

## AFRICA & NEAR EAST - Insect Infestation

### BURKINA FASO

Burkina Faso faced a significant grasshopper infestation in 1986 which required international assistance. More than 210,000 ha were sprayed by airplanes to protect crops. This operation proved successful, but the Government of Burkina (GOB) and the donors were concerned because the grasshoppers were able to lay eggs before they died. Thus, planning for the 1987 season began early; if rain fell at 1986 levels, the infestation would be at least as serious.

In December 1986, the GOB presented a plan in which it estimated that 150,000 ha would need to be treated during the early part of the 1987 agricultural season and that 30,000 ha would need treatment later on. The plan divided the campaign into two phases. During the first phase, ground treatment was expected to cover 50,000 ha and would involve both extensive use of dusting bags by farmers and vehicle-mounted sprayers by Crop Protection Service (CPS) agents. Phase One also included the use of three helicopters for both surveying and the treatment of 100,000 ha. During the second phase, the GOB planned to limit ground treatments to 25,000 ha, using vehicle-mounted sprayers, but increase aerial treatment to 275,000 ha, which would require three small aircraft and two helicopters for both surveying and treatment.

The plan also spelled out the required inputs for the anti-grasshopper campaign and appealed to the international community for assistance. U.S. Ambassador Leonardo Neher responded by declaring the situation to be a potential disaster on February 21, 1987. USAID/Ouagadougou decided to concentrate its contribution on providing technical assistance, 20,000 liters of fenthothion, and helicopter surveying. The technical assistance component consisted of two people: Charles Kelly, who provided management support to USAID/Ouagadougou, and Dr. William H. Settle, an entomologist from the University of California at Davis. Mr. Kelly also provided guidance to the U.S. Mission in Niamey on the grasshopper/locust campaign in Niger. Other donors--major donors included France, West Germany, Canada, Italy, the Netherlands, and the EEC--provided propoxur (for ground control), more fenitrothion, sprayers, radios, protective clothing, logistical support, and technical assistance.

As it turned out, the grasshopper situation in Burkina in 1987 was significantly less severe than expected. During Phase I (June 15-August 15), a total of 125,000 ha was evaluated as infested by grasshoppers, principally Oedaleus senegalensis, a voracious pest which has some locust characteristics (such as the tendency to become gregarious). Only 9,070 ha were treated, all by ground crews.

The area assessed as being infested during the second phase (September 15 - November 1) totalled 113,100 ha. Only 34,635 ha were treated, mainly by a Canadian-financed Turbo Thrush, due to low insect densities. Of the total hectareage infested, approximately 60,000 ha were located in a block southwest of Yako (100 km northwest of Ouagadougou) where 19,648 ha were treated (17,900 of this by air) before operations ceased on October 15, due to the political situation. Only 600 liters of the USG-donated fenitrothion (out of 20,000 liters) were needed. The CPS report on the 1987 campaign attributes the low level of infestation to several factors: the late start of the rainy season, poor rainfall (both in quantity and timing), hot weather, and grasshopper larvae deaths during the early part of the season due to dust storms. Armyworms were generally a bigger problem than grasshoppers.

Summary of USG Assistance

FY 1987

Mission allotment for a manager (Charles Kelly) for 12 months.....	\$73,400
Mission allotment for the purchase of 20,000 liters of fenitrothion:	
OFDA funds.....	\$35,000
AFR/OEO funds.....	\$170,000
Contract with Evergreen Aviation for a helicopter to do survey work.....	\$235,082
Mission allotment for support of the helicopter operation: vehicle (\$17,000), maps, labor, and fuel (the Toyota was donated to the SCF office in Ouagadougou after the grasshopper campaign).....	\$38,250
Entomologist (Dr. William H. Settle) for 12 weeks (August 7 - October 31) from University of California at Davis.....	\$40,000
Total OFDA.....	\$421,732
Total Other USG.....	\$170,000
Total FY 1987.....	\$591,732

FY 1988

OFDA Extension of Charles Kelly's contract for 1 month.....\$10,600  
Total FY 1988.....\$10,600

TOTAL \$602,332

Assistance Provided by U.S. Voluntary Agencies

None reported

Assistance Provided by the International Community

Canada - provided \$746,268 for 310 MT of propoxur, other pesticides, a Turbo Thrush, and training.

China, People's Rep. - contributed 22 MT of malathion.

EEC - donated \$178,674 for 15,320 liters of fenitrothion, protective clothing, 700 face masks, and technical assistance.

France - gave \$515,000 for 8,000 liters of fenitrothion, 100 hand sprayers, 500 ULV sprayers, a helicopter for surveying, protective clothing, and training at PRIFAS.

Germany, Fed. Rep. - provided \$420,000 for 170 MT of propoxur, 20,000 liters of fenitrothion, 500 ULV sprayers, protective clothing, 1,000 face masks, Unimogs, and training.

Italy - contributed \$399,166 for 7,520 liters of malathion, other pesticides, 194 sprayers, 50 dusters on wheels, 4 large-volume dusters, protective clothing, 510 masks, 25 tents, 6 vehicles, and an expert.

Netherlands - donated \$375,000 for 100 MT of malathion, 20,000 liters of fenitrothion, 300 sprayers, 330 goggles, and logistical support.

Soviet Union - provided protective clothing, 1,000 face masks, and an entomologist.

Switzerland - contributed \$221,429 for 15,000 liters of fenitrothion, protective clothing, and training.

UNDP - provided \$267,342 for 50 sprayers, 10 tents, 2 experts, and 2 vehicles (on loan) through FAO.

UNICEF - donated \$25,000 for the loan of 2 trucks and operating costs.

TOTAL \$3,147,879

## CAMEROON

Cameroon stood on the fringe of the 1986 locust and grasshopper invasion but still experienced outbreaks. Insects covered a total of 32,000 ha in the far northern part of the country with densities of up to 100,000 to 150,000 per ha. The Crop Protection Services (CPS) of the Government of the Republic of Cameroon (GRC) was able to treat only 2,650 ha from the ground. Fortunately, however, aerial spraying in Chad kept crop losses to a minimum in northern Cameroon.

The inadequacy of 1986 control efforts caused concern that abundant rains in 1987 would lead to serious outbreaks of grasshoppers. A preliminary FAO assessment in the early spring of 1987 found the area at serious risk to comprise 70,000 ha, while GRC estimates were 90,000 ha. Land affected by insects supports 40,000 to 60,000 farm families. The GRC then presented a plan of action to the donors which involved the treatment of 240,000 ha in a two-phase campaign; the GRC and FAO later revised this figure to 170,000 ha. In response to this appeal, U.S. Ambassador Myles Frechette declared a disaster on March 24, 1987. The USG contribution totaled \$200,000 and had two components: \$190,000 for a grant to FAO/ECLC for assistance to the CPS and \$10,000 to pay for the services of two radio communications specialists. FAO worked with the GRC to coordinate the campaign. Other major donors included the EEC, Canada, and the United Kingdom.

Phase I activities continued until the end of August and covered the six divisions in the far northern province. The CPS reported that 54,000 ha were treated in a joint farmer-CPS ground control effort. Densities of the pests reached 50 per sq. m in Mayo Tsanaga Province around Mokolo and mortality averaged 90 percent in treated areas. The Senegalese grasshopper was reported to be the most prevalent species.

However, an FAO evaluation team which visited Cameroon in October 1987 found that control efforts had only reached 15,000-20,000 ha and were in general inappropriate. For example, the major pest was not O. senegalensis but a deep-burrowing grasshopper better eradicated with bait formulation rather than from backpack sprayers. The FAO team also found that the levels of infestation did not warrant second-phase activities.

### Summary of USG Assistance

Grant to FAO for field agent and farmer training, a locust specialist, air and ground logistician, equipment, vehicle, and administrative costs (AFR/OEO funds).....	\$190,000
2 radio communications specialists.....	\$10,000

Total OFDA.....\$10,000  
Total Other USG.....\$190,000

TOTAL \$200,000

Assistance Provided by U.S. Voluntary Agencies

None reported

Assistance Provided by the International Community

Canada - provided \$144,300 for the local purchase of pesticides and sprayers.

