# Assessment of the Africa Emergency Locust/Grasshopper Assistance (AELGA) Project

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## List of Acronyms Used in this Assessment

| | |
|---|---|
| ADA | African Disaster Assistance Fund |
| AELGA | African Emergency Locust/Grasshopper Assistance Project - USAID/Washington |
| AFGRO | Agency for Facilitating Growth of Rural Organizations, Mali |
| AFR | Africa Bureau, USAID |
| AFR/ARTS/FARA | Office of Analysis, Research, and Technical Support, Division of Food, Agriculture, and Resource Analysis, Africa Bureau, USAID |
| AFR/OEO | Office of Emergency Operations, Africa Bureau, USAID |
| AFR/DP | Office of Development Planning, Africa Bureau, USAID |
| AFR/GC | Office of General Counsel, Africa Bureau, USAID |
| AFR/TR | Office of Technical Resources, Africa Bureau, USAID |
| AGRHYMET | Agro-Hydro-Meteorologie (a CILSS project) |
| AID/W | USAID, Washington |
| ANR | Division of Agriculture and Natural Resources, Africa Bureau/TR, USAID |
| APHIS | Animal and Plant Health Inspection Service of USDA |
| CABI-IIBC | International Institute for Biological Control, Commonwealth Agricultural Bureau, International |
| CIDA | Canadian International Development Agency |
| CILSS | Comite Permanent Inter-Etats de Lutte contre la Secheresse dans le Sahel |
| CLCPANO | Desert Locust Survey and Control in Northwest Africa |
| CPS | Crop Protection Service |
| DFA | Development Fund for Africa |
| DFPV | Departement de Formation en Protection des Vegetaux |
| DGIS | Dutch International Assistance Agency |
| DLCO-EA | Desert Locust Control Organization for Eastern Africa |
| DL-SWA | Desert Locust Survey and Control in Southwest Asia |
| DPM | Disaster, Prevention, and Mitigation Project |
| DRCO | Disaster Response Coordination Office, AFR/AA, USAID |
| DWRC | Denver Wildlife Research Center, USDA |
| EA | Environmental Assessment |
| ECOWAS | Economic Commission of the West African States |
| ECLO | Emergency Center for Locust Operations, FAO |
| ENV | Environment Unit of AFR/ARTS/FAR |
| ESF | Economic Support Fund |
| FAO | Food and Agriculture Organization of the United Nations |
| FAO-DLCC | Desert Locust Control Commission, FAO |
| FEWS | Famine Early Warning System, USAID/AFR |
| GHLSIM | Sahelian Grasshopper Crop Loss Simulation Model |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| GTZ | Deutsche Gesellschaft fur Technische Zusammenarbeit |
| HF | High Frequency radio |

| | |
|---|---|
| ICIPE | International Center for Insect Physiology and Ecology, Nairobi, Kenya |
| IDA | International Disaster Assistance |
| IITA | International Institute for Tropical Agriculture |
| INSAH | Institute du Sahel, CILSS |
| IPM | Integrated Pest Management |
| LOCUSTOX | Locust Pesticide Ecotoxicology Project, Senegal |
| LOP | Length of Project |
| MOA | Ministry of Agriculture |
| MSU | Montana State University |
| NDVI | Normalized Difference Vegetation Index |
| NE | Near East Bureau, USAID |
| NRI | National Research Institute, British |
| NWS | New World Screwworm |
| OEA | Other Emergency Assistance Fund |
| OEO | Office of Emergency Operations, Africa Bureau, USAID |
| OCLALAV | Organisation Commune du Lutte Antiacridienne et de Lutte Antiaviaire |
| OFDA | Office of Foreign Disaster Assistance, USAID |
| ONI | Office of New Initiatives, Africa Bureau, USAID |
| OSU | Oregon State University |
| PACD | Project Activity Completion Date |
| PEA | Programmatic Environmental Assessment |
| PRIFAS | Programme de Recherches Interdisciplinaire Francais sur les Acridiens du Sahel |
| RSSA | Resource Support Services Agreement |
| SADC | Southern Africa Development Commission |
| SADE | Southern Africa Drought Emergency Task Force |
| SEA | Supplemental Environmental Assessment |
| SECNA | Screwworm Emergency Center for North Africa |
| SYSAPEC | Surveillance, Monitoring, and Pest Early Warning Project, UNDP/FAO, Niger |
| TA | Technical Assistance |
| TDY | Temporary Duty |
| ULV | Ultra-low Volume (aerial pesticide application) |
| UNDP | United Nations Development Programme |
| USAID | United States Agency for International Development |
| USAID/AFR | Africa Bureau, USAID |
| USAID/Ethiopia | USAID Mission to Ethiopia |
| USAID/Mali | USAID Mission to Mali |
| USAID/Morocco | USAID Mission to Morocco |
| USAID/NE | Near East Bureau, USAID |
| USAID/Niger | USAID Mission to Niger |
| USAID/W | Agency for International Development, Washington |
| USDA | United States Department of Agriculture |
| USDA/OICD | Office of International Cooperation and Development, USDA |
| USEPA | US Environmental Protection Agency |
| USG | United States Government |
| USGS | United States Geological Survey |

## 1.0 Executive Summary

The African Emergency Locust/Grasshopper Assistance (AELGA) project was remarkably successful in achieving both of its purposes, 1) to combat the 1986-1989 locust plague, and 2) to effect measures to facilitate longer term prevention and control. Throughout the plague AELGA, in coordination with OFDA, provided technical assistance, commodities, and aerial spray services that helped to avert excessive crop damage in the Sahel.

Since 1989 AELGA has focused heavily on building the capacity of African counterparts and regional organizations in the prevention and mitigation of locust and grasshopper outbreaks, as well as rodent control. Over 500 people were formally trained directly through AELGA and thousands were trained in FAO, OCLALAV, and USGS training events sponsored in part by AELGA. Well over 10,000 copies of publications and documents have been produced and distributed by AELGA, and they now form a very visible, ubiquitous part of African crop protection service's offices and laboratories.

AELGA has been able to accomplish these goals despite a lack of the necessary administrative and logistic support for undertakings of such complexity. Moreover, the project successfully conjoined emergency and development activities under one umbrella -- a task that the rest of Africa Bureau has been struggling with for years.

As the AELGA project evolved, other types of crop protection emergencies, such as devastating rodent outbreaks, occurred and countries declared disasters. As the mandate for AELGA expanded (through amendments) to cover these other crop protection emergencies, AELGA responded with appropriate activities. AELGA funded pioneering rodent control research and training in Chad. Requests from missions increased in 1992/3, to cover armyworm, locust, and grasshopper outbreaks in regions not historically covered by AELGA. Even USAID/Morocco has informally expressed an interest in being able to access the pool of talent and resources found in AELGA. Requests continue and AELGA requires the flexibility to move into still other types of crop protection emergencies, such as armyworm and bird control, and even to provide access to other regional bureaus. AELGA was involved in the highly successful 1988-1990 OFDA-led New World Screwworm Eradication program in North Africa. Other exotic pests with major devastating impacts, such as the New World Screwworm, will unpredictably arise in the future, and Africa Bureau will need to be poised, with the expertise found in AELGA, to respond.

Research activities funded by AELGA were successful at developing several new technologies. Biological control agents were brought closer to practical use, effective rodent control measures were developed, and a crop loss assessment model was

developed. Promising research results continued into 1993, as more virulent fungus strains were discovered in Madagascar. This work is extremely valuable and will provide alternate control methods to chemical pesticides when fully developed.

Much of the success of AELGA's efforts could not have been achieved without assistance from USAID Missions and their counterparts. Since its inception, the AELGA Project has allowed for eleven bilateral buy-ins from field missions, two of which lasted for five years.

AELGA has consistently taken the lead in environmental protection and sustainability issues. AELGA provided assistance for the completion of Supplementary Environmental Assessments throughout the Sahel, Madagascar, and East Africa. And the project was responsible for helping develop and implement the overall agency PEA. Moreover the project and its environmental awareness initiatives have strongly influenced national policy decisions in several African countries. Many African regulations on pesticide registration and use, handling of toxic wastes, and environmental protection now closely mirror those present in the USA.

Most of the crop protection personnel across the Sahel have received their training in safety and environmental protection through AELGA; now safe handling of pesticides and health testing for users are commonplace in many places in Africa, again reflecting the strong impact AELGA has left. Unsafe pesticide handling does still occur, thus the battle is not won. These types of training need to continue, both to reach more people and to provide constant safety reminders to those already trained. Most past training has focused heavily on Sahelian countries; some of it now needs to shift to East Africa, primarily Ethiopia, Eritrea, and Sudan.

Recently AELGA has taken the lead in starting to shift the emphasis on locust control issues to East Africa (where locust plagues begin) from the Sahel (where they end up). In 1993, the project reacted quickly to get SEAs into place for Eritrea and Ethiopia, and has reacted to provide emergency assistance to this region for control of an impending plague. This shift should continue and AELGA can play a lead role in moving the FAO in this direction.

In mid 1993 AELGA took the lead role in forging ahead with a plan to get countries with large pesticide stocks, such as Morocco, to donate these to sub-Saharen African countries in more immediate need due to locust outbreaks. At the time of this assessment serious moves were underway to get USAID approved pesticide donations shipped from Morocco to Sudan. This type of 'non-traditional donors' assistance, if successful, will have been pioneered by AELGA leadership. Bold (and common sense) steps such as these should be strongly supported and continued by AELGA

management.

The AELGA project is not without inherent constraints, the primary one being the ability to respond more rapidly to emergencies. Future AELGA emergency assistance will need to be streamlined; this will require a commitment on the part of Africa Bureau, possibly through the SADE Task Force or its successor, to training and providing a quality emergency procurement and contracts officer. This person would be responsible for liaising with and understanding the needs and roles of other Africa Bureau and USAID offices (e.g. GC, DP, and OFDA) and then using waivers/mechanisms/authorities as appropriate to rapidly provide goods and services for emergencies, including pest and pesticide-related emergencies. This move by Africa Bureau would be seen as very prudent considering the increased emphasis likely to be placed on emergency assistance by the current administration and USAID leadership.

AELGA has developed into one of USAID's most successful and needed projects. Without exception, all parties interviewed for this assessment indicated a strong desire to see AELGA activities continue, and in many cases, expand. In an outbreak year, such as 1993, when locust populations reach emergency levels, approximately $8 million will be required for operations and emergency procedures and activities. In recession years, $2-3 million will cover preparedness measures such as monitoring, research, training and proactive interventions. The emergency nature of the project will require that the AELGA project is continued long-term, for at least another 10 years.

The current administration's and world leader's emphasis on environmental protection and sustainability bode well for a project such as AELGA that is committed to these causes and has already provided leadership, and strongly influenced environmental policy, in African countries. USAID should maintain this strong influence and presence through the AELGA project and will receive due attention for their pioneering leadership in these areas.

Publicity aside, the AELGA project provides the Africa Bureau with a tool for solving real and impending problems on a continent plagued with emergencies and disasters. Without a doubt, food security needs will increase, and what production is produced will need to be protected from loss. The experience present in the AELGA project will continue its record of accomplishment, and with sufficient support, well into the future.

## 2.0 Introduction

AELGA was initiated in 1987 to assist with a potentially devastating desert locust plague that was rapidly spreading across the semi-arid regions of Africa. This outbreak seriously threatened food security, environmental stability, regional economic growth, and as a result, budding democratic institutions; all of which are highest priority concerns of the Africa Bureau (AFR) and the then newly-implemented Development Fund for Africa (DFA), AFR's primary source of finance.

By the time the plague was brought under control in 1989, donors had contributed an unprecedented $275 million. While procuring and obligating these funds, donors concluded that prevention of the plague in 1986 (proactive efforts then-1986/7-were precluded in part by armed conflict in key locust breeding areas) would have been far less costly and more environmentally sound, and the discussion of proactive measures was rekindled. The Africa Bureau responded appropriately with the design of the AELGA Project.

