targeted beneficiaries for 12 months, with the exception of ex-soldiers and their dependants.

APPENDIX E (CONT'D)

Table 13: Ethiopia Production of Cereals and Pulses (MT 000)

Region	1987/88	1988/89	1989/90	1990/91	1991/92	1992/1993
Arsi	653	620	649	708	621	725
Bale	94	115	132	128	128	172
Gamo-Gofa/Sidamo	384	341	398	391	344	348
Gojam	928	713	774	940	959	1043
Gondar	396	364	319	360	365	354
Hararghe	358	502	381	400	333	293
Ilubabor/Keffa	598	431	615	655	590	618
Shewa	1502	1675	1671	1943	1898	2041
Tigray	132	300	190	220	310	490
Welega	420	279	362	400	444	458
Wello	301	484	361	350	390	407
Sub-total	5766	5824	5852	6495	6382	6949
Settlements	123	133	86	117	60	49
State farms	288	251	270	228	146	150
Total *meher*	6177	6208	6208	6840	6588	7148
Following *belg*	533	572	490	491	471	540
Total production	6710	6780	6698	7331	7059	7688
Less non-food uses	1007	1017	1005	1100	1059	1153
Net production	5703	5763	5693	6231	6000	6535
Add cereal equiv.						
Enset and roots	570	570	570	600	620	640
Milk	249	261	273	285	300	310
Meat	185	190	195	200	200	200
TOTAL	6707	6784	6731	7316	7120	7685

Notes: Regions have been grouped according to old, pre-1987 administrative boundaries for comparative purposes (see Map 10). Figures for 1987-90 are CSA official statistics.
Statistics for 199/91 are CSA statistics; regional break-down as amended by FAO; MOA estimates, adjusted by FAO, provisional-1992/93.
All figures are expresed in thousand MT.

F.

PPENDIX F

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

AID/AFR/ONI/TPPI:YBELAYNEH:YB
04/19/93 (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, N/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. THE FOLLOWING IS AN ALPHABETICAL LISTING OF THE PESTICIDES

UNCLASSIFIED

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/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

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/AFR/RD/H:RHeadlon(info)

AGENCY FOR INTERNATIONAL DEVELOPMENT
BUREAU FOR AFRICA
Office of Analysis, Research and Technical Services/
Office of Operations and New Initiatives
AFR/ARTS-ONI

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

FINAL ACTION FORM

COUNTRY: ERITREA

DATE: March 1993

ACTION TAKEN:

Approved: ✓ Date 6/4/93

Disapproval: _____ Date _____

Bureau Environmental Officer: _____

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