Denmark - financed FAO-provided technical assistance for one month.

EEC - donated \$73,000 for pesticides and protective clothing.

France - provided funding for pilot and mechanic of UTAVA--the GRC aerial spraying unit--and for training.

Germany, Fed. Rep. - donated \$125,000

United Kingdom - contributed \$250,000.

TOTAL \$592,300

CHAD

Chad faced a major insect infestation in 1986: almost 150,000 ha were treated by air in a campaign to which donors contributed more than \$4.3 million. Because of the late start in the aerial campaign and inadequate ground control efforts, many of the grasshoppers were able to lay eggs before they were killed. Both the Government of Chad (GOC) and donors were concerned that the country could face an equally serious infestation in 1987 if weather conditions were favorable to hatching.

In order to prepare for the potential disaster in 1987, the GOC and donors began to draw up an action plan in December 1986. The strategy of the GOC control program was divided into two phases: Phase I focused on ground control while Phase II concentrated on aerial treatment. More frequently than most Sahelian countries, Chad is at risk from infestations of desert locusts (Schistocerca gregaria) and African migratory locusts (Locusta migratoria), as well as of grasshoppers, particularly Oedaleus senegalensis. With the proper climactic conditions, Chad could be hit with an extremely serious crop loss. To make matters worse, rats

plagued Chadian farms in 1986 and 1987 (see the case report on the Chad rat infestation). Because of weak infrastructure in Chad, the action plan put emphasis on getting campaign inputs, such as pesticides, vehicles, fuel, and aircraft, pre-positioned at field depots.

The U.S. Mission in Ndjamena recommended that the USG concentrate its part of the multi-donor intervention on technical assistance, pesticides, aerial control, and transport. U.S. Ambassador John Blane declared on February 12, 1987, that Chad faced a potential disaster due to insect infestation and requested that OFDA fund, as soon as possible, an entomologist to work with the USAID/Ndjamena and the GOC for at least six months. This entomologist, Habib Khoury, arrived in early April and helped coordinate the USG component of the campaign. OFDA provided malathion for aerial treatment, 250 hours of flying time, fuel, transport, and radios. Other donors concentrated on funding eggpod surveys, training, ground control, and technical assistance.

The rainy season got off to a good start in May: the rains began earlier than usual and precipitation levels in late May and early June were high. This good start to the rains proved favorable to grasshopper development. However, the lack of rains from mid-June through early July diminished the insect population. Regular rains started again in July, causing the northern movement of the grasshopper population. This population grew, developed, and increased in numbers in the northern sahelian zone until mid-September. Diminishing rains in late September and early October forced the insects to return southwards to more favorable habitats.

The desert locust situation was carefully monitored also. The first sighting was recorded in mid-June indicating the presence of solitary desert locust adults in north Kalait. Another report in early July indicated the presence of larval bands around the same zone. The FAO consultant in Chad confirmed this presence in late July. He observed dense gregarious larval bands and light flying swarms north of Kalait. More reports in August noted that desert locust swarms were observed flying over Iriba and Guereda and moving in different directions (eastward and westward). However, an aerial survey financed by USAID and France and conducted by PRIFAS, FAO, and USAID in late August did not find any gregarious concentrations around the suspected locations.

In mid-September, October, and early November, desert locust infestations were again observed around the Kalait area. Thus, simultaneous prospection and ground treatment were started by the National Plant Protection Service and OCLALAV in Kalait, Fada, Iriba, Guereda, and Biltine.

In early October, USAID provided satellite imagery and additional maps to the prospection teams to better orient their efforts. The imagery indicated the most favorable breeding locations for desert locusts.

The temperature drop to 8°C (5°C at night) reported around the Kalait zone in early November was an indicator that the desert locust infestation would be reduced. After that no more infestations were observed. African migratory locusts posed no danger to Chad this year.

The GOC conducted eggpod surveys and implemented the ground-control phase of the campaign. Although the severity of the infestation was not as serious as feared--due to inconsistent rains and inadequate ground control--it was still necessary to carry out an aerial intervention program. The GOC requested that USAID work in the eastern part of the Sahelian zone. This area covered five prefectures--Ouaddai, Biltine, Guera, Batha, and Salamat--that were at high risk of infestation according to the eggpod survey done in early 1987. Thirteen locations in these prefectures were chosen as operating sites for the aerial program; the choice of these sites was based on the availability of landing strips, warehouses, and proximity to important agricultural crop lands. The malathion purchased by OFDA arrived in Ndjamena in late April--in time to be pre-positioned at the operating sites before the beginning of the rainy season, when road transportation becomes difficult if not impossible. Avgas, fuel, and vehicles were also pre-positioned, allowing smooth and uninterrupted operation of the airplanes. FAO provided the aerial control teams with radios, financed by A.I.D. in 1986, that greatly improved communications between the field and Plant Protection headquarters. A.I.D. provided four more radios in 1987.

The objective of the USAID aerial treatment program was to spray 150,000 ha of the crop area in eastern Chad. USAID/Ndjamena contracted Mission Aviation Fellowship (MAF) to execute the program. MAF worked with USAID technicians and the GOC Plant Protection prospection teams. The GOC teams played an essential role in the program by preparing infestation maps and conducting field surveys. Aerial treatment began on September 9 and was completed within two months; spraying took place on 32 days and the rest of the time was used for moving from one site to another or for on-site preparations. The aerial program reached about 90 percent of its target, or nearly 134,000 ha of crop land and the closely surrounding grassland. Surveys after treatment showed mortality rates averaged 95 percent; many local farmers indicated their complete satisfaction with the effectiveness of the aerial spraying. The total flying time used was 376 hours and the amount of malathion needed was 63,560 liters.

In conclusion, Habib Khoury, the A.I.D.-contracted entomologist, noted that the 1987 grasshopper infestation was heavy but less serious than expected due to the extended dry period in June and July. In eastern Chad, the timely and effective aerial treatment killed most of the grasshopper population before the end-of-season heavy egg laying. Thus, the initial grasshopper population of the 1988 season should be low and the infestation light in central and eastern Chad.

Summary of USG Assistance

Entomologist: Habib Koury contracted for April 1 - October 31  
(most of this case report is based on Mr. Khoury's final  
report).....\$112,000

Aerial treatment specialist: Alfred Rivas contracted for  
July 1 - October 31 (however, this TDY was cut short).....\$79,000

Purchase and shipping of 90,000 liters of malathion 98% ULV  
from American Cyanamid (ocean freight costs amounted to  
\$11,482, while air freight from Antwerp to Ndjamena cost  
\$175,000).....\$490,000

Mission allotment for in-country transport of the malathion.....\$16,500

Contract with Mission Aviation Fellowship for aerial treatment  
program (cost included flying time, spare parts, tools,  
generators, 2 teams, 6 radios, 10 maps, 2 first-aid kits, and  
other logistical support).....\$398,700

Mission allotment for avgas and diesel fuel.....\$74,023

Mission allotment for ground support: clearing of airstrips  
and other support.....\$80,000

Purchase and shipping of 4 radios from Electronic Equipment  
Bank, Inc.....\$3,988

TOTAL.....\$1,254,211

Assistance Provided by U.S. Voluntary Agencies

Mission Aviation Fellowship - implemented aerial spraying program.

WVRO - donated 50 hand sprayers.

Assistance Provided by the International Community

Canada - provided \$30,000 for the local purchase of pesticides.

EEC - donated \$196,500 for 14,600 liters of fenitrothion and \$27,000 for  
transport.

FAO - contributed 33,000 liters of fenitrothion.