When first designed, the AELGA Project was to provide stop-gap assistance in the form of short term technical assistance to deal with immediate locust control and environmental needs. In addition the project was mandated to take a more proactive, long term approach to plague threats by building African capacity to tackle such problems in the future.

As the project evolved it took on (through several amendments) research components to develop more environmentally sound and less costly means of control, and means for economic monitoring. At the same time, USAID bilateral missions were sending requests for assistance dealing with other types of unpredictable pests, that were not, due to their unpredictable nature, programmed into the yearly activities. Such outbreaks have included grasshoppers of various species, rodents, birds, and other insects like armyworms. These additional pest problems periodically threaten millions of dollars worth of agricultural production and incomes. Bilateral and regional missions have indicated an interest in a mechanism within which to fund control activities, and other regional bureaus, NE in particular, would like a bank of expertise upon which to draw.

This report outlines and assesses all of the activities undertaken to date, and those recommended for future action. The report was prepared by reviewing program documents and project reports, and by interviewing relevant parties in USAID/W, projects contractors and USAID field management and implementers in Ethiopia, Mali, Niger, and Morocco. The findings in this report will be used for considering the extension of AELGA activities.

## 3.0 Short Term Technical Assistance and Field Operations Support

At the height of the last plague (1986-1989), the immediate concerns were those of control. To address these concerns, short term technical assistance was provided. Such assistance was provided to African National Crop Protection Services (CPS), USAID bilateral missions, and regional coordinating agencies such as FAO.

Technical assistance was composed of environmental assessments and monitoring, pesticide management, greenness maps, technical advice and donor input, field operations support, and assistance with a disorder of neem trees in Niger. The table in Appendix 1 shows types of regular goods and services, by country, provided by AELGA.

In addition, AELGA provided technical advice and finance to the FAO for survey, forecasting, training, and preventive control strategies. AELGA played an important role at FAO meetings and was influential in regional decision making.

Besides donating chemical provisions, AELGA also provided assistance to USAID missions and Sahelian countries' crop protection services through coordination, funding and participation in training programs, working with national governments on pesticide disposal issues, research and ecotoxicological studies, and in pesticide efficacy testing.

The AELGA Project Technical Advisor helped backstop a problem with dying neem trees in Niger in 1991. Neem trees, that had been studied by AELGA as a potential source of botanical chemicals for locust and grasshopper control, across Niger were beginning to show signs of wilting and tip die-back at the tree apex. It was feared that many trees may be infected with some sort of disease organism, and that it would spread across major neem production areas of Niger and the Sahel. It was found that the problem was likely either a root-borne fungus or a physiological problem, or a combination of the two. Since then the condition has spread to other parts of Niger and other Sahelian countries as well. Most neem trees in the Sahel will likely experience some die-back and death.

The AELGA program organized and funded a West African regional conference in Niger on the disposal of empty pesticide containers and stocks of obsolete pesticides. Shortly thereafter AELGA helped coordinate the disposal of obsolete stocks of dieldrin from Niger. Over 50,000 liters of dieldrin were removed for disposal from Niger through a collaborative effort of USAID/Niger, Shell Chemical Company and GTZ; and was shipped back to the place of origin (Netherlands) for proper disposal.

## 4.0 Emergency Response

Probably the most formidable problem currently facing the Africa Bureau is the inability to respond to emergencies, such as a locust outbreaks, in a fashion similar to the way in which OFDA is able to respond. This problem is not new to AELGA and has repeatedly arisen in interviews for this assessment as one which has plagued the project from its outset. OFDA was the undisputed leader in dealing with emergency/disaster responses to locust outbreaks during the last (1986-1989) plague. AELGA was called in to assist with the problem.

As recently as March 1993, AELGA gave OFDA $240,000 of ADA funds for procurement and shipping of 25,000 liters of malathion ULV, 25 full sets of protective clothing, and 5 radios (air ground) to Eritrea; all of this was coordinated by AELGA. However, it took more than ten weeks to move the approval through Africa Bureau to send the first tranche to FAO.

OFDA operates under a "notwithstanding clause" that permits it to procure goods and services quickly in response to a disaster situation by waiving normal USAID source/origin and competition requirements. This is done only under disaster circumstances. There has remained a compelling need for similar authority under urgent or emergency situations, like locust outbreaks, that would likely lead to a disaster declaration if not handled proactively. AELGA's primary goal is one of prevention, that is to prevent situations from becoming emergencies, and if they do become emergencies, to prevent them from becoming disasters.

In 1989 GC developed new delegations of authority for regional bureaus to respond in emergency situations, especially where procurement was involved. The last locust plague ended in 1989 and the need for Africa Bureau to respond to an emergency has not arisen until recently, with the resurgence of heavy locust activity in the fall of 1992 and spring of 1993. This may be the reason why the authority was not used by Africa Bureau or reinvoked until recently. There was no urgent need for it. In February 1993, there was urgent need, as the various offices in Africa Bureau floundered over the approval, and tranching to FAO, of $0.76 million in ADA funds for emergency locust control, and ten weeks passed overcoming bureaucratic hurdles. A second tranche, however, took only 4 weeks; still far too long due to bureaucratic hurdles.

Recent changes in regulations that USAID must follow, for instance the 'Buy America' Act, supersede many of the old regulations on source and origin, so that the old waivers no longer apply. AELGA will need to have in place waivers of the current regulations where rapid procurement is involved. It will be necessary for these emergency waivers to be processed by a specialist familiar with the USAID offices involved, regulations, and restrictions. GC suggests that Africa Bureau delegate one of

its officers as an "emergency procurement officer." Such an officer would obtaining blanket waivers of the new source/origin and competition requirements for serious emergencies under prescribed guidelines.

OFDA has become increasingly reticent to respond unless a disaster declaration is made; OFDA fully expects the regional bureaus to respond and attempt to control locust outbreak emergencies before they can reach the disaster stage.

One overriding concern in funding emergency activities is the fund source. The primary source of funding for Africa Bureau is the DFA, and more recently ADA funds (which will be discontinued in 1994). The AELGA project naturally conjoins development assistance and emergency relief activities, and the interface between these activities is often blurred. Many development activities, goods, and services donated for development are used to divert emergencies and even to help control them. The question at hand is one of magnitude, just as is the difference between an emergency and a disaster. The purchase and stockpile of chemicals for plant protection is a normal part of most agricultural development projects, and those chemicals are used at the discretion of the plant protection personnel. When an emergency occurs, the same chemicals are used, only in higher quantities. The use of relatively small amounts of resources, such as chemicals, for an emergency, as opposed to large amounts needed during a disaster, effectively represents insurance against costly disaster responses. One of the future hurdles for AELGA is convincing GC that it is prudent and very cost effective to control during an emergency and that DFA funds can be used for these activities on an emergency time-line (procurement and use of the funds expedited). If it is concluded that AELGA cannot use DFA funds, then some sort of emergency relief and rehabilitation fund (e.g., IDA fund) should be sought out.

In summary, in the past AELGA has not been sufficiently prepared to expedite material and fund transfers in emergencies. AELGA has been able to train a number of young entomologists, and provide them with experience working with locusts prior to a plague. Now there is a well trained cadre of locust-experienced scientists with language capabilities, in addition to USDA's cadre, for AELGA's use.

## 5.0 Preventive Control

The primary goal and essential concepts, of the currently amended AELGA project are **preventive control and proaction**, so that emergencies and disasters can be avoided. Prevention includes any strategic measures taken to keep the locust and grasshopper populations in check, so that they do not reach outbreak stages. This includes use of surveys and greenness maps for monitoring,

prepositioning of pesticides, supplies, and aerial services, training in preventive measures, regional coordination, and use of integrated pest management tactics to prevent the build-up of locusts and grasshoppers in breeding areas.

Proaction involves the use of highly prepared, trained, and organized, overwhelming tactical force to control and manage locust outbreaks if they begin, so that they cannot reach the disaster stage. AELGA has strongly grasped and implemented both concepts. Primary locust breeding sites have been located and mapped in Mali, greenness maps have led CPS agents to areas of high infestation in several countries, goods and services (i.e., DLCO staff) have been prepositioned in most affected countries, a massive amount of training took place (over 500 people were formally trained directly through AELGA and thousands were trained in FAO, OCLALAV, and USGS training events sponsored in part by AELGA) during the past recession (1989-1992), FAO and DLCO have developed effective regional coordination capacities (they were able to provide coordinated control response within weeks of the recent, 1993 outbreak), and IPM tactics are in the process of being researched. AELGA has played a very influential role in leading the donor community in developing and implementing these preventive and proactive measures, and will continue.

One of the major efforts in preventive control has been the use of egg pod field surveys to locate, dig up, and destroy locust and grasshopper eggs, especially in West Africa. These technologies were effectively used in Mali in the 1980's, however there are reports of the CPS agents leaving the fields to hatch in the 1990's so that emergencies could be declared, along with the accompanying supplies, vehicles, fuel, hefty per diems, and public attention. The Mali mission has been discouraging this type of behavior, but unfortunately the leadership of the CPS has been weak and ineffective, even at times encouraging the behavior. The mission has been reluctant to provide requested pesticides; instead continuing to encourage the implementation of preventive control tactics.

Niger, on the other hand has made great strides in prevention with the DPM (disaster prevention and mitigation) project currently being implemented. This program will serve as a model for other missions to follow and will help forge a stronger framework within which AELGA activities will naturally fit. The strong linkages between the AELGA project and the DPM project should be maintained and monitored for impact, as this relationship may serve as a model for other missions.

In the 3 years following the mid-term evaluation of AELGA (1989), egg pod surveys were conducted regularly throughout Niger using FAO financial and technical assistance. Preventive measures underway in Niger have been assisted by use of an HF radio network, hand-held GPS, and 9 FAO/UNDP SYSAPEC project observation post

facilities. In 1993 the project is slated to cover the entire country with 18 observation posts equipped with radios being installed using AELGA funds.

Another preventive measure being developed and currently in use is the implementation of satellite greenness maps for monitoring and prediction. Greenness maps help streamline ground and aerial surveys by directing agents to areas most likely to contain locusts. The major problem with these has remained the lack of ability of field CPS staff to interpret them. Also there is a dire need for ground-truthing of the maps, and until it occurs, will remain one of the major shortfalls to their full implementation. Other problems include high cost and time lag in getting the maps to those who can use them. The maps could be improved by incorporating information on soils, rainfall, land use, agricultural areas, crop types, forests, and rangelands. Pioneering work needs to be done on the correlation between greenness map data and location of egg pod fields.

Aerial and ground surveys have been undertaken to locate hatching locusts and grasshoppers and hopper bands so that early control can be initiated. This has included the use of helicopters to reach remote locations in Niger, and the use of airplanes and 4x4 vehicles.

These technologies should be transferred to East Africa where desert locust plagues most often begin. Ethiopia, Eritrea, and Sudan have effective crop protection services, and training in egg pod surveys and control, as well as greenness map interpretation and use should ensue as soon as possible.

Already the Eastern Africa CPSs are adept at survey. In the nomadic regions of Hararghe and the Afar delta of eastern Ethiopia the CPS agents rely heavily on seeking out information from the nomadic herders as to location of the hopper bands or adult swarms. In the sedentary highlands, the farmers come to CPS agents when they have overwhelming locust problems, and often assist in control operations as well. The CPSs could take advantage of the farmer/nomad enthusiasm and interest to do egg field surveys and excavations.

Gains made by the AELGA project and other donors in the past six years at building preventive capacities began paying off in 1993. Continuous monitoring by CPSs, regional locust control groups such as DLCO, and FAO-ECLO provided timely warnings of locust band and swarm size, location, life stage, movement and current and impending weather conditions. All of this resulted in accurate tracking and timely control of migratory locusts before they could reach the plague stage. And control of desert locusts was well under way at the time of this assessment, with a relatively high chance of containing the outbreak.

AELGA played key roles in containing the 1993 outbreak. First, it was instrumental in getting the FAO to shift attention from the Sahel to the central region (i.e., Eritrea, Ethiopia) for locust outbreaks. Second, it responded to requests for technical assistance, goods, and services in a manner sufficiently timely to control outbreaks in Sudan and Eritrea. Before control efforts using USG assistance could begin in Eritrea and Ethiopia, SEAs had to be researched and written for each country. To this AELGA responded very quickly, sending assistance within weeks of the request, and overseeing the completion of each SEA within two weeks of the start. Radios supplied to Eritrea allowed ground surveillance agents to closely monitor and report on locust conditions as they developed. Chemicals supplied to Sudan and Eritrea stopped the outbreaks from spreading into surrounding countries and areas. All of the efforts were assisted in no small part by the relatively calm political/military situation present in the region; during the last plague military wars were being waged in all of the key locust breeding/outbreak areas (Northern Coastal Sudan, Northern Ethiopia, and Eritrea) and monitoring and control were next to impossible. The 1993 control campaign was hindered by the war in Somalia, and swarms of migratory locusts were reported in May and June coming from Somaliland, where there was no control, into Eastern Ethiopia, but by mid-July they were under control in Ethiopia.

## 6.0 Networking

Major regional organizations that have been operating and networking in locust and/or grasshopper control efforts for Africa include: AGHRYMET, CILSS, CLCPANO, DLCO-EA, DL-SWA, FAO-DLCC, FAO-ECLO, OCLALAV, PRIFAS, and USGS. In addition, several other bilateral donors are very active in regional locust control efforts; these include GTZ, NRI, and DGIS. AGHRYMET collects synoptic weather data and now provides greenness maps (USGS used to provide these) for monitoring possible locust outbreak sites. CILSS operates AGHRYMET and deals with drought related issues. In Mali the CILSS institute researches and provides high quality information transfer on all crop production constraints, especially locust and grasshoppers, for the Sahel.

CLCPANO, DLCO-EA, and DL-SWA do surveys and locust control in different regions. FAO coordinates desert locust control, research, and information collection and dissemination. OCLALAV used to be active in locust, grasshopper, and bird survey in West Africa, but recently has been cut back, thus limiting its effectiveness in the region. PRIFAS is still active in combining weather data, acridid development models, and soil and vegetation maps to predict locust movements. They regularly report on these activities to donors.

FAO and Regional Coordination

AELGA's strongest linkage has been with the FAO (especially by virtue of two grants totalling $3.7 million from 1988 to 1991), in donor coordination and in using them for influencing regional policies and decisions. Recently AELGA has very successfully used FAO as a tool to move some major initiatives. One such initiative was the effort to get non-traditional donor countries, such as Morocco, to donate pesticides to other developing countries in more immediate need due to locust and/or grasshopper infestations. Currently two such initiatives are underway, with more on the horizon. Morocco has verbally committed to send 50,000 liters of malathion to Sudan for the current outbreak there; the transfer will be funded by AELGA. This initiative was started when AELGA suggested it in talking points presented at the FAO meeting in Rome in March of 1993. Since then FAO has suggested that Tunisia donate malathion to Yemen. Tunisia has responded positively and is moving in this direction.

Now AELGA is working to facilitate the transfer of malathion from The Gambia and Guinea Bissau to Chad (currently infested by desert locusts in areas in urgent need of appropriate pesticides) if the stock contains sufficient active ingredient and is safe for transfer and use.

There have been attempts to get Sahelian countries to coordinate efforts on cross-border control. The only success to date has been the semi-clandestine spraying of locusts in northern Mali by Algerians in 1988; Algeria did this without permission from Mali, and only ventured about 20 kilometers into Malian territory. Coordination of these types of efforts in the future will speed control and restrict locust cross-border movement. The resources of wealthier countries such as those in North Africa can be put to use.

Future networking through FAO should be pursued on several fronts, to get countries to: make donations of expendable supplies to countries with the most immediate needs; to cooperate in cross-border types of survey and control efforts; and to exchange local experts for training, research, monitoring and control activities, instead of heavy reliance on expensive expatriates from developed countries.

Both the DLCO-EA and OCLALAV have suffered from lack of institutionalization due to local 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 these organizations. AELGA and other high profile donors and regional coordination groups should urge that DLCO and OCLALAV be made into associate International Agricultural Research Centers with strong operational functions.

## 7.0 Short Term Technical Training

Conferences, Training, and Workshops

The AELGA Project Paper states that short term technical training would be provided, but that institutional development, per se, along with the accompanying generation of organizational and physical structures requiring recurrent cost financing, was not a project goal. Current thinking holds that training of any type may be referred to as institution building, thus although not one of the project goals, institution building has occurred. Field agent training would be done in the second and third year of project implementation, while the first year would be used for drafting and field testing didactic materials. The training would be in collaboration with other donors, and to avoid duplication FAO would help organize and coordinate such efforts. Training was to be provided at three distinct levels: policy/managerial, technician, and field levels. Country plan needs were to dictate training elements required. Managerial/policy level training would occur in the form of FAO sponsored conferences.

Thirteen percent of the total AELGA funding was to be used to develop and implement training activities. Although considered to have a high startup difficulty, training activities were considered essential to the project, and potentially replicable after the project PACD.

Subsequent amendments to Project Paper, especially amendment 3, addressed additional training needs. These included informal extension training in rodent identification, research, and control.

Impact of the project activities would be measured in terms of increased pest management and control capacity among host country participants. Without testing, the effects and impacts of training programs are difficult to measure. The project logframe matrix charts 300 Sahelians formally trained and 1,500 trained informally in current control methods as the objectively verifiable indicators; and implementation of training programs, observation of on-the-job work by trainees, and training activities reports as the means of verification.

Current control methods included in training activities are: 1) monitoring and identification of the problem; 2) choice of control method(s); 3) environmental ramifications of control method(s); 4) safe use of control method(s); 5) followup on effects of control method(s) on target, nontarget, and human health; 6) disposal of outdated or environmentally damaging control chemicals; 7) research and testing of new control technologies.

The AELGA program has been actively involved in initiating, organizing, coordinating, as well as funding several national,

regional, and continent-wide conferences, training programs, and workshops. The training activities implemented by AELGA are recorded in Appendix 2. AELGA also played a major role as co-organizer, sponsor, and active participant in several conferences and technical meetings conducted by the FAO; these are also listed in Appendix 2.

Appropriate records on the number of participants in training events are lacking, and number of days spent were not well recorded for training events in the past; in the future they should be kept for bookkeeping and reporting purposes. Observations of on-the-job work is recorded second-hand from mission personnel responsible for monitoring such activities. Some limited information gleaned from training activities reports is summarized below.

## Assessment of Effectiveness of Training Activities

International fora and training programs implemented in 1986 and 1987 in Africa to sensitize donors and affected African countries to environmental issues led to an agreement in Rome in 1987 to ban certain pesticides from the locust and grasshopper campaigns. And several of the concerned countries have written decrees of their own on pesticide registration and use, disposal, and environmental regulations, following the lead of the donors' sensitization through training and information transfer.

Several of the regional training courses designed for regional field level control have brought in upper management personnel instead of the field agents. Future courses in field level control should be held nationally, so that field level personnel may be able to attend. Managerial/policy level training should continue in the form of FAO sponsored conferences.

USAID/Mali has provided per diem to farmers and agents to come to Bamako for training. Training conducted in Mali on egg pod surveys and farmer training on identification, pesticide application, safety, and other control methods was deemed to be extremely effective by the CPS and USAID/Mali. Additionally, training provided by Montana State University taught Malian CPS scientists to perform research trials on *Beauveria*. The results of the trials subsequently run by the Malians were consistent with results found in other trials in Cape Verde and Montana, leading one to believe the training paid off well.

Unfortunately, the OSU project on crop loss assessment has not been able to train any Malian or Chadian CPS personnel or other local researchers, either formally or informally, in use of their models or research methodologies. On-the-job training occurred with the research activities undertaken. In addition, a crop loss assessment workshop taught information learned from the OSU studies.

One of the recommendations in the 1989 Mid-Term AELGA Evaluation was to undertake training in health effects of pesticide usage and the importance of cholinesterase testing. The recommendation was followed up on very successfully. A local health professional organized a specialized training program on recognizing the effects of pesticide poisoning and cholinesterase training. USAID/Mali and the Malian CPS both deemed the effort very beneficial. Similar activities were pursued in Niger in 1993.

In Mali another very helpful resource in the training efforts has been the work of CILSS/INSAH in preparing outstanding training materials and programs for both literate CPS agents and illiterate farmers and nomads. The publications cover everything from environmental protection and IPM to pest identification and control. The good association currently existing between this CILSS/INSAH office and USAID/Mali and AELGA should continue to be nurtured and strengthened. Other groups, especially NGO/PVOs, such as Africare, are involved in training farmers on the risks of pesticide use.

Use of military personnel in control efforts has occurred in several Sahelian and North African countries; training for this cadre of human resources should be implemented in future activities. The Malian military was successfully used in the 1989 control campaign. In Morocco, the military is extensively used for control campaigns, more so than in the Sahel. The CPS in Niger indicated that it would be useful to include military personnel in future training programs.

Most of the recommendations found in the 1989 Mid-Term AELGA Evaluation have been followed up on by the locust/grasshopper control team in Niger. Since 1989 there has been training on survey techniques, greenness map interpretation, and production of training materials, all of which were recommended by the evaluation.

## Future Training Activities

Past training has focussed little, if any, attention or effort on the Horn of Africa and the Red Sea coastal areas, when in fact the 1987-1989 desert locust plague that led to the birth of AELGA began in these regions. Ironically, most donor attention, efforts, and funds have gone to the Sahel. This may have occurred due to the fact that by the time donors were ready to respond to the plague, the problem had extended to and engulfed the Sahel, so controls and associated training were instituted there. The unstable politics and armed conflict in Ethiopia, Eritrea, and Sudan did not permit activities in that region until recently.

An overwhelming majority of the training went to Mali and Niger (which had continuing bilateral programs), whereas now that

preventive strategies are being developed to affect the problem before it reaches these areas, some emphasis should shift to the Horn region, and training of CPS personnel and farmers/nomads in Ethiopia, Eritrea, and coastal Sudan should ensue. Continuous training should take place to update CPSs in the Sahel, but efforts in preventing a full-blown plague need to begin at once in the Horn. Regional training events should encompass the two regions--Near East and Africa--since the desert locust breeding grounds exist on both sides of the Red Sea, irrespective of sociopolitical boundaries. A campaign to continue sensitization of USAID/NE and FAO of the need for this shift will be necessary to build the linkages for cooperation and collaboration. AELGA has already been summarily responsible for the eventual development of an FAO preventive plan in this "Central Locust Region."

In the future, AELGA should strive to make an inventory of NGO/PVO groups, and the key contact people in them, doing training on pesticide safety, locust/grasshopper control, and control of other pests such as rodents. These groups should also be tapped for assistance in training implementation organized by AELGA.

## 8.0 Research and Technology Development

Biological Control of Locusts and Grasshoppers:

As environmental concerns over use of pesticides heighten, other control measures are being sought out. Biological control methods hold promise as alternatives to synthetic chemical pesticides. They are usually species or group specific, thus they would not harm other insects and arthropods (some of which may be beneficial in controlling the locusts and grasshoppers themselves). They are considered relatively less toxic to human handlers and wildlife, as compared with chemicals. And they can possess an efficacy similar to that obtained with chemicals. Thus there are high stakes payoffs to be gained from investing in research on biological controls.

In Cape Verde, efficacy of bacteria, fungi, protozoa and viruses against grasshoppers and locusts were evaluated via collaborative works between the Cape Verde Agronomic Research Center and Montana State University/Mycotech Corporation, through the USAID/AELGA funded research projects. Eighteen hectare plots were treated with *Beauveria bassiana* in Cape Verde in the summer of 1992, however the trials were started later than is optimal (so that adults were treated) due to funds obligation being held up. The experiments were also confounded by interplot migration of grasshoppers, such that there were up to 40-50% reductions in density in some plots.