France - donated 80 hours of helicopter prospection, 150 hours of aerial  
spraying, ground-control equipment, 40 MT of propoxur and lindane dust,  
10,000 liters of fenitrothion, funds for eggpod surveying, 500 ULV  
sprayers, 100 backpack sprayers, technical assistance, and training; some  
of this assistance amounted to \$490,000.

Germany, Fed. Rep. - contributed \$252,809 for technical assistance, 50 MT of propoxur, 10,000 liters of fenitrothion, 1,000 hand sprayers, and protective clothing.

Indonesia - donated \$10,000.

Italy - contributed \$244,444 for pesticides, vehicles, sprayers, and protective clothing.

Switzerland - donated \$27,000 for training.

UNDP - contributed \$34,000.

TOTAL \$1,311,753

### ETHIOPIA

For the second consecutive year, swarms of locusts and grasshoppers infested northern Ethiopia. Extensive breeding of desert locusts occurred in Eritrea's Red Sea coastal plains, a primary breeding habitat. The incipient outbreak appeared in this lowland region during December 1986, and locusts finished hatching in February. The Ministry of Agriculture (MOA), in conjunction with the Desert Locust Control Organization for East Africa (DLCO-EA), mounted a spray campaign against adults and new offspring. Despite the control operations, considerable numbers of locusts survived. Favorable ecological conditions fostered early maturation and reproduction. Many swarms moved westward into the highlands. To prevent further migrations, MOA and DLCO continued aerial spraying. Hazy weather conditions reduced the effectiveness of their operations and several swarms could not be controlled. By June, the MOA and DLCO-EA had sprayed 70,000 ha by air in Eritrea with another 10,000 ha covered by ground-control operations. Eritrea's northwestern lowlands also harbored locusts. Swarms coming from neighboring Sudan and Ethiopia's infested highlands invaded Eritrea and then migrated southward into Tigray, infesting all regions of the latter as far as to the Tigray/Wello border. In addition to the locust infestation, large numbers of voracious armyworms were found eating grass and crops in Tigray.

Two rebel secessionist movements operating in Eritrea and Tigray impeded survey and spraying in these two regions. The Eritrean Relief Association (ERA), an organization affiliated with the Eritrean People's Liberation Front (EPLF), voiced concern about the locust threat to the major 1987 harvest. The Relief Society of Tigray (REST), the assistance arm of the Tigray People's Liberation Front (TPLF), spotted locust breeding in Tigray and expressed fear of the enormous swarms coming in from Eritrea. Both the ERA and REST conducted ground-control operations within their respective provinces but by July felt compelled to appeal for assistance from the international community. Despite all control

efforts, including the MOA/DLCO spraying campaign, locust swarms continued spreading southward. Although little crop damage had been reported by mid-July, expanded locust control was deemed necessary to prevent the spread of the infestation into Wello. On July 13, FAO called an emergency desert locust meeting for selected donors, private relief organizations, and U.N. agencies. MOA appealed to the USG and the international community for support of urgent actions to control the locust infestation in northern Ethiopia.

Due to the potential threat to crops and possible movement of locusts to the neighboring countries of Sudan, Somalia, and Kenya, U.S. Chargé d'Affaires James Cheek declared a disaster on July 28. The U.S. Mission requested that OFDA provide a grant to FAO for the multilateral locust control effort. A \$168,500 grant was allocated to FAO and used to purchase protective clothing, camping equipment, and first-aid kits, and to provide logistical support for two survey and control helicopters provided by Canada. Of the FAO grant, \$273 was used to print 4,000 brochures in Amharic on how to apply carbaryl and necessary safety precautions. In late August OFDA financed the procurement and shipment of 35 MT of carbaryl and 10,000 face masks.

Summary of USG Assistance

Grant to FAO for logistical support for Canadian helicopters.....	\$140,000
Grant to FAO for camping equipment, protective clothing, first-aid kits, and brochures.....	\$28,500
10,000 face masks from DOD, plus shipping costs.....	\$1,552
35 MT of carbaryl purchased from Union Carbide.....	\$150,464
Air freight of carbaryl.....	\$60,000
	<u>TOTAL</u> <u>\$380,516</u>

Assistance Provided by U.S. Voluntary Agencies

None reported

Assistance Provided by the International Community

International Organizations

EEC - provided 60,000 liters of fenitrothion and overhaul of aircraft engines, valued at \$750,000.

FAO - sent a locust expert and distributed camping equipment, radios, and batteries, valued at \$100,000.

ICRC - provided 3 fixed-wing aircraft, valued at \$500,000.

World Bank - contributed knapsack sprayers.

#### Governments

Australia - donated \$71,000 for helicopter logistical support.

Canada - provided 2 helicopters with pilots qualified in survey and control, valued at \$370,000.

France - sent 25,000 liters of pesticide, valued at \$320,000.

Switzerland - gave 10,000 liters of Basuden pesticide, 50 knapsack sprayers, and protective equipment for ground-spraying teams, valued at \$160,000.

Sweden - contributed 50,000 dry-cell batteries to operate ULV hand sprayers, totaling \$25,000.

United Kingdom - donated pesticides and equipment, totaling \$800,000.

#### Non-Governmental Organizations

Band Aid - gave 37.5 MT of bendiocarb, valued at \$140,000.

Oxfam/U.K. - sent 37.5 MT of bendiocarb, valued at \$140,000.

TOTAL                    \$3,376,000

#### THE GAMBIA

(Please note: OFDA responded to two insect infestation disasters declared in the Gambia in FY 1987. The first, declared on October 14, 1986, addressed residual needs related to the 1986 Sahel-wide campaign against the grasshoppers. A case report of that disaster is included in the FY 1986 OFDA Annual Report. OFDA funds for this disaster totaled \$568,091 in FY 1987. The description below covers the second disaster, declared in February 1987.)

In 1986, the Gambia faced a major infestation of Oeduleus senegalensis and Zonocerus variegatus species of grasshopper and treated almost 320,000 ha, mostly by air. Unfortunately, eradication efforts that year were too late to prevent significant egg-laying. In order to prevent a recurrence, the Government of the Gambia (GOTG) in 1987 set up a task force to deal with the potential grasshopper infestation while the FAO representative convened a donor steering-committee in late January.

The GOTG task force developed a strategy calling for a two-phased approach: Phase I emphasized farmer and CPS ground spraying while Phase II focused on aerial spraying. The CPS conducted eggpod surveys in early February and indicated that 280,000 ha would have to be treated if rains were reasonably abundant. The donor community was concerned that the eggpod survey was done without technical assistance, yet USAID/Banjul accepted a figure of 300,000 ha at risk, encompassing three of the country's five divisions. On the basis of this assessment, U.S. Ambassador Herbert E. Horowitz declared the situation in the Gambia to be a potential disaster. At the Mission's request, OFDA immediately provided funding for an entomologist to assist the CPS in its work and for a local-hire coordinator to assist USAID/Banjul in implementing the USG program. An OFDA-sponsored assessment team sent to Senegal also went to the Gambia in mid-March for several days to help USAID/Banjul design an appropriate USG response. The team met with USAID and GOTG officials and representatives of other donor organizations and inspected CPS facilities and equipment.

The GOTG Task Force refined its action plan with the help of Dr. George Allen, the U.S.-funded entomologist, and other technical assistance in late April. The strategy for Phase I, commencing in mid-June with the onset of the rains, was to consist of a major ground offensive by trained farmers and ground crews to suppress early populations of hoppers. Farmers were to treat 35,000 ha using dust and ULV formulations of propoxur, fenitrothion, and malathion from existing government stocks. The CPS established a well-organized system to oversee survey and spray activities. Nine phytosanitary bases were strategically located across the country to provide a network to monitor, survey, and control hopper outbreaks. A total of 29 surveillance posts, consisting of two CPS agents and one extension person, reported to the phytosanitary stations. These nine stations supplied logistical support, collected data, and assisted in spray activities. CPS extension ground crew operations in Phase I consisted of vehicle-mounted and backpack ULV applications of malathion on 75,000 ha of open and crop lands and 50,000 ha adjacent to forested areas. In addition, 4,000 ha were to be treated with Sevin-4-Oil (carbaryl) bait to introduce this technology and compare the efficacy of ULV and bait formulations in areas containing high grasses. Phase I was to make maximum utilization of the CPS and farmer training activities. Phase II was to include treatment of 20,000 ha by air if necessary. However, it was hoped that success of ground crew and farmer activities would reduce the need for aerial application to small areas. Aerial operations are considered to be less effective in certain areas of the Gambia as the growing season progresses because grasses and other foliage keep spray from reaching the insects.