In Benin, the International Institute of Tropical Agriculture (IITA), the International Institute of Biological Control (CABI-

IIBC) and in Niger the CILSS Crop Protection Training Center (DFPV) are conducting a multi-donor collaborative research project focusing on promising fungi species to control locusts and grasshoppers. AELGA provided a nearly $1 million grant to IITA for this research. Their work has narrowed down to the study of *Metarhyizium* fungus for control.

In Mali, trials were carried out in 1989 and 1990 in collaboration with USAID/Mali, Mali National Crop Protection Services, CIDA, Ciba-Geigy and FAO, on promising fungus species as an alternative to the current locust and grasshopper control method. For the 1993 grasshopper season MSU has proposed to USAID/Mali to do large plot tests of *Beauveria bassiana*, in collaboration with Ciba-Geigy, and has plans for testing fungus and pyrethrum mixtures for control.

In 1993 Montana State University found three highly virulent *Metarhizium anisophilae* strains in Madagascar. They also found an unusual red fungus, *Sporosporella*, reported to be highly virulent to the migratory locust; a Mycotech Corporation scientist has pioneered a breakthrough in culturing this fungus. Testing against the migratory locust will ensue in Cape Verde in 1993, and should be extended to East Africa to take advantage of the current migratory locust outbreak there.

There is good reason to believe that biological control methods will be developed to successfully mitigate locust and grasshopper threats in Africa in the future. Already there have been promising control results obtained with the fungus *Beauveria bassiana* by Montana State University & Mycotech Corporation. The results are promising in that they give the same level of control as conventional insecticides, only have a one week lag time before target mortality occurs. *Beauveria* now has an experimental use permit from the USEPA. Problems with fungus use will be in handling and storage, as optimal conditions are difficult to achieve in developing countries.

Future activities should include running the trials over larger areas, such as 50-100 ha plots. This should reduce interplot migration and give more accurate estimates of control. After this, trials should move to the on-farm stages of testing with full participation of CPS and extension personnel and farmers. Other activities should include: testing of biocontrol agents in Madagascar; testing of fungus/pyrethrum combinations; development of 'cottage industries' to produce the fungus locally, with attention to quality control, by the private sector; and the ability and will of farmers to purchase biocontrol agents.

Rodent Control Research

Amendment 3 (1988) to the AELGA project included $615,000 for

activities on rodent research. This was done in response to a major rodent outbreak occurring concurrently with the locust plague. In fact, the same climatological conditions that lead to locust outbreaks--heavier than usual rainfall, followed by vegetation flush--also give rise to rodent outbreak emergencies. Several Sahelian countries had declared national disasters and the crop protection services did not have the expertise to deal with the problem; it was not even known what species were present.

The Denver Wildlife Research Center had been operating in Chad in 1987-1989 on exploratory technical missions, thus this research project was implemented in Chad by DWRC in collaboration with USAID/Chad and Chad Ministry of Agriculture. The project has been underway, with some no-cost extension, for the past four years (1990-1993). The goals of the project were to identify species present and their biology, research and develop appropriate intervention measures, devise a method to assess crop loss from rodent outbreaks, and prepare training materials on rodent biology and control for use by Chad CPS personnel.

All of the project goals have been achieved except devising a method to assess crop loss. In addition, there was not sufficient time to develop a technology transfer package for transfer to farmers. However, a good training manual and video were produced. DWRC has proposed a 2-3 week TDY to Niger in July/August, 1993 to examine possible study sites and collect rodents for comparison with those obtained in Chad in 1992. Also immunocontraceptive control mechanisms are being developed and hold promise as being more environmentally innocuous than current methods.

Future activities in rodent control should include: expanding activities, especially training, to other countries in the Sahel that declared emergency rodent outbreaks during the last plague; beginning collaboration and information exchange with the Ethiopian MOA (they had an emergency outbreak of rodents in the Siadamo region of southern Ethiopia in the spring of 1993 and used zinc phosphide to control the outbreak); educating farmers on the need and methods for controlling rodent outbreaks and safe use of rodenticides; testing the predictive ability of the rainfall and NDVI (Normalized Difference Vegetation Index) data that is thought to correlate with rodent outbreaks; devise a method to assess crop loss; environmental assessments need to account for rodenticides if supplied under USAID; MOAs and CPSs in Sahelian countries should prepare contingency plans for dealing with the next potential rodent outbreak. The project should look into possibilities of local production of rodent control substances and possibilities for farmers being able to afford or having the will to purchase rodent controls. An economic analysis may be in order.

The Africa Bureau/ARTS/FARA supports research on routine production constraints across the Sahel through funding to regional agricultural research networks. These networks should initiate

research on this important production constraint. Or AELGA and ARTS/FARA could collaborate on support to this initiative.

Given the increasing rainfall and vegetation flush present across the Sahel in the spring and early summer of 1993, it is likely that rodent outbreak emergencies will recur. The AELGA project should be positioned to respond, and research activities of the DWRC should continue to support the longer range goals of preparedness and prevention.

Crop Loss Assessment Research:

Three different groups have been involved with developing grasshopper or locust crop loss assessment models: the British (through NRI), GTZ, and OSU through the AELGA project. OSU has been involved in this research since 1989.

A software package on a preliminary simulation model (GHLSIM) of Senegalese grasshoppers in millet and sorghum has been developed by OSU. The model was based on data collected from field trials conducted in Mali with the help of USAID/Mali and national agricultural research system on the population dynamics of Senegalese grasshopper. The model was designed to analyze the relationship between grasshopper number and the resulting economic loss in order to make decisions on the most cost effective control operation. OSU has developed damage thresholds, but the work lacks field data and ground-truthing before it can be further developed. Oregon State University has also done research on pearl millet damage by five grasshopper species in Mali, as well as stem borers, blister beetles, head borers, and birds. This data was subsequently used as an aid for detection and assessment of damage.

Problems with the model developed by OSU include: it does not perform for species complexes found on millet and sorghum; the predictive capability is accurate for only one species at a time on the crop, a situation rarely encountered in the farmers field; it is not transferable to losses due to locusts. These drawbacks greatly limit the usefulness of the GHLSIM model. This type of research is still in its infancy and much more basic research needs to be done before it will have field predictability applications.

Practical applications of this type of research will be years into the future. This type of basic research is needed, especially where justifying economic losses due to locusts, grasshoppers, and other types of pest outbreaks are concerned. However with shrinking budgets the issue of payoff in the foreseeable future, in terms of locust prevention and environmental sustainability, is seriously brought into question. Also, the fact that 3 different groups are working on the same problem at the same time raises the issues of duplication and overlap. Future funding for this type of research should be seriously reviewed, and cautiously pursued.

Only projects that will yield a useable product in the next five years and contribute directly to project goals of prevention, control, and environmental sustainability should be pursued.

Several Malian CPS agents interviewed had not yet received results of the OSU studies. One suggestion produced during consultation was that AELGA may want to investigate forming a relationship with universities in Texas, since the climate and crops are similar with those found in Mali. Also the strong relationship currently existing between Mali and Texas A&M in agricultural research could be taken advantage of.

Again, AFR/ARTS/FARA is supporting long term institution building and basic research on major production constraints across Africa. In areas where locusts and grasshoppers are economically important, research networks funded by them should consider funding basic, long range activities such as this.

Neem Oil Trials in Mali and Niger:

An assessment of research needs and approaches to investigate the potential of neem kernel extract as a crop protection agent was undertaken in Mali. Also, a study of the role neem could play in increasing agricultural productivity of small-scale farmers was made by the Agency for Facilitating Growth of Rural Organizations (AFGRO) in collaboration with USAID/Mali and the national crop protection service.

In Niger, a neem project was undertaken in collaboration with AFGRO and the Consortium for International Crop Protection (CICP). The objects of the project were to assess the efficacy of the extract on sahelian species of grasshoppers in cereals and investigate the socio-economic feasibility of village level production units of neem kernal extract for local use.

The results of these studies appeared promising. NKE was found to be effective against a range of cereal pests, including several species of grasshoppers. Moreover, as neem has been in use for pest control purposes in Niger, Mali, Togo, and other West African countries, it was hoped that it would also be adopted and used for the same purpose by other African farmers.

The major problem with the use of neem is that it is not reliable. The amount of neem found in the kernels and leaves can vary widely over the growing season and even from week to week. High variability also exists from one neem tree to another. Past studies done with neem have been inconclusive due to the fact that neem oil applied to a crop would appear to be effective in one trial and not show any repellency in the next. There is potential for developing neem varieties, through selective breeding, that will consistently yield sufficient quantities of active ingredient.

However this work's potential lies several years into the future, and will require much basic research before it shows more immediate potential.

There are literally thousands of studies on neem and the uses for its extracts. And there are several currently underway to develop high yielding neem varieties. Which seriously brings into question the need for additional studies on neem. Also noteworthy is the fact that neem trees across the Sahel are currently dying from an apparent decline disorder, basically a physiological problem related to drought stress. Further, one Malian CPS agent stated that neem is not widely used by farmers in Mali. No further studies on neem should be undertaken at this time by AELGA.

## New World Screwworm Control

The New World Screwworm (NWS), accidentally introduced into Libya, was a serious threat to African livestock and wildlife from 1988-1990. OFDA was the leading force behind the NWS eradication program; it was actively involved in US discussions with FAO (the implementer), tracking and responding to developments, and continuously assessing options for control.

The Africa Bureau provided $1 million of the $3 million made available to FAO for the Screwworm Emergency Center of North Africa (SECNA). In 1991 the NWS was eradicated from Libya by use of the sterile male release technique. Constant monitoring was done for several months after the NWS was eradicated. AELGA's past activities and experience in the region make it an appropriate vehicle to establish a contingency that will facilitate the eradication of screwworm and other introduced species that threaten to become major pests in Africa.

## Future Research Activities

In addition to the promising work being done with biocontrol agents for grasshopper and locust control, other promising measures are on the horizon and beginning to be investigated by various groups. These include research into the use of insect growth regulators and semiochemicals for locust and grasshopper control. These hold promise in that they are very group or species specific, and they are naturally occurring compounds which would likely represent fewer environmental risks, and be safer to handle than synthetic chemicals. Basic research on isolating and identifying these compounds is currently underway by FAO. These studies should continue to be pursued, and AELGA, through donor coordination in FAO, should support these efforts.

Another promising lead developed in 1993 was the discovery by AELGA management of a plant species in Eritrea that is highly

repellent to desert locusts. The species was identified informally as a variety of sesame. There are a few reports of this phenomenon in the literature, however it has never been fully followed up on. It is possible that the extent of this repellency has not been reported on in Eritrea until recently because of the inaccessibility of the region to scientists due to the military conflict that raged there for the past 15 years. There may be varieties of sesame in Eritrea that are highly resistant; these should be further researched to determine their potential for locust and grasshopper control. Various varieties of sesame are also cultured in many places throughout East Africa; thus there is the possibility for widespread use if sesame is found to contain repellents.

## 9.0 Environmental Sustainability

USAID Programmatic Environmental Assessment (PEA) and Supplemental Environmental Assessments (SEAs)

Due to a plague of locusts in eastern and Sahelian Africa in 1987, the Administrator of 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 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) 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 most Sahelian countries, Eritrea, Ethiopia, Morocco, Tunisia, and Madagascar. In 1991, the 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. In fact, AELGA provided most of the intellectual leadership for the PEA/SEA development processes. AELGA oversaw the completion of all SEAs produced to date, and AELGA has been a leader in seeing that African scientists and policy-makers are trained in the concepts present in the PEA and SEAs. Evidence of this is found in Appendix 2.