The GOTG action plan estimated the campaign cost to total \$1.9 million including pesticides, spray equipment, communications, technical assistance, and supplies. USAID/Banjul anticipated that timely communications and transport would be a major impediment in the campaign as no reliable system existed for communicating vital data from surveillance posts to phytosanitary stations. Therefore, USAID/Banjul,

with the help of the OFDA-funded assessment team and entomologist, decided to focus on these needs, providing approximately one-third of the estimated campaign requirements. Coordinating closely with the GOTG and other donors, USG inputs totaled \$633,754 and included training, pesticides, radios and communications equipment, motorbikes, sprayers, aviation fuel, and technical assistance. The "train-the-trainers" program, designed by OFDA and AFR/OEO, took place in Banjul in early April (see Section I, Preparedness, for more detail). The U.S.-donated communications equipment enabled field agents to report grasshopper infestations and requirements to CPS headquarters. Malathion and carbaryl bait were provided for both aerial and ground application. The U.S. also contributed 18,000 liters of fuel for the Phase II airplane, provided by Luxembourg. Other donors provided pesticides, spraying equipment, and technical assistance in order to ensure that the GOTG had sufficient resources for the campaign.

Rainfall continued to be sporadic and generally below average into August. The primary threats to crops in early summer included hairy caterpillars, army worms, and millipedes, with some localized nymphal Senegalese grasshopper populations reported. Phase I ground control crews, made up of both CPS agents and farmers, monitored and treated these pest outbreaks. Propoxur, fenitrothion, and malathion dusts were in stock at all 38 CPS stations while each phytosanitary base received one drum each of liquid malathion and fenitrothion.

By mid-August, rainfall approached average levels but pest outbreaks remained sporadic and limited in size. However, farmers and CPS surveyors identified a risk area of 5,400 ha of forest land bordering on rice fields in Western Division. The GOTG decided to use the Luxembourg-donated plane to treat this area with fenitrothion 98 percent ULV; this was the only instance of aerial treatment in the 1987 campaign. Ground control activities continued throughout August and September.

By October 1, participants at the GOTG steering committee meeting agreed that Phase I activities had been successful. The concerted response was much improved over the 1986 campaign: campaign planning was initiated and completed earlier, donors responded sooner, inputs arrived on time, and the CPS teams were trained and expeditiously deployed to various areas of the country to control localized grasshopper outbreaks.

#### Summary of USG Assistance

(Note: The total here does not add up to \$633,754 as the training courses are included in the preparedness section.)

Entomologist: Dr. George Allen contracted for April 1 - June 15 and again from August 31 - September 26; funds included cost of a vehicle (Nissan Patrol 4-WD diesel).....\$96,000

Entomologist: Timothy McNary of USDA/APHIS for July 20 - September 21 (AFR/OEO funds).....	\$40,000
Communications system: 38 station radios, 4 mobile radios, and 4 air-to-ground receivers purchased from N&G Distributing Company.....	\$105,068
Transport for radios.....	\$20,925
73,750 liters of malathion 91% ULV purchased from American Cyanamid; cost includes ocean transport on Maersk Lines.....	\$268,357
1,840 liters of Sevin-4-Oil carbaryl purchased from Union Carbide; cost includes ocean transport.....	\$7,052
Mission allotment of 18,000 liters of aviation fuel (for Luxembourg Cessna Agtruck) purchased from Mobil/Dakar.....	\$20,000
Mission allotment for the local purchase of electrolyte for batteries.....	\$300
Mission allotment for the local purchase of 100 motorized backpack sprayers.....	\$10,000
Mission allotment for the local purchase of 29 motorbikes.....	\$25,000
10 lawn spreaders purchased from Sears for the application of carbaryl bait, plus transport; these turned out to be the wrong type of spreaders.....	\$466
10 cyclone seed spreaders purchased from Spyker Spreader Works for the application of carbaryl bait, plus transport.....	\$1,116
50 hand-held tally registers purchased from Carolina Biological Supply Company for field counting of grasshopper populations, plus transport.....	\$614
Total OFDA.....	\$554,898
Total Other USG.....	\$40,000
	<u>TOTAL</u> \$594,898

Assistance Provided by the U.S. Voluntary Agencies

None reported

Assistance Provided by the International Community

Action Aid - contributed 52 motorized backpack sprayers, valued at \$15,000; 4 vehicle-mounted Micronair sprayers, valued at \$36,000; and 200 protective outfits (jackets, aprons, masks, and boots), valued at \$13,000.

EEC - provided 14,600 liters of fenitrothion, 3 Micronair sprayers, and protective clothing, all valued at \$195,897.

Italy - donated 400 manual backpack sprayers, 90 motorized backpack sprayers, 4 spray guns, and 10 wheelbarrow-mounted sprayers; and 5,000 liters of malathion, valued at \$200,793; and an agricultural agronomist for six months.

Japan - contributed 132 motorized backpack sprayers, 20 MT of fenitrothion 3% dust, and 12 small trucks.

Luxembourg - provided a Cessna Agtruck airplane with pilot and mechanic for 200 hours of flying time, valued at \$140,000.

United Kingdom - provided 140 MT of propoxur, valued at \$105,000; 510 hand dusters, valued at \$5,100; and a logistician for one month.

TOTAL \$710,790

#### GUINEA-BISSAU

In late April, the U.S. Mission in Bissau reported that the populations of several species of grasshoppers had reached damaging levels, particularly in northeastern and central Guinea-Bissau along the border with the Casamance area of Senegal. The Government of Guinea-Bissau (GGOB) estimated that 77,000 ha of cropland and many more hectares of surrounding forest land were affected. Egg-pod surveys conducted by the GGOB Crop Protection Service (CPS) in conjunction with FAO in April and May revealed that at least 52,000 ha contained enough eggs to produce grasshopper densities of 18.5 to 92.5 per sq. m, depending on location. The major pest was Zonocerus variegatus, although the Oedaleus senegalensis was also sighted. The area of heaviest infestation started at the border with Senegal near Gabo and extended south to Bafata and east to Bissora. The GGOB projected potential 1987 losses of as much as 70 percent of crops; this was based on 1986 observations, which included 100 percent loss of sorghum in some villages due to frequent heavy rains.

The Director of the CPS coordinated donor inputs, specifically requesting that pesticides be in place before the heavy rains began in July. By spring, the CPS had begun applying fenitrothion with ULV backpack sprayers in the highest risk areas. At that time, dust pesticides were not available in Guinea-Bissau for farmer application, although later Italy and the EEC provided fenitrothion 3 percent dust and propoxur pesticides.

U.S. Ambassador John Dale Blacken determined on May 28 that the potential insect infestation threatening Guinea-Bissau constituted a disaster. The USG contribution totaled \$290,320 and included several components: an entomologist to assist the CPS, pesticides, spare parts, training, and sprayers (see below for more details).

Summary of USG Assistance

(Note: Although the bulk of the program was funded by the A.I.D. Africa Bureau, OFDA purchased the pesticides and sprayers.)

Entomologist: Bruce Thornley (from USDA/APHIS) to assist the CPS from July through October (AFR/OEO funds).....	\$39,000
Funds to enable 2 CPS personnel (the Director and Chief of Field Operations) to attend A.I.D. training course held in Niamey in May (AFR/OEO funds).....	\$5,000
90 bicycles plus spare parts and tires (AFR/OEO funds).....	\$25,000
Vehicle and application equipment spare parts (AFR/OEO funds).....	\$50,000
8,000 liters of Sevin-4-Oil carbaryl purchased from Union Carbide (\$17,500 for pesticides, \$6,750 for ocean transport) (AFR/OEO funds).....	\$24,250
7,500 liters of malathion 95% ULV purchased from American Cyanamid (\$25,085 for pesticide, \$6,952 for ocean transport) (AFR/OEO funds).....	\$32,037
100 motorized backpack ULV sprayers plus spare parts from Hudson for CPS (AFR/OEO funds).....	\$40,000
20,000 liters of vehicle fuel (15,000 liters diesel fuel, 5,000 liters gasoline fuel) (AFR/OEO funds).....	\$13,000
Allotment to USAID/Bissau for operational expenses (AFR/OEO funds).....	\$20,000
Camping equipment (AFR/OEO funds).....	\$35,000
Technician: Dr. Donald Pletsch to repair and maintain sprayers (OFDA funds).....	\$7,033
Total OFDA.....	\$7,033
Total Other USG.....	\$283,287
<u>TOTAL</u>	<u>\$290,320</u>

Assistance Provided by U.S. Voluntary Agencies

None reported

### Assistance Provided by the International Community

Denmark - contributed the salary for the services of OCLALAV technicians for one month.

EEC - provided 3,000 liters of fenitrothion.

FAO - provided 2 Micronair sprayers and 90-day training at a French grasshopper research facility in Montpellier for one CPS employee.

Italy - provided 2,000 kg of propoxur 2% dust, 100 liters of malathion, and other pesticides.

### MALI

Mali suffered again in 1987 from grasshopper and locust infestations, with a major outbreak of the Senegalese grasshopper, Oedaleus senegalensis. Organizing for this year's grasshopper/locust control campaign effectively started in February when the Ministry of Agriculture of the Government of the Republic of Mali (GRM) briefed the donor community on the potential threat to crops projected both from last year's infestations and eggpod surveys done in December 1986 and early January 1987. The GRM also presented an operational plan designed to meet that threat in a rational and timely manner in two phases. One phase emphasized pesticide treatment by farmers and included ground techniques such as hand dusting, backpack spraying, and vehicle-mounted equipment. Projections for Phase II operations emphasized aerial treatment.

On February 12, U.S. Ambassador Robert J. Ryan, Jr., declared the insect infestation threat to be a potential disaster. The USG became involved in Mali's control campaign, supplying crucial equipment and technical assistance. (See "Summary of USG Assistance," below).

The season was characterized by rainfall that was generally lower than 1986 and more sporadically distributed in time and space. Thus, grasshopper hatchings, particularly those of the Oedalus, were less than expected. Due to the complex mix of different coexisting generations of grasshopper populations, the two phases of operations, namely ground and aerial, overlapped greatly. Ground operations continued very late into the season.

Phase I treatments were effective in mitigating local crop damages, particularly with regard to the non-migratory pests such as Kraussaria angulifera and Hieroglyphus. A USAID-financed Evergreen helicopter arrived in Bamako August 6 for survey work, which was conducted between August 19 and September 19. Spraying treatments began October 5 and lasted through October 18. Parts of southeastern Mauritania, near Mali's border, were treated during this spray operation.

The GRM Cabinet, Ministry of Agriculture, and the FAO resident representative convened a donor meeting on November 3, 1987, to review the 1987 operational program. It was the general consensus that CPS efforts with donor support were effective in protecting over 400,000 ha (61,000 ha in southeastern Mauritania) against grasshoppers. All participants noted much improvement in management and coordination of the 1987 program over the 1986 effort. For the most part, donor pledges reached field sites on time and were available for control activities.

Populations of the desert locust, Schistocerca gregaria, were found in dense concentrations in Adrar des Iforas, in the northeastern part of the country. Spray operations began on December 25 and continued until January 14, 1988. Altogether nearly 15,000 ha of hopper and adult concentrations were controlled, using 4,500 liters of malathion and 4,000 liters of fenitrothion 50 percent ULV. While the results of the control measures were satisfactory, some swarms escaped, heading west and northwest toward northern Mauritania and Western Sahara. In the event of widespread spring breeding in northern Africa, the Sahelian countries will be potentially threatened by invasions of the desert locust in 1988.

#### Summary of USG Assistance

##### FY 1987

Mission allotment for a manager (Ian McKay) to help implement the control program.....	\$42,000
Mission allotment for farmer training.....	\$10,000
Funds for CPS training and support: radio training (\$3,500), training manuals (\$6,500), and logistical support and fuel (\$15,000) (AFR/OEO funds).....	\$25,000
Purchase of 100 scales from DOD (\$545), plus shipping costs (\$400).....	\$945
Purchase of 10,000 face masks from DOD, plus shipping costs.....	\$1,305
Entomologist (George Popov) to help implement control program; OFDA funds.....	\$38,000
AFR/OEO funds.....	\$14,000
Aviation fuel for Phase II operations (AFR/OEO funds).....	\$20,000
Mission allotment for 350 hours of flying time for Phase II operations (AFR/OEO funds).....	\$304,000
Purchase of 32,000 liters of malathion from American Cyanamid.....	\$106,404
Sea freight of malathion.....	\$11,150

Contract with Evergreen Aviation for a helicopter for 100 hours of surveying.....	\$152,629
Mission allotment for support of control campaign.....	\$80,000
Mission allotment for fuel and logistical support for Phase II campaign (AFR/OEO funds).....	\$67,000
Mission allotment for aerial support for Phase II (AFR/OEO funds).....	\$40,000
Mission allotment for support of helicopter (AFR/OEO funds).....	\$100,000
Total OFDA.....	\$442,433
Total Other USG.....	\$570,000
Total FY 1987.....	\$1,012,433

FY 1988

Transport of malathion from Dakar to Bamako.....	\$5,541
Total FY 1988.....	\$5,541

TOTAL            \$1,017,974

Assistance Provided by U.S. Voluntary Agencies

None reported

Assistance Provided by the International Community

Canada - provided \$500,000 for aerial spraying.

Denmark - provided technical assistance.

EEC - contributed \$308,940 for 118 MT of fenitrothion, 15,600 liters of fenitrothion, protective clothing, eggpod surveying, and support costs.

France - gave \$575,000 for 5,000 liters of fenitrothion, 30 MT of propoxur, 500 sprayers, a truck, 80 hours of helicopter time, training, a plane, and logistical support.

Germany, Fed. Rep. - contributed \$546,000 for training, technical assistance, sprayers, 100 MT of propoxur, and 6 MT of fenitrothion.

Italy - provided \$140,000 for pesticides, sprayers, dusters, and protective clothing.

Japan - gave 150 MT of propoxur.

Norway - contributed \$1,500,000 through Stromme Foundation for aerial operations, 100 sprayers, protective clothing, face masks, 33,000 liters of fenitrothion, and 4 Land Rovers.

UNDP - provided a truck.

United Kingdom - contributed \$285,000 for 150 MT of propoxur and 10 Land Rovers.

TOTAL \$3,854,940

### MAURITANIA

Mauritania suffered again in 1987 from grasshoppers and locusts. In January the U.S. Mission in Nouakchott requested that A.I.D./Washington provide an entomologist for an eggpod survey conducted jointly by Mauritania and Mali. A.I.D. responded by sending USAID/Bamako entomologist Ian McKay, who participated in a two-week training mission with Malian and Mauritanian crop protection personnel. Results of the eggpod survey confirmed the infestation of the dominant grasshopper species Oedaleus senegalensis in Mauritania.