Environmental/Pesticide Regulations in Africa

In addition to the USG regulations that require the PEA and SEAs to be implemented where USAID pesticide assistance is rendered for locust/grasshopper control, host country governments are beginning (1993) to draft decrees and pass regulations governing the registration, use, and disposal of pesticides, and protection

of natural areas from pesticide mishaps. AELGA is promoting these new regulations, and encouraging their enforcement. The new regulations should be added to the SEAs prepared for each country as they are obtained by missions and AELGA TDY visits.

In most countries, ministries of natural resources, environment or environmental protection are very new. In 1993 the Ministry of Agriculture in Ethiopia split and formed a new Ministry of Natural Resources and Environmental Protection. The Ministry of Environment is also new in Mali. The underlying philosophy shared in Mali and Ethiopia is that environmental protection is a luxury to be focussed on after more dire problems such as reduction of poverty and hunger are addressed. Donor pressure is forcing the issue, however, so that basic environmental protection is achieved. Environmental assessments help ensure environmental protection and sustainability where USAID assistance is provided, and also examine and make recommendations on overall crop protection involving regional programs such as DLCO-EA and non USAID funded activities of MOAs/CPSs, so the impact and environmental protection stretches further.

## Pesticide and Pesticide Container Disposal

AELGA's SEAs advise and require a system for dynamic inventory, alternate use, and disposal of obsolete pesticides and containers.

In 1990 AELGA sponsored a West African Regional Conference on Disposal of Pesticide Containers and Obsolete Pesticides in Niger. Participants from the following countries provided listings of obsolete pesticides: Burkina Faso, Cape Verde, Chad, Gambia, Ghana, Guinea Bissau, Ivory Coast, Liberia, Mali, Mauritania, Morocco, Niger, Senegal, and Togo. These are published in the Proceedings of this conference, published by AELGA. Recently, lists of obsolete pesticides maintained by the DLCO-EA in Eritrea and Ethiopia were provided in the SEAs for those countries. Thus the project has been successful in starting a system of inventory and increasing awareness of these issues in Africa.

Most countries are awaiting financing for disposal. In 1991 the AELGA project, in coordination with other donors, funded a program to ship over 50,000 liters of obsolete dieldrin back to the producer, Shell Chemical Company, in the Netherlands. The transfer was completed and the operation was deemed successful, albeit very expensive. Unfortunately tighter budgets will limit this type of disposal activity in the future. For now most chemicals are being stored, and many of the barrels are in poor, leaking condition. The emphasis is placed on storing the pesticides in safe areas and conditions, and repackaging. Many will probably await the development of affordable detoxification technologies.

In the past many barrels have made their way into the public's hands, for use in storing food, water, and animal feed. And more recently barrels have been washed and cut up to make fences, rooftops, gates, and doors. In the opinion of CPS personnel these activities have been greatly curbed in recent years due to increased awareness and monitoring by donors like USAID. There have been programs in several countries to rinse, puncture, crush, and bury used drums in remote desert areas. Many countries are simply storing the barrels until better solutions can be found. AELGA's activities have influenced and improved the situation. One possible solution to the excess and obsolete pesticides being pioneered by AELGA is elaborated on below.

## Pesticide Donations from Non-traditional Donors

In mid 1993 AELGA took the lead role in forging ahead with a plan (that had been stuck in the discussion phase since 1990) to get countries with large pesticide stocks, such as Morocco, to donate these to other developing countries in more immediate in need due to locust outbreaks. Currently two such initiatives are underway, with more on the horizon. Morocco has verbally committed to send 50,000 liters of malathion to Sudan for the current outbreak there; the transfer will be funded by AELGA. This initiative was started when AELGA suggested it in talking points presented at the FAO meeting in Rome in March of 1993. Since then FAO has suggested that Tunisia donate malathion to Yemen. Tunisia has responded positively and is moving in this direction. Other stocks of pesticides donated for locust and grasshopper control in Guinea Bissau may be transferred to East Africa as well.

This type of 'non-traditional donors' assistance, if successful, will have been pushed out of the discussion phase and into the implementation phase by AELGA leadership. Bold (and common sense) steps such as these should be strongly supported and continued by AELGA management.

## Safe Use of Pesticides

USAID environmental assessments of pesticide use advise and require: training in pesticide safety, labelling of pesticide containers, prohibited use in fragile habitats such as parks and sanctuaries, limited non-target impact, residue monitoring, minimum area applications, and sufficient storage facilities.

The AELGA project has sponsored or helped support over 10 regional and local training events in Africa that deal with pesticide use. In addition each of the country SEAs contain complete, detailed country-specific sections on each of the above issues. Many of the African decrees being drafted on pesticide use follow closely USEPA regulations and USAID's environmental

procedures. So the AELGA information transfer activities and examples set by them have been effective and successful on several levels, especially in influencing policy at the national level. Implementation and enforcement will be the next major hurdles.

## Ecotoxicological Studies

Monitoring the impact of control operations involving pesticides is one of the most important means for ensuring the protection and sustainability of environmental resources. The AELGA project has attempted to contribute by sponsoring studies on the impact of pesticides on non-target and beneficial organisms and tests for chemical residues in soil and on vegetation. The Dynamac Corporation was contracted by USAID and attempted trials in Mali in 1987 and in Sudan in 1988. Deficiencies in planning, research methods used, implementation, and analysis led to inconclusive results. In fact, the 1989 AELGA Mid-term Evaluation reports that the investment made by AELGA was largely lost in this instance.

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 AELGA to focus on funding similar studies in east Africa, primarily Ethiopia, Eritrea, and Sudan making full use of local MOA/CPS, Ministry of Natural Resources and Environmental Protection, and University personnel. Given that this geographical region is where most plagues begin, it follows that this is also the region with the highest potential for pesticide use, and the most at risk from environmental contamination. In the first half of 1993 this was certainly the case. There is an open opportunity for AELGA to make a mark in this 'high use' region by promoting ecological studies there. Studies should take advantage of lessons learned from other donor's work in west Africa and contracted groups should have some regional and locust familiarity and experience. Some personnel from DWRC have ecotox experience, are familiar with the region, and have performed well in past AELGA activities.

## 10.0 Human Health and Safety Concerns

The PEA recommends that USAID, through AELGA, should support the design, reproduction, and presentation of public education materials on the safety and use of certain pesticides for locust and grasshopper control; design training courses for health personnel; provide health centers with pesticide antidotes and posters describing diagnosis and treatment of poisonings; and field test kits for monitoring human exposure to pesticides. AELGA has been active and successful in all of these areas.

As noted earlier, a course on health impacts of pesticide use was held in Mali in 1989. Other training courses, particularly the regional ones run by FAO, have also emphasized the need for toxicity testing and safe use of pesticides. AELGA published, in 1989, a pesticide user's guide for African extension workers, and clip art book, in 1990, containing pictures of proper and improper pesticide handling and human health concerns. Most of the proceedings of training events sponsored by AELGA have also been published. FAO has produced a series of posters on human health and pesticide safety. Thus there is now a plethora of material available and circulating on health and safety.

Presently there is need to ensure that copies of the informational materials produced are distributed to those involved in crop protection and training. AELGA should continue to help with the multiplication and distribution of these materials where deficiencies exist. Such areas will include Ethiopia, Eritrea, Sudan and Somalia.

Many of the past AELGA donations of pesticides have also included provision of safety equipment. However, many of the CPS personnel and most of the farmers assisting in control still will not use protective clothing due to the heat. This was especially documented in northern Ethiopia. It was noted, however, by Ethiopian CPS agents working in the north that most of the farmers applying pesticides in 1993 were doing so for the first time in years and would likely only come in contact with pesticides for one or two days of spraying once in that year. So the threat of prolonged exposure was practically nil during locust campaigns. The CPS agents working in the pesticide warehouses, the ones with the greatest risk of repeated or prolonged exposure, allegedly used safety equipment consistently. In other countries (and other parts of Ethiopia) the situation may be different; in some parts of Mali farmers near locust and grasshopper breeding grounds end up applying chemicals several times per year, each year.

There will always remain a need to continue and refresh training and information transfer on pesticide use risks, and ways to avoid them. Only the continued repetition will make people think twice before handling pesticides. AELGA should continue

these efforts, in concert with FAO wherever possible, in all of the countries involved.

The Red Cross has also been active in conducting health seminars and cholinesterase testing in the past. Future AELGA activities in human health and safety might be done in cooperation with the Red Cross, thus combining resources and cutting costs.

## 11.0 Economic Impact of Pest Control Activities

A decision support system for benefit/cost analysis of the Senegalese grasshopper developed by cooperators at Oregon State University showed a ratio of returns of 2.6 - 3.8 for a control program in Chad. Research activities commonly produce such high rates of return for the investment. Likewise, in Tunisia in 1988, 40% of the wheat and barley crops (worth $29 million) were at risk, and the cost for control was between $8 and $17 million. The locusts were controlled and losses were negligible, and again the returns are about 2 - 3 times that of the cost of control. Moreover, these estimations do not even take into account all of the cash crops which make up a large portion of the incomes of the Tunisians. If these crops were taken into account the returns to the investment for control could have been substantially greater. The costs for locust and grasshopper control in purely economic terms are clearly justifiable.

An economic study on the comparative costs of 1) no control, 2) prevention, and 3) plague control might shed some light on the potential economic damage that may result under each scenario. This may be pursued during the new AELGA project phase.

## 12.0 Administrative/Management

Amendments, LOP Funding, PACD

By July 1993 there had been eight amendments written to the original AELGA project. In summary the amendments did (in the case of Amendment 8, will do) the following:

1 Raise LOP to fund (ADRN funds) and extend FEWS
2 Raise LOP to fund (ADRN & SDP funds) and extend FEWS
3 Raise LOP to fund (SDP, ESF, & DFA funds) AELGA
  Extended AELGA PACD to end 1990
4 Extended AELGA PACD, without cost, to end 1992
5 Extended PACD, with funds (ARDN) for Madagascar, to end 1993
6 Raise LOP to fund (DFA) AELGA, buy-ins, etc.
7 Raise LOP with funds (ADA) for Sudan, Eritrea, and Ethiopia
8 Pending: If approved, will raise LOP to fund (DFA) AELGA, and extend PACD to end 1994

By amendment 7 the LOP had been increased to $34.255 million. Special emergency funds had been provided to Madagascar, Sudan, Eritrea, and Ethiopia for unexpected locust outbreaks. And components such the Famine Early Warning System (FEWS) and SAFIRE Projects were funded through AELGA. Since the end of 1988, the FEWS component became a special project, separate from AELGA. However, close cooperation between the two projects continues to the present, especially where monitoring and mapping are concerned.

The LOP funding level has, and will continue, to vary greatly from years of locust/grasshopper (and other pest) emergencies to recession years. In an outbreak year, such as 1993, when locust populations reach emergency levels, approximately $8 million will be required for operations and emergency procedures and activities. In recession years, $2-3 million will cover preparedness measures such as monitoring, research, training and proactive interventions.

The emergency nature of the project will require that the AELGA project is continued long-term, for at least another 10 years. Current thinking in USAID holds that there will always be a need for certain types of donor assistance that cannot, and likely will never, be able to be supplied by the recipient countries, due to cost and administrative complexity (USAID missions, especially in Africa, are downsizing or being phased out altogether).

Waivers and Procurement of Goods and Services

The AELGA project paper contained two blanket waivers, one for purchase of pesticides, survey, and control equipment from sources and origins other than the USA or cooperating countries, and a waiver for provision of non-USA produced motor vehicles and spare parts. These were to last the life of the project. And assurances were given that most pesticides would be purchased from US sources.

Another waiver in effect from the 1986 locust control campaign was that of USAID Regulation 16, on review of environmental safety and protection where pesticides would be involved. This waiver was continued through the 1987, 1988 and part of the 1989 locust campaign years with assurances that the then-being-developed Programmatic Environmental Assessment would ensure that compliance with Reg 16 would move significantly closer to fulfillment. The waiver expired on August 15, 1989 and the PEA was completed in March of 1989. The PEA and country-specific SEAs now fulfill, and in some cases exceed, the requirements of Reg 16. All USAID locust/grasshopper control assistance now requires that an SEA be completed for each country where implementation will occur.

The emergency nature of this project makes it impossible to procure and transport from the USA appropriate equipment or vehicles in time to control outbreaks. Thus, in the future AELGA

will need to maintain the use of waivers of normal procurement procedures. As the predictive capabilities of locust control groups improve, the additional lead time should allow greater compliance with purchases from American sources. Already most of the pesticides procured under this project have been from American sources.

AELGA will need to have in place waivers of the current regulations where rapid procurement is involved. It will be necessary for these emergency waivers to be processed by a specialist familiar with the USAID offices involved, regulations, and restrictions. GC suggests that Africa Bureau delegate one of its officers as an "emergency procurement officer." Such an officer would obtaining blanket waivers of the new source/origin and competition requirements for serious emergencies under prescribed guidelines. This will require a commitment on the part of Africa Bureau, possibly through the SADE Task Force or its successor, to training and providing a quality emergency procurement and contracts officer. This person would be responsible for liaising with and understanding the needs and roles of other Africa Bureau and USAID offices (e.g. GC, DP, and OFDA) and then using waivers/mechanisms/authorities as appropriate to rapidly provide goods and services for emergencies, including pest and pesticide-related emergencies. This move by Africa Bureau would be seen as very prudent considering the increased emphasis likely to be placed on emergency assistance by the current administration and USAID leadership.

## Project Staffing

The original AELGA project paper lists the following five personnel as essential for operation: a branch chief (direct hire manager), and four consultants: two full time analysts, an entomologist, and a chemical engineer. Over the years the number of people working on the project has dwindled to three, a direct hire project manager, and two consultants: a technical advisor (entomologist), and a project assistant (ecotoxicologist).

Locust outbreaks recurred in late 1992 and the first half of 1993, with no signs of recessing. USAID management and technical experts have been, and continue to be short-handed to cover all of the activities needed and being requested. As the mandate of AELGA expands, as expected, to cover these and other types of pest emergencies (it already expanded in Amendement three to cover rodent outbreak emergencies and associated activities) it is expected that the project will require the services of additional technical assistants.

## Project Buy-ins

AELGA has had buy-ins with several missions. The most visible throughout the project were those with Mali and Niger. Recently the Madagascar mission used AELGA for assistance with a locust outbreak. Several missions have requested SEAs. Table 1 in this document lists activities that took place in various countries where AELGA was involved.

The AELGA project should forge strong relations with the USAID/Niger DPM project, as it may well serve as a model for disaster prevention and mitigation activities across the Sahel and East Africa. Mali, Cape Verde, and Madagascar will help with the running of biocontrol experiments with Montana State University in 1993. These activities and buy-ins should continue and be expanded to other countries in the region, and especially to East Africa.

Missions can offer AELGA assistance in pushing through, and helping implement initiatives such as the "non-traditional donors assistance." In addition, they can continue buying-into the project in support of the biological and alternative controls, and training initiatives. Missions that require and request support for field visits should be prepared to finance part or all of the TDY, and provide adequate in-country support. Missions should be persistent in tracking control efforts to ensure that SEA guidelines are being followed. The missions in Niger and Mali have been successful in this regard, due in part to the relatively high amount of training received in those countries, and the USAID mission's level of interest.

## Impementation through FAO

FAO has been the major implementor of activities through the AELGA Project, with two grants totalling $3.7 million from 1988-1991, and one grant totalling $1.76 million for technical assistance and commodity procurement for the recent outbreak in East Africa ($1 million for Ethiopia/Eritrea, and $760,000 for Sudan). At the time of this assessment there were plans to grant FAO an additional $1.4 million (through the end of CY93) for locust control in the Horn and across the Sahel. FAO will remain the leader of donor coordination for locust control activities. FAO has been the leader in research on new semiochemicals and insect growth regulators as alternatives to synthetic insecticides. Also, they have lobbied African countries to discontinue the use of insecticides that the USA has banned; and they will broker the transfers of insecticides from non-traditional donor countries to other countries in need. FAO has also led coordination among donors for regional training events, especially for upper-level policy-makers, as well as for crop protection personnel (see Appendix 2); and FAO is a leader in regional locust surveillance activities. The importance of FAO to AELGA's efforts and goals

cannot be overemphasized.

Implementation through USDA/OICD & APHIS

USDA/OICD has administered most of AELGA's contracting for technical assistance (through RSSAs and PASAs), travel, and contact with cooperating and collaborating organizations (such as MSU, OSU, DWRC, University of Missouri, and others) in the USA. These services are compiled in Appendix 1. Concerns with this arrangement have arisen over the high (31%) overhead charged by USDA/OICD for their services, and a lack of rapid responsiveness by USDA/OICD to AELGA's needs. For instance, when asked recently for an accounting of AELGA's expenditures and budgetary totals, USDA/OICD was unabel to respond with the turnaround needed by the AELGA Project, and the budget was overspent by over seven thousand dollars. In the future, USDA/OICD should be required to send running budgetary totals to the Project's Manager and Technical Advisor on monthly or bimonthly basis, and account for the breakdown of the 31% overhead.

USDA/APHIS provided technical input and assistance to the last locust plague. They were represented in the weekly Desert Locust Task Force meetings, along with the U.S. Forest Service, USGS, and the EPA. Historically, USDA/APHIS had been FAO's main contact agency in the U.S. regarding locust outbreaks. At present, the AELGA Project is the primary contact point for FAO. Recently USDA/APHIS produced a roster of personnel from which to draw for locust control. The AELGA Project may use this roster if the locust situation intensifies.

## 13.0 Relationships with other Entities

OFDA

The AELGA project's closest cooperator has been OFDA. OFDA has assisted with locust control during locust disasters, as well as during outbreak emergencies. A 'not-withstanding' waiver allows them to very rapidly procure, and provide transportation of, goods and services without adhering to the normal bureacratics associated with USAID procurement policy and regulations. Africa Bureau has never been able to do sufficiently rapid procurement, so OFDA has repeatedly come to the rescue. As budgets have shrunk and the number of disaster needs grown, OFDA has become increasingly reluctant to handle locust/grasshopper emergencies for Africa Bureau, and will probably only respond now if locust disasters are officially declared. They fully expect Africa Bureau to prevent the problem from becoming an emergency or disaster through development assistance and rapid response to outbreaks.

If the current, 1993, outbreak continues and develops into a

plague, and disasters are declared, the two groups would require very close and careful collaboration. OFDA's not-withstanding clause would be taken advantage of in this circumstance to rapidly procure goods and services. In addition, OFDA's rapid response abilities will need to be called upon until the Africa Bureau develops its own rapid response capabilities. AELGA would assist with some of the operations and in liaising with FAO, and would provide trained, experienced technical support.

ARTS/FARA

For the past 6 years the AELGA project has resided in the Africa Bureau in the office for Technical Resources (TR), Agriculture and Natural Resources (ANR) division, which in 1991 became the office for Analysis, Research, and Technical Support (ARTS), Food, Agriculture, and Resource Analysis (FARA). Before that, it spent one year in the Africa Bureau Office of Emergency Operations (OEO). Also in 1991, Tropical Research and Development (TRD), Incorporated completed a report entitled "Planning and Analysis for Pesticide Management Activities in Sub-Saharan Africa: Options for the Africa Bureau" for AFR/ARTS/FARA. The purpose of the report was to study the major elements, particularly of USAID Africa Bureau, pest management experiences in Africa over recent years. The report then goes on to make recommendations concerning future USAID activities in pest management in Africa, where they should be located in the agency, and how they should be carried out. Although the TRD report has elements relevant to locust control; many elements found in the report have already been addressed by the AELGA Project and were even in the process of being incorporated when the report was being written. In 1992 AELGA was transferred to the Office of New Initiatives (ONI).

The relationship between ARTS and AELGA will remain strong through the ARTS Environmental Unit (where both the past AELGA Manager and Technical Advisor now reside). SEAs must be cleared by the Africa Bureau Environmental Officer, who also resides in ARTS/FARA. Since the project has such a strong environmental component, and Africa Bureau/ARTS/FARA promotes the adoption of IPM, the two offices have a natural interdependency. This relationship should continue to be nurtured and supported in any extension of AELGA.

As the name suggests, ARTS is concerned with analysis, research, and technical support. So is AELGA. There is much overlap between the scope of the two offices, and there needs to be a division of labor and responsibility between the two. This will need to be worked out, possibly with the implementation of a special working group, between the two offices. As suggested in other parts of this assessment, ARTS/FARA should become involved in supporting crop loss assessment research and analysis. Also, ARTS/FARA should promote the initiation of research on rodent

research and control through its agricultural research networks initiative. ARTS/FARA/ENV could also become involved with training and capacity building activities and general pesticide problems that impinge on environmental protection. Again, a working group will need to come to consensus on division of labor on these activities.

AFR/SADE (DRCO)

The Southern Africa Drought Emergency (SADE) task force was set up in 1992 to serve as a "bulletin board" for information and coordination on the drought in Southern Africa and provided assistance for other humanitarian efforts in Somalia and Rwanda. SADE holds weekly meetings, during which the locust situation is always discussed by AELGA staff.

In the future the office could continue to exist for emergency operations, and may best serve the Bureau by placing and training an emergency procurement officer. The officer would be responsible for putting in place the proper waivers and would liaise with and understand the requirements of other Africa Bureau and USAID offices, such as GC and DP, and OFDA; and then using this information and authorities to rapidly provide goods and services for emergencies including pest outbreaks. This move by Africa Bureau would be seen as very prudent considering the increased emphasis being placed on emergency assistance by the current administration, USAID, and Africa Bureau leadership.

Southern Africa

In the Spring of 1993, AELGA dispatched a consultant to southern Africa to determine needs for assistance. He visited Botswana, Tanzania, and Zambia to do a needs assessment for possible post-drought outbreaks of pests, and determine mission interest in conducting SEAs. Major pest problems were identified and ranked, other pest concerns, including *Quelea* birds, were listed, and research areas and SEA needs and status were reported on. All three countries need an SEA and would like to collaborate and assist in preparation. The armyworm came up repeatedly as a problem of major concern to the CPSs in these countries.

Armyworm should be included in AELGA's mandate, as it arrives to outbreak emergency proportions in most of East Africa. The Kenya mission requested assistance with it in 1993. AELGA recently assisted with SEA preparation in Madagascar and Mozambique, and should assist in the preparation of SEAs for additional south-eastern African countries.

In order to pursue control of these other pests, the PEA and SEAs for affected countries will need to be amended to contain

guidelines for control and environmental protection measures. These activities, if requested by missions, should be financed by these missions.

AID/NE

USAID/Morocco has informally expressed strong interest in being able to access a pool of talent and resources such as that found in AELGA. Recently, USAID/NE completed a draft SEA in-house for the implementation of locust control efforts in Yemen. The NE Bureau was advised to seek assistance from AELGA, so they copied the recently-completed SEA for Eritrea, and re-worked it for Yemen. To finalize the document and make it useable they will need to send someone to the field to do verification work. Expertise in AFR/AELGA should be used for this task. AELGA is the only project in USAID that is set up to do SEAs and has a roster to quickly get such TA to the field.

Cooperation between NE and AFR should lead to more non-traditional donors' donations of expendable commodities, like pesticides, to other developing countries. A case in point is the current effort underway to ship malathion donated from Morocco to Sudan. Similar transfers are also in the works, and will reflect well on both bureaus should they succeed. More of this type of cooperation should ensue in the future. NE, and the CPSs in their mandate countries, would like to receive greenness maps for locust/grasshopper monitoring. AGRHYMET and FEWS should be brought in for this type of support.

USAID/NE can also encourage relatively well trained and equipped north African country crop protection services to become involved in control efforts in the northern reaches of some of the Sahelian countries. It is to their advantage to do this in order to keep the locusts from moving north into their countries. Algeria, Morocco, and Tunisia could be tapped for these activities. A politically neutral entity such as FAO can be used to oversee such initiatives.