Based on the 1986 grasshopper/locust campaign, the Government of the Islamic Republic of Mauritania (GIRM) developed a plan of action for the anticipated 1987 infestation. The plan involved two phases of operations, with survey work done by the CPS. During the first phase, the CPS trained farmers and coordinated crop-dusting activities. The CPS teams aimed to treat 100,000 ha in this fashion. The second phase involved small-plane spray operations in the southeastern region. By October 16, a total of 33,000 ha had been sprayed in Mauritania. After the FAO reviewed the plan and a multi-donor and GIRM committee accepted it on January 28, various donors began pledging support. At USAID/Nouakchott's request, OFDA's assessment team, which was already in Africa, went to Mauritania between March 22 and 27.

Following the GIRM's appeal to the USG for assistance, U.S. Ambassador Robert L. Pugh determined on April 2 that Mauritania's anticipated grasshopper/locust threat constituted a disaster. AFR/OEO then funded a one-year contract between USAID/Nouakchott and entomologist Bill Thomas, who served as technical assistant and consultant during Mauritania's control campaign. AFR/OEO also provided \$5,000 to fund key participants' involvement in the PRIFAS training course in Montpellier, France.

OFDA provided essential supplies for the pest control campaign and financed flying time for Phase II operations. In November, swarms of desert locusts (Schistocerca gregaria) were sighted in north-central Mauritania, moving north toward Morocco and Algeria.

Summary of USG Assistance

Entomologist: Bill Thomas contracted for 1 year to act as program coordinator for USAID/Nouakchott; funds included a vehicle and associated costs (AFR/OEO funds).....	\$100,000
Mission allotment for logistical support and a public awareness campaign.....	\$25,000
Purchase of 12,000 face masks from DOD (\$1,100), plus air freight (\$500).....	\$1,600
Purchase of 15 radios (\$21,764), plus air freight (\$1,536).....	\$23,300
Mission allotment for vehicle fuel.....	\$45,000
Mission allotment for flying time on Luxembourg-provided airplane.....	\$32,600
Total OFDA.....	\$127,500
Total Other USG.....	\$100,000
	<u>TOTAL</u> \$227,500

Assistance Provided by U.S. Voluntary Agencies

None reported

Assistance Provided by the International Community

China, People's Rep. - contributed 20 MT of insecticide.

EEC - donated \$236,300 for 110 MT of fenitrothion, technical assistance, the transport of 598 MT of Japanese pesticides, and protective clothing.

FAO - contributed \$20,000 for in-country training.

France - contributed \$197,700 for helicopter flying time, 50 MT of propoxur, 10,000 liters of fenitrothion, a 4-WD truck with sprayers and blowers, technical assistance, and a donation for the PRIFAS training course.

Germany, Fed. Rep. - donated \$112,400 for ground treatment.

Italy - gave \$442,000 for 4 vehicles, pesticides, and protective clothing.

Japan - gave 13 vehicles, 30,000 liters of fenitrothion, other pesticides, protective clothing, and field materials (tents, beds, and mosquito nets).

TOTAL \$1,008,400

## NIGER

Niger was less affected by infestations of grasshoppers and locusts than its neighbors were in 1986. This was due to several factors: less favorable ecological conditions for grasshopper growth, adequate control efforts in other Sahelian countries, and the fact that the Nigerien Crop Protection Service is one of the best in the Sahel. Nevertheless, limited infestations did occur and the Government of Niger (GON) was concerned as 1986 drew to a close about the possibility of a much larger problem in 1987. The GON therefore prepared an action plan and a list of requirements; it presented these to a donor committee at the end of the year. Donors made various tentative commitments in early 1987; USAID/Miamey felt that the most appropriate USG response should include pilot and mechanic training, aircraft maintenance and fuel, pilot and aircraft insurance, and radios. Pesticide requirements, other training, and ground-control supplies were covered by other donors and in-country stocks. The Grasshopper/Locust Working Group in Washington dispatched Carroll Voss, an aircraft specialist and a member of the OFDA assessment team (see Senegal case report), and Charles Kelly, OFDA-sponsored drought and locust disaster coordinator in Burkina Faso, to Niger in early March to help define the U.S. Mission's requests. U.S. Ambassador Richard W. Bogosian then declared the situation to be a potential disaster on March 13, thereby allowing OFDA funds to be committed.

Rainfall during 1987 began later and was less plentiful than expected in many areas of southern Niger. As a result, the grasshopper situation did not develop as expected. During most of the 1987 agricultural season, only scattered grasshopper infestations were reported in the Tahoua, Maradi, and Zinder departments, usually from areas bordering Nigeria.

Grasshopper infestations became more intense in the eastern Tahoua, Maradi, and Zinder departments in early September as the result of abnormal rainfall patterns. Other areas of the departments were, at the same time, experiencing moderate to severe drought conditions. In late August, the CPS dispatched its three Cessna spray planes to respond to increased field reports of grasshopper damage in the three departments.

As the normal end of the rainy season began, reports of more serious grasshopper infestations were received at the regional and national level. Field surveys in late September by the FAO/Niger entomologist, using the USAID-financed Evergreen helicopter, indicated that an area of approximately 40,000 sq. km, including 600,000 ha of severe infestations, existed in central Niger.

Based on these field reports, the GON mounted an urgent and large-scale control operation to minimize crop losses. Specific requests for new donor assistance were made and the GON directly contracted for the services of a locally available spray aircraft.

The effectiveness of the emergency control operation, which eventually involved five spray planes and the Evergreen helicopter, was limited. The emergency operations began after the peak of the grasshopper damage had occurred and at the point of harvest (October) in many of the areas under attack.

The CPS reported that a total of 141,213 ha were treated for grasshoppers by ground crews and villagers during 1987. Aerial spraying reportedly covered 208,593 ha, although repeat treatments by aircraft and ground crews occurred with some frequency due to low kill rates and reinfestation. No estimates of the area requiring retreatment have been reported.

As for locusts, early rains in 1987 led to the development of small gregarious bands of desert locusts in the eastern Air mountains. OCLALAV, in cooperation with the CPS and using CPS aircraft, undertook a joint control operation in July and August. Although isolated immature gregarious locust bands had been identified through ground surveys, a helicopter survey of the mountains in early September indicated that no major concentrations existed. Based on the aerial survey, vegetation conditions in the south and central regions of the mountains were assessed as being good for transiting locust swarms from areas further to the east (Chad and Sudan).

Ground surveillance continued in the Air mountains and Tamesna during September and early October. The effectiveness of this surveillance was limited by the transfer of some OCLALAV vehicles to Chad.

During early October, unconfirmed reports were received indicating that locust swarms had begun arriving in and were transiting through the Air mountains and the areas to the west. OCLALAV, Algerian, and CPS ground crews confirmed these observations, but were hampered in control operations by a lack of vehicles, communications, and equipment.

In early October, at the same time the decision was made to increase grasshopper control operations in south central Niger, the GON began reallocating aircraft and dispatched the rented twin-engine aircraft to assist in locust control operations. The effectiveness of the aircraft was limited due to poor communications, the lack of adequate field teams, the lack of vehicles for locating locust swarms, and the speed with which swarms were migrating across the Air mountains and northwestern Niger.

In late October, the USAID-financed helicopter was dispatched to the locust zone to assist in surveys and in swarm location. The helicopter covered the western Air mountains and verified that reported swarms had moved from the mountains towards the west. Helicopter operations in the desert area (Tamesna) were not undertaken for technical reasons, although one swarm was identified 50 km west of the town of Arlit.

Locust control operations by aircraft and ground crews continued in the Tamesna area into late November. By the beginning of December, the CPS concluded that all major swarms had moved west from Niger but substantial residual populations of solitary or gregarious locusts remained in isolated areas of vegetation in the northwest, and in the Air.

During 1987 an estimated 15,200 ha were treated for locusts by ground crews. Aerial treatment of locusts during the season is estimated to have covered 41,600 ha. Some repeat treatment by aircraft and ground crews occurred due to reinfestations and poor kill rates.