Private Sector

AELGA has involved the private sector in several of its activities. The Ciba-Geigy Corporation has cooperated, through its field laboratory at Cinzana in Mali, with the biological control work being undertaken by MSU. A proposal for research with Ciba-Geigy in combining fungal pathogens with naturally-occurring insecticides like pyrethroids was recently submitted by MSU to USAID/Mali, for bilateral funding. The private sector has also been involved in this project each time that insecticides, flying time, and equipment and supplies have been purchased for locust/grasshopper control. The Mycotech Corporation has

collaborated with MSU to provide fungi for biocontrol work. Private sector rosters have been tapped to buy technical assistance services. Linkages with the private sector in the USA and in African countries will continue well into the future.

OTA

The U.S. Congress Office of Technology Assessment (OTA) produced a special report entitled "A Plague of Locusts" in July of 1990. This report was produced after the 1986-1989 plague was over and millions of dollars of donor assistance had been spent. Congress played a central funding role throughout the plague, appropriating special funds for disaster assistance. Although the report contains several gross errors in understanding of the problem and in judgement, it does focus attention on ways in which USAID could operate more effectively in regard to assisting in the control of locust/grasshopper outbreaks in the future. The report finds that the following areas deserve future attention: prevention; integrating emergency control programs with long-term development; emphasis on different strategies for solving individual versus multiple pest problems; and proaction and prevention (i.e., strategic control). The report emphasizes training to build the capacity of local and regional groups to safely and preventively or proactively control potential outbreaks before emergencies occur. Also there is an emphasis on IPM, environmental protection, the development of alternative control technologies, and on monitoring insects, weather, and vegetation.

The AELGA Project, as witnessed by the preceding information in this report, has made major advances in all of these recommended areas. The project has helped put into place mechanisms such as regional monitoring through FAO, USGS, AGRHYMET, and others to detect weather changes, vegetation flushes, and locust/grasshopper activities. Close monitoring allowed FAO and DLCO to get a step-up on the recent outbreaks in the Horn of Africa, such that as soon as the locusts began to swarm, donor appeals were made and supplies, equipment, and technical assistance were delivered before the swarms could amass to the plague stage. The AELGA Project helped to train hundreds of scientists and others involved in pest control in Africa and these people are now in positions to control locust outbreak situations before they become disasters (Section 7). The project has successfully conjoined emergency and development activities under one umbrella - a task that the rest of Africa Bureau has been struggling with for years.

The AELGA Project has funded research on alternate control measures, as found in Section 8 on the development of biological and botanical controls. And the AELGA Project has been a leader in the intellectual development and implementation of the PEA and SEAs (Section 9), answering to OTA's concerns over environmental protection.

The concerns raised in the OTA report have been seriously addressed by the AELGA Project; the project is now in a position to help prevent plagues through proactive and mitigative measures, something not possible six years ago at the start of the last plague.

## 15.0 Recommendations

Administrative/Management

In an outbreak year, such as 1993, when locust populations reach emergency levels, approximately $8 million will be required for operations and emergency procedures and activities. In recession years, $2-3 million will cover preparedness measures such as monitoring, research, training and proactive interventions.

The emergency nature of the project will require that the AELGA project is continued long-term, for at least another 10 years.

AELGA should continue its new focus on East Africa and in playing a lead role in moving FAO in this direction.

ALEGA should promote the creation of an emergency procurement and contracts officer, possibly to be seated in the SADE office. This officer would also improve overall Africa Bureau's ability to respond to other non-pest types of emergencies. Thus, AELGA should seek support from other projects and offices in Africa Bureau to push this initiative.

USDA/OICD should be required to send running budgetary totals to the Project's Manager and Technical Advisor on monthly or bimonthly basis, and account for the breakdown of the 31% overhead.

The strong linkages between the AELGA project and the USAID/Niger DPM project should be maintained and monitored for impact, as this relationship may serve as a model for other missions.

Armyworm could be included in AELGA's mandate, as it arrives to outbreak emergency proportions in most of East Africa, where the British are not prepared to handle it alone.

It is expected that the project will require the services of additional technical assistants.

If it is concluded that AELGA cannot use DFA funds, then some sort of emergency relief and rehabilitation fund should be sought out.

Relationships with other USAID Entities

Cooperation between USAID bureaus needs to be encouraged, and other missions in Africa Bureau should be able to buy into the AELGA Project.

Cooperation between NE and AFR should lead to more non-traditional donors' donations of expendable commodities, like pesticides, to other developing countries.

## Networking

Future networking through FAO should be pursued on several fronts, to get countries to: make donations of expendable supplies to countries with the most immediate needs; to cooperate on cross-border types of survey and control efforts; and to exchange local experts for training, research, monitoring and control activities, instead of heavy reliance on expensive expatriates from developed countries.

AELGA and other high profile donors and regional coordination groups should urge that DLCO and OCLALAV be made in to associate International Agricultural Research Centers with strong operational functions.

## Training

Training and technologies developed through AELGA should be transferred to East Africa where the desert locust plagues most often begin. Ethiopia, Eritrea, and Sudan have effective crop protection services, and training in egg pod surveys and control, as well as greenness map interpretation and use should ensue as soon as possible. These initiatives should also be pursued in Somalia when it becomes more politically stable.

Several of the regional training courses designed for regional field level control have brought in upper management personnel instead of the field agents. Therefore future courses in field level control should be held nationally, so that field level personnel may be able to attend.

The positive association currently existing between the CILSS/INSAH office, USAID/Mali, and AELGA in training should continue to be nurtured and strengthened. Other groups, especially NGO/PVOs, such as Africare and Red Cross are, and should continue to be involved in training farmers on the risks of pesticide use.

Use of military personnel in control efforts has occurred in several Sahelian and north African countries; training for this cadre of human resources should be implemented in future activities.

Training of CPS personnel and farmers/nomads in Ethiopia, Eritrea, and coastal Sudan (and, in the future, Somalia) should receive more attention.

Regional training events should encompass the two regions--Near East and Africa--since the desert locust breeding grounds exist on both sides of the Red Sea, irrespective of sociopolitical boundaries.

AELGA should continue to help with the multiplication and distribution of training materials where deficiencies exist, especially to the horn of Africa.

There will always remain a need to continue and refresh training and information transfer on pesticide use risks, and ways to avoid them. AFR/ARTS/FARA should continue to be involved, and/or taking the lead in collaboration with AELGA, in these efforts, in concert with FAO wherever possible, in all of the countries involved.

Research

Testing of biological control agents against migratory locusts should be extended to East Africa to take advantage of the current migratory locust outbreak there.

Future biological control activities should include running the trials over larger areas, such as 50-100 ha plots. This should reduce interplot migration and give more accurate estimates of control. After this, trials should move to the on-farm stages of testing with full participation of CPS and extension personnel, and farmers. Other activities should include: testing of biocontrol agents in Madagascar; testing of fungus/pyrethrum combinations; development of 'cottage industries' to produce the fungus locally, with attention to quality control by the private sector; and the ability and will of farmers to purchase biocontrol agents.

Future activities in rodent control should include: expanding activities, especially training, to other countries in the Sahel that declared disaster rodent outbreaks during the last plague; beginning collaboration and information exchange with the Ethiopian MOA (they had an emergency outbreak of rodents in the Siadamo region of southern Ethiopia in the spring of 1993 and used zinc phosphide to control the outbreak); educating farmers on the need and methods for controlling rodent outbreaks and safe use of rodenticides.

Rodent control research should also include: testing the predictive ability of the rainfall and NDVI (Normalized Difference Vegetation Index) data that is thought to correlate with rodent outbreaks; devise a method to assess crop loss; environmental assessments need to account for rodenticides if supplied under USAID; MOAs and CPSs in Sahelian countries should prepare contingency plans for dealing with the next potential rodent outbreak. The project should look into possibilities of local production of rodent control substances and possibilities for farmers being able to afford or having the will to purchase rodent controls. An economic analysis may be in order.

Future funding for crop loss assessment research should be seriously reviewed, and cautiously pursued. Only projects that

will yield a usable product in the next five years and contribute directly to project goals of prevention, control, and environmental sustainability should be pursued.

AELGA's past activities and experience in screwworm control make it an appropriate vehicle to establish a contingency that will facilitate eradication of screwworm and other exotic and dangerous pests in Africa should they arise again in the future.

Future AELGA activities should include funding research on the use of insect growth regulators (IGRs) and pheromones, as appropriate, with donor collaboration from FAO.

Environmental Sustainability

AELGA recently assisted with SEA preparation in Madagascar and Mozambique, and should assist in the preparation of SEAs for additional East African countries.

New regulations on pesticide registration and use, disposal of toxic wastes, and environmental protection being written by African governments should be added to the SEAs prepared for each country as they are obtained by missions and AELGA TDY visits.

Support for 'non-traditional donors' assistance, such as insecticide transfers (as one solution to disposal), should be strongly supported and continued by Africa Bureau management.

AELGA has already provided leadership, and strongly influenced environmental policy in African countries. USAID should maintain this strong influence and presence through the AELGA project.

Economics

Future AELGA efforts should attempt to calculate the rates of return for control and research activities if possible. These would be very useful to include in the DFA report to The Congress, as well as other reporting instruments.

After the completion of the review of this document AELGA should send a cable to all field missions to explain the capabilities of AELGA and the requests they have received and can now handle.

## Appendix 1: Technical Services Provided by AELGA

Table 1: Types of technical goods and services provided or assisted by AELGA to locust and grasshopper control efforts, 1987–1993

| Country | SEAs (1) | Maps (2) | Chemicals (3) | Safety Equip. (4) | Surveillance (5) |
|---|---|---|---|---|---|
| Burkina Faso | 1991 | | | | |
| Cameroon | 1991 | | 1987/8 | 1987/8 | |
| Cape Verde | | | | 1989 | |
| Chad | 1991 | | 1987/8 | 1987/8 | |
| Eritrea | 1993 | | 1993 | 1993 | |
| Ethiopia | 1993 | | 1993 | 1993 | |
| Gambia | | | 1987/8 | 1987/8 | |
| Guinea Bissau | | | | | |
| Guinea Conakry | | | | | |
| Kenya | Expected | | | | |
| Madagascar | 1992 | | 1993 | 1993 | |
| Mali | 1991 | | 1988–90 | 1988–90 | |
| Mauritania | 1990 | | 1988 | 1989 | FAO |
| Mozambique | 1993 | | | | |
| Niger | 1990 | | 1987/8 | 1987/8 | |
| Senegal | 1991 | | 1987/8 | 1987/8 | |
| Somalia | Expected | | | | |
| Sudan | 1990 | | 1987/88/93 | 1987/88/93 | FAO |

(1) SEAs: Supplemental Environmental Assessments

(2) Maps: Vegetation Index (Greenness) Maps for prediction

(3) Chemicals: EPA–approved pesticides provided for control (N.B., OFDA provided pesticides for most control efforts in the 1986–1989 plague)

(4) Safety and Application Equipment (All pesticide donations are accompanied by safety equipment); Cape Verde received backpack sprayers in 1989

(5) Surveillance includes helicopter/fixed wing aircraft, ground support and teams supported through missions using AELGA or AELGA grants to FAO, OCLALAV, or DLCO

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## Long-term Technical Assistance (under USDA/OICD RSSA)

Advisors:

Entomologist 2 years (1987-1988)
Entomologist 4 years (1989-1992)
Entomologist 6 months (1993)

Assistants:

Environmental Specialist 6 months
Entomologist 4 months (1988)
Entomologist 3 years (1990-1992)
Ecotoxicologists 5 years on and off (1990-1993); in part on detail from EPA

## Short-term Technical Assistance (most under USDA/OICD RSSA & PASA)

1988

Conduct locust surveys, Recommend control actions
4 countries - 3 APHIS Entomologists

Conduct locust surveys, Coordinate aerial spraying
Niger - 3 Entomologists

Conduct locust and egg-pod surveys, Supervise crop protection program
Mali - 1 Entomologist

Conduct locust surveys
Mauritania -

Examine pesticide and container disposal
Niger, Cape verde - 1 Environmental Specialist

Technical consultancy for mission
Chad - USDA/OICD staff

1989

Examine pesticide and container disposal
Niger - 1 Technical Assistant

## Short-term Technical Assistance (under grants to FAO)

1988

Work with Crop Protection Service
Chad - 1 FAO Entomologist

## Forecasting Services Financed by AELGA

USGS Greenness Maps
FAO/ECLO Regional Surveillance System

## Aircraft and Commodities*

Mission Buy-ins
- USAID/Mauritania - Aerial Spray Services, fuel, spare parts
- USAID/Niger - Logistics Services
- USAID/Cape Verde - Backpack Sprayers

Umbrella FAO Grant
- Cape Verde - Operational Assistance
- USAID/Senegal - Fuel
- Niger - Radios
- Sudan
- Mauritania
- Mali
- Chad

*n.b., Many aerial operations were financed by OFDA and through combined donor support, some of it with AELGA participation in funding.