USAID's support of the CPS grasshopper/locust control program began in early May with the hiring of a project assistant and periodic technical assistance from OFDA regional adviser, Charles Kelly. This assistance expanded with the provision of funding for aircraft operations (fuel and repair costs) and training (pilots in the U.S., technicians at PRIFAS/France, and the aerial application workshop in Niamey). Additional assistance was requested for VHF (later changed to HF) radios and operating costs for the OCLALAV/Niger teams for monitoring locust conditions in Niger. Stephen Straley, of the U.S. Forest Service, went to Niger to work as the aerial operations manager from July 5 through September 3 (he was funded through a pre-existing contract between OFDA and the U.S. Forest Service). OFDA also contracted with Evergreen for a helicopter to be used in several Sahelian countries for insect surveying. The helicopter proved very useful but equipment failure caused delays on several occasions in Niger.

#### Summary of USG Assistance

##### FY 1987

Purchase of 6 VHF radios for the GON to support aircraft ground coordination.....	\$3,333
Mission allotment for aircraft maintenance (routine maintenance of 3 Cessnas and the services of 2 mechanic aides).....	\$26,500
Mission allotment to enable USAID/Niamey to hire someone locally to help manage the grasshopper/locust campaign (AFR/OEO funds).....	\$16,867
Grant to GON for campaign expenses.....	\$10,000
Mission allotment for OCLALAV team support (for basic operating costs of teams in Agadez: per diem, fuel, etc.).....	\$15,000
Contract with Evergreen Aviation for the use of a Bell 206 helicopter.....	\$173,431

Mission allotment for helicopter support: 20,000 l of jet fuel, chase vehicle support and fuel, and miscellaneous supplies:

OFDA funds.....	\$11,000
AFR/OEO funds (transferred from unused training funds).....	\$17,100
7 HF radios purchased from Motorola for the CPS.....	\$41,433
Mission allotment for avgas (aircraft fuel).....	\$20,000
Protective clothing purchased from USFS and air freight.....	\$1,500
3 battery chargers and air freight.....	\$1,222
Total OFDA.....	\$303,419
Total Other USG.....	\$33,967
Total FY 1987.....	\$337,386

FY 1988

Mission allotment for increase in operations support (jet fuel, vehicle fuel, salaries, and supplies).....\$8,500

Total FY 1988.....\$8,500

TOTAL \$345,986

Assistance Provided by U.S. Voluntary Agencies

None reported

Assistance Provided by the International Community

Belgium - provided 11,000 liters of fenitrothion, 30,000 liters of fuel, a technician and a mechanic, 2 Land Rovers, and 2 Unimog sprayers.

Canada - contributed \$373,134 for 5,000 sets of protective clothing, training for 10,000 villagers, the repair of landing strips, fuel, salaries for 2 CPS pilots, tools and spare parts for CPS aircraft, and pumping equipment.

EEC - donated \$354,610 for 90 MT of fenitrothion dust, 24,000 liters of fenitrothion 50% ULV, 15,000 pairs of protective clothing, and other pesticides.

FAO - provided 40 MT of warfarin (rodenticide), and equipment and consultants for the UNDP/FAO early warning project.

France - contributed \$329,489 for an entomologist for FAO, a pilot, repair of landing strips, 500 ULV sprayers, 50 MI of lindane, 5,000 liters of fenitrothion, a PRIFAS project in Niamey, and consultants and experts.

Germany, Fed. Rep. - donated \$2,528,090 for 10,000 ULV battery sprayers, 220,000 liters of fenitrothion 20% ULV, batteries, 10,000 pairs of gloves and protective goggles, a micro-computer, 4 HF radios, and equipment for the UNDP/FAO early warning project.

Italy - contributed \$430,952 for 4 vehicles, 20 motorcycles, 500 face masks, 500 protective goggles, 300 pairs of rubber boots, 1,000 units of protective cream, 20,000 liters of malathion 40% ULV, other pesticides, salaries for a driver, per diem for CPS agents, an agro-economist for 6 months, and fuel.

Japan - gave 90,000 liters of fenitrothion.

Switzerland - provided \$42,000 for the UNDP/FAO early warning project.

UNDP - contributed \$594,000 to finance the early warning project with FAO.

TOTAL \$4,652,275

#### SENEGAL

The 1986 anti-grasshopper campaign in Senegal was one of the largest in Africa. More than 1.0 million ha were treated by aerial spraying, with planes provided by both the United States and Canada. Despite problems with donor coordination and logistical arrangements, the 1986 grasshopper control program was considered a success. Major crop losses were averted, but the grasshoppers were able to lay eggs before spraying took place. Therefore, it was expected that another campaign would be necessary for 1987 but that it would run much more smoothly.

This expectation proved to be correct. A limited infestation occurred in 1987 which was successfully handled by the Senegalese Crop Protection Service (CPS) and donor inputs. Relatively meagre rainfall in 1987 and the excellent 1986 control effort were identified as causes for the lower than expected levels of infestation.

In early February 1987, USAID/Dakar estimated that between 800,000 and 1,000,000 ha might need treatment that year. This projection was based on the number of hectares infested in 1986, the stage of the pest life cycle when treatment was applied, and the probability of infestation in areas which were assessed as potential problem areas in 1986 but not treated. CPS eggpod surveys and preliminary forecasts from FAO and PRIFAS, a French-based entomological institute, also indicated a potentially large area of infestation. This led U.S. Ambassador Lannon

Walker to declare a disaster on February 19, 1987. Early-season USG assistance concentrated on the provision of an entomologist, an assessment team, and field monitor to assist the CPS in performing eggpod surveys and a four-member assessment which went to Senegal in early March. This team--consisting of an OFDA operations officer, an entomologist, an aerial spray specialist, and a logistician--spent several weeks in Senegal, giving technical advice and assisting the CPS and donor representatives in drawing up the Senegal action plan. (The cost of this team is included under "Africa-regional" because members of the team also went to several other countries.)

The resulting action plan called for treatment of between 1.2 and 1.32 million ha, 700,000-800,000 of this by air, in three phases. Phase I of the program was due to start in mid-June with the onset of the rainy season and carry on to mid-August. During this phase, 270,000 ha were to be treated from the ground, using both dust and ULV pesticide formulations, while 100,000-200,000 ha were slated for aerial treatment. Phase II would cover the period from mid-August until early October and involve 140,000 ha of ground control and 500,000 ha of aerial treatment. Phase III, consisting of 110,000 ha of ground treatment and 100,000 ha of aerial spraying, was designed to eliminate returning third generation pests. Before the first phase, the Senegalese CPS planned to conduct farmer training, pre-position pesticides, and conduct surveys. USAID/Dakar, with the assistance of the OFDA assessment team, recommended that the USG concentrate on providing training, one-third (240,000 ha) of the aerial treatment requirements--including pesticides, flying time, and fuel--and technical assistance and equipment for an operations center.

In mid-July, field surveys reported that the lack of sufficient rains in June and early July greatly retarded the hatching of significant populations of grasshoppers throughout Senegal. Then in late July, three areas totaling 33,000 ha, infested with O. senegalensis were delineated. Densities ranged from five to 30 per sq. km. Two Turbine Thrush aircraft, donated by the USG, sprayed 5,000 ha of this area along the Gambian border from Passi Ngayene to the Pate forest reserve and along the banks of the Bolon River from Dabali to Diamafare. Aerial treatment began on July 23 and ended within two days. CPS agents treated the rest of the infested area.

In August, an additional 19,000 ha were delimited for treatment in the forest reserve of Mebegue. Activities of the U.S. team, the CPS, the Canadian team, and the French military were well-coordinated. Equipment, pesticides, and fuel were dispatched to Kaolack and spraying began on August 10. Six days later, the two U.S.-provided Thrushes finished treating 22,000 ha.

As a result of a combination of factors, including the excellent intervention in 1986 and better and more timely ground control measures in 1987, only 27,000 ha required aerial treatment in Senegal in the 1987 campaign. The weather in particular played a big role in reducing grasshopper outbreaks: early rain followed by drought caused heavy mortality in the early instars; later rains were heavy enough to cause mortality in late-hatching grasshoppers. As of December 1987, it is not anticipated that a major control campaign will be needed in 1988.



China, People's Rep. - donated 20 MT of malathion.

EEC - provided \$265,038 for 20,000 liters of fenitrothion, operating expenses, and technical assistance.

France - contributed \$176,277 for Alouette helicopter, 30 MT of propoxur, 500 pulverizers, PRIFAS training, and logistical support (provided by French military).

Germany, Fed. Rep. - provided \$134,831.

Italy - donated \$318,492 for 5 trucks, spayers, dusters, and protective equipment.

Japan - provided 50,000 liters of fenitrothion.

United Kingdom - contributed 15 Land Rovers.

TOTAL \$1,644,638

#### SUDAN

Insects continued their onslaught in Sudan despite that country's aggressive counter-attack of 1986. The coastal part of Red Sea Province, and the central Northern Kordofan and Northern Darfur provinces, winter and summer breeding grounds respectively for desert locusts, witnessed the most activity.

As 1987 began, adult locust swarms were sweeping in from northern Eritrea in Ethiopia to reproduce in Kassala and Red Sea provinces. Threatening harvests as far away as the Middle East, this outbreak had the potential to be the most serious in the Red Sea region since a similiar plague in 1978-79. In mid-February, Saudi Arabia reported mature swarms entering its territory from that breeding ground. When the summer season began in May, the infestation shifted to a vast area in central and western Sudan. Breeding occurred as far east as Khartoum and as far north as Northern Province, but was especially concentrated in Northern and Southern Darfur provinces, with some swarms crossing over from Chad. Once the locusts had emigrated from the region in November, reports along the Red Sea Coast indicated renewed winter breeding there. Scattered outbreaks of grasshoppers all over the country increased the threat to agriculture. The insect plague in Sudan is expected to continue in 1988.

The Sudanese Plant Protection Department (PPD) along with DLCO-EA, assumed primary responsibility for insect control, issuing biweekly reports on the situation. PPD teams undertook ground spraying and dispensing poisoned bait while DLCO-EA conducted the winter aerial spraying. Control efforts by GOS-contracted aircraft for the summer was

supplemented by DLCO which sprayed Northern and Southern Darfur provinces. A steering committee comprising representatives of the GOS, FAO, and other international donors met regularly to monitor the campaign. Despite difficulties imposed by the scattered nature of the swarms, crop loss was kept to a minimum in the affected zones. By mid-October, intense ground and air work had cleared Khartoum, Kordofan, and both Darfur provinces of the predators. Up to 43,000 ha were sprayed in northern Sudan alone with the major aerial initiatives of 1987 taking place against densely packed locusts in Northern and Southern Darfur.

Benefitting from past experience and donations, the PPD was able to mount a more extensive survey and control operation in 1987 than in previous years. Nevertheless, as the summer campaign began, outstanding needs included additional pesticides and staff training. On February 15, Ambassador G. Norman Anderson declared the situation a disaster. OFDA provided \$600,000 to the EEC to purchase 400 MT of propoxur 2 percent dust through a Luxembourg procurement agent, Luxconsult. Shipments totaling 100 MT of the pesticide arrived by air throughout June with 300 MT being delivered by sea in August. AFRO/OEO also furnished \$50,000 for locust control and pesticide management training to PPD staff from June 8-18 in Khartoum. An additional \$298,400 unspent over from an OFDA grant to the EEC in FY 1986 was put into a fund with an EEC contribution of \$122,600 and used for FAO technical assistance. Counterpart funds of \$1,722,000 generated by the Commodity Import Program went towards local campaign costs.

Summary of USG Assistance

Grant to the EEC for 400 MT of propoxur.....	\$600,000
	<u>TOTAL</u> <u>\$600,000</u>

Assistance Provided by U.S. Voluntary Agencies

None reported

Assistance Provided by the International Community

Canada - sent a delegation to assess the situation and provided \$175,000 for the medium-term locust effort.

EEC - contributed \$35,000 through FAO for radios; provided funding for consultant to do a mid-program evaluation; gave \$122,600 for FAO technical assistance; and donated fuel for PPD operations.

Italy - furnished protective clothing and spray equipment, worth \$157,000.

Finland - provided \$57,000 through FAO for purchase of equipment and miscellaneous costs.

Japan - supplied 50,000 liters of pesticide through FAO.

Netherlands - assisted the USG training program and donated \$211,000 through FAO for equipment; sent Bendiocarb 1% pesticide, valued at \$600,000.

United Kingdom - gave 80,600 liters of fenitrothion and vehicles, valued at \$1,200,000, plus \$175,000 worth of equipment.

TOTAL \$2,732,600

#### YEMEN

In mid-March, the Yemeni Liaison Officer for Locust Control and Counsellor to the Ministry of Agriculture and Fisheries (MAF) met with USAID/Sanaa staff to discuss the status of the Yemeni desert locust campaign. MAF officials had conducted a locust survey the previous month which identified an area 90 km by seven km near Wadi Midi as the zone of highest infestation. The adult locust population was estimated at one per 30 sq. m. The MAF sprayed this area but was able to kill only ten to 15 percent of the locusts. More hatching was expected to take place in late March. The MAF had pesticides and spraying equipment but supplies were inadequate and antiquated. For all these reasons, the MAF was concerned that the locust situation had crisis potential and therefore requested international assistance.

To further assess the situation and work with MAF locust control officials, OFDA and A.I.D.'s Asia and Near East Bureau dispatched Maghdy Ghieth, pesticide management specialist from USAID/Cairo, to Yemen. Mr. Ghieth's subsequent field survey found that the northern Tihama region near the Saudi border and Red Sea coast was experiencing an "alarming" level of infestation of desert locusts. The affected area measured 1,000 sq. km. These locusts were gregarious hoppers at first, second, and third instars of the nymphal stage feeding on sorghum, millet, and non-crop vegetation. After this assessment, U.S. Ambassador William A. Rugh declared a disaster on April 16. Potential donors held a meeting in mid-April and requested that the FAO act as coordinator of the campaign.

The Yemen Arab Republic Government (YARG) developed a three-phase plan for the control and containment of the locusts. Phase I, the emergency effort, called for intensive ground spraying and baiting in the northern Hama area and in the adjacent valleys in the western escarpment. No aerial spraying was anticipated. Phase II was to begin in July 1987 and consist of monitoring and control when needed in the central highlands and eastern region. Finally, Phase III, the long-term plan, called for developing an early warning monitoring network and training a cadre of specialists.

The USAID pesticide management specialist assisted USAID/Sanaa in identifying appropriate USG contributions. OFDA provided carbaryl bait and malathion for ground control, protective clothing, and generators. In addition, A.I.D./Washington furnished funds for a YARG official to attend the A.I.D.-designed training course in Khartoum on June 1-18 and for a consultant (Janice Jensen) to conduct a pesticide disposal survey from June 26 to July 4. (These training activities were funded from OFDA's preparedness budget and are discussed in more detail in the preparedness section).

Summary of USG Assistance

Pesticide management specialist: Maghdy Ghieth (from USAID/ Cairo) for a 3-week assessment (March 28 - April 18).....	\$3,441
Purchase and shipping of 10,000 liters of malathion from American Cyanamid.....	\$37,382
Purchase and shipping of 15 MI of carbaryl (Sevin 855) from Union Carbide.....	\$67,275
25 sets of protective clothing purchased from USFS (includes goggles, masks, rubber boots, and cotton overalls), plus shipping.....	\$2,500
Mission allotment for 8 5-kVA generators and round-trip airfare for a trainer.....	\$25,000
<u>TOTAL</u>	<u>\$135,598</u>

Assistance Provided by U.S. Voluntary Agencies

None reported

Assistance Provided by the International Community

FAO - provided a 4-wheel-drive pickup and 2 Micronair sprayers.

Japan - contributed 5,000 liters of malathion.

United Kingdom - provided 20,000 liters of fenitrothion and 2 Land Rovers.