## Appendix 2: Training Events Sponsored by AELGA

1) Events Conducted by AELGA and AELGA-funded Technical Assistants

1987

Regional Workshops: Train the Trainers in Locust/Grasshopper Control.
- Banjul, Gambia - March/April
- Dakar, Senegal - April
- Khartoum, Sudan - June

Regional Workshop: Aerial Applications and Operations
- Niamey, Niger

Specialized Technical Training: Egg Pod Surveys for Field Agents
- Bamako, Mali - early 1987
- Bamako, Mali - late 1987 (10-15 field agents)

Specialized Technical Training: Farmer Education on Locust/Grasshopper Identification, Pesticide Application, Safety, and Other Control Methods
- Bamako, Mali

Workshops: Greenness map uses and limitations for locust control, USAID Mission staff, CPS managers & technicians
- Banjul, Gambia - June/July
- Nouakchott, Mauritania - June/July
- Dakar, Senegal - June/July

1988

No formal training activities took place in 1988, due to several factors, most prominent of which were overwhelming operational expenses for emergency control in this year, and the reassignment of AELGA to AFR/TR from AFR/OEO. However, on-the-job training occurred through most of the survey and control activities being undertaken at this time.

1989

Workshop: Safe Use, Maintenance and Supervision of Aerial and Ground ULV Applications
- Niamey, Niger - April

Workshop: Crop Protection Training Material Development
- Niamey, Niger - May

Conference: Health Impacts of Pesticide Use
- Bamako, Mali - May/June

1989

Specialized Technical Training: Species and Instar Identification
Bamako, Mali - taught 2 times in 1989

1990

Conference: Disposal of Obsolete Pesticides and Pesticide Containers in West Africa
Niamey, Niger - January (53 participants)

Workshop: Immature Grasshopper Identification and Ecology
Bamako, Mali - July/August

Specialized Technical Training: Rodent Control Research and Training
Ndjamena, Chad - October

Workshop: Rodent Identification, Biology, Ecology, Data Collection, and Population Monitoring (2 days)
Ndjamena, Chad - November (18 MOA personnel)

1991

Training Course: Egg-Pod Survey: A Strategy, Methodology, Evaluation of Results, and Control of Egg-Pods as Part of Grasshopper IPM Approach at Farmer Level
Bamako, Mali - January/February

Workshop/Colloquium on Crop Loss Assessemnt
Ouagadougou, Burkina Faso - June

Workshop: Biological Control of Grasshoppers and Locusts: State of the Art Workshop (with IITA/BCP)
Cotonou, Benin - April/May

Training Course: The Ecology and Identification of Immature Grasshoppers with Emphasis on Intervention Strategies (with DFPV/AGRHYMET/USAID/Niger).
Niamey, Niger - July/August

1992

Specialized Technical Training: Biological Control of Grasshoppers, Insect Pathology, Beauveria Research
MSU, Bozeman, Montana - Fall (4 Malians)

Seminar: Rodent Biology and Control (5 days)
Ndjamena, Chad - August/September (15 Chadians)

1993

Workshop on Pesticide Safety and Enviromental Health
Niamey, Niger - June

1987 - 1992

Interpretation of Vegetation Index (Greenness) Maps for Locust and Grasshopper Monitoring and Other Applications, by AGRHYMET and USGS (10 workshops)

Niger, Burkina Faso, Chad, Mali, Mauritania, Senegal, and Sudan

2) Events Conducted by FAO with AELGA Sponsorship/Support

1989

Workshop: FAO W. African Regional Pesticide Management
Accra, Ghana - September

1990

Workshop: Regional Locust/Grasshopper Surveillance
Niamey, Niger - February

Conference: Second Regional Sahel Conference on IPM in Food Crops
Bamako, Mali - January

1991

Technical Meeting: Pesticide Management (with FAO/ECOWAS)
Cotonou, Benin - March

Regional Workshop: Pesticide Management (with FAO/SADDC)
Harare, Zimbabwe - April/May

Technical Meeting: Preventive Control of Desert Locust in West and Northwest Africa (FAO)
Rome, Italy - April/May

1988-1990

During this time, OCLALAV/FAO ran 10 workshops/year on survey and control, equipment and radio use and maintenance, and other topics.

**Appendix 3: Project Outputs: Publications & Reports (FY 92 & 93)**
(Last updated on April 16, 1993)

**General/Assessments**

A.I.D. 1991. Review of Environmental Concerns in A.I.D. Programs for Locust and Grasshopper Control in Africa. AID/AFR/TR Publ. Series No. 91-7. Louis Berger and Assoc., Washington, D.C. 71 p.

Belayneh, Y. and W. Knausenberger. 1991. Africa Emergency Locust/Grasshopper Assistance (AELGA) Project: Accomplishments and Lessons Learned. USAID Africa Bureau. 10 p.

Cavin, George. 1992. Action Plan for Migratory Locust Control in Madagascar. USAID Africa Bureau AFR/ARTS/FARA

Panos Institute, Inc. 1993. Grasshoppers and Locusts: Plague of the Sahel. Dossier 5. London. 110 p. [in press]

Thomas, W. 1992. Potential for Outbreaks of Periodic Pests Following the Drought of Southern Africa. Information memo.

Thomas, W. 1992. Supplementary Environmental Assessment of the Madagascar Locust Control Program. AID/AFR/ARTS/FARA and USAID/Madagascar. 63 p. (draft)

Tropical Research and Development, Inc. 1991. Planning and Analysis for Pest and Pesticide Management Activities in Sub-Saharan Africa: Options for the Africa Bureau. 182 pp.

**Biological Control**

Lange, C.E., J.M. Brito and John E. Henry. 1992. Characteristics of a microsporidium (Protozoa:Microspora) infecting grasshoppers (Orthoptera:Pyrgomorpha) in Cape Verde, Africa. Journal of Protozoology (in press)

Lomer, C.J. and C. Prior (eds.). 1992. Biological Control of Locusts and Grasshoppers. Proceedings of a Workshop held at the International Institute of Tropical Agriculture, Cotonou, Benin. CABI International (Wallingford, UK) and IITA (Ibadan, Nigeria). 394 pp.

Montana State University, INIA (Cape Verde). 1992. Synopsis of 1991 Research on Development of the fungus Beauveria bassiana for Grasshopper Control in Africa. 17 pp.

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USAID, GTZ and INIA. 1992. Efficacy and Environmental Impact of *Nosema locustae* against Grasshoppers in Cape Verde, West Africa. A Synthesis Report. Deutsche Gesellschaft fuer Technische Zusammenarbeit and USAID Africa Bureau. 16 pp.

**Decision Tools for Grasshopper Management**

Coop, L.B., B.A. Croft , C.F. Murphy and S.F. Miller. 1991. Decision Support System for economic analysis of grasshopper treatment operations in the African Sahel. Crop Protection Journal, vol. 10, pp. 485-495.

Coop, L. B. and B.A. Croft. 1992. Pearl millet damage by five grasshopper species (Orthoptera:Acrididae) in Mali. Journal of Economic Entomology (submitted)

Coop, L.B. and B. A. Croft. 1992. Decision Tools for Grasshopper Control. Progress Report July 1992.

Coop, L.B. and B.A. Croft. Grasshopper pests of millet: intervention decision worksheet. 2 p.

**Rodent Population Monitoring and Management Research**

Brooks, J. E. 1992. The toxicity and efficacy of several rodenticides to Sahelian Rodent Species in Chad. Technical Report No. 3 Chad Rodent Control Research Project. 11 p. USDA/APHIS/Denver Wildlife Research Center, Chad Ministry of Agriculture, USAID/Chad.

Denver Wildlife Research Center. 1992. Training Manual. Rodent Research and Control. Chad Rodent Research and Control Project (AELGA Project). 90 pp. USAID/Chad, Chad Ministry of Agriculture, USDA/APHIS/Denver Wildlife Research Center.

Fiedler, L.A. 1992. An assessment of rodent control programs and problems in Niger, Burkina Faso, Mali and Cote d'Ivoire. USDA/APHIS/Denver Wildlife Research Center, Internat. Prog. Research Section, USDA-APHIS. 12 pp. (Trip Report)

Lavoie, G. K. et al. 1992. A preliminary research bibliography of rodent pests of the Sahel, Africa. Tech. Report No. 1, Chad Rodent Control Research Project. Denver Wildlife Research Center. 18 p.

McDonald, Trent L. and Lyman L. McDonald. 1992. Prediction and Monitoring of Rodent Abundance in Agricultural Areas of Chad, Africa. Chad Rodent Control Research Project Technical Report No. 4. Dec. 1992. 36 pp. [USDA/APHIS/Denver Wildlife Research Center, Chad Ministry of Agriculture, USAID/Chad.]

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**Pesticide Assessment, Management and Waste Mitigation**

Bell, V., et al. 1992. Pesticide Management and Waste Mitigation Options for the Africa Bureau. USAID Administrator's Fellow Report (AFR/ARTS/FARA). (draft)

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USAID/Niger and AID/AFR/ARTS/FARA. 1992. The Niger Dieldrin Disposal Program: Final Report (Including Descriptive Pesticide Disposal Plan Outline and Descriptive Environmental Assessment Outline). 220 p.

**Neem**

Belayneh, Y. 1991. Review and Analysis of Neem Research and Development, with Particular reference to the Recent A.I.D.-funded Work Under the Africa Emergency Locust/Grasshopper (AELGA) Project. USAID Africa Bureau, AFR/TR/ANR. 22 pp. + appendices.

Hodges, C.S and J.S.Beatty. 1992. Evaluation of a Disorder of Neem in Niger. Technical Assistance Report. USAID Africa Bureau (prepared through USDA Forestry Support Program, USAID/R&D/ENR). 52 p.

**Integrated Pest Management**

Knausenberger, W.I. and R.C. Hedlund. 1992. Report on Workshop on Implementing Integrated Pest Management in West Africa. 27 April - 1 May 1992, Accra, Ghana. USAID Africa Bureau. 10 pp.

DeLattre, M. and Knausenberger, W.I. 1991. Technical Analysis of Agricultural Research and Integrated Pest Management Programming Options. Background paper for proposed AFR/SWA/REGL project "Programs for Applied Development Research in the Sahel". 66 p.

## Appendix 4: People Contacted for this Assessment

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**In addition to the references listed here, those listed in Appendix 3 were also consulted.**

# AGENCY FOR INTERNATIONAL DEVELOPMENT
## BUREAU FOR AFRICA
### Office of Operations and New Initiatives
### Technical Projects and Program Implementation
### AFR/ONI/TPPI

## ASSESSMENT OF THE AFRICA EMERGENCY LOCUST/GRASSHOPPER ASSISTANCE (AELGA) PROJECT

## FINAL ACTION FORM

DATE: August, 1993

ACTION TAKEN:

Approved: ✓

Disapproval: _____

AELGA Project Manager: Vicky Doyle

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