Return of the Locust: A Cloud Over Africa

Last year's rains brought better harvests—and a bigger crop of locusts and grasshoppers, threatening a revival of the plagues of the past

In the second week of September, four American DC-7's sprayed malathion on 360,000 hectares of land in northern Senegal in the first phase of an attack on grasshoppers that are threatening crops in a broad area of the West African country. Across the border in Mauritania and Mali, control efforts are also in progress. In Chad, African migratory locusts have been reported in ominous numbers. Further east, in Sudan and Ethiopia, the problem is voracious desert locusts. In southern Africa, red locusts pose a threat in Tanzania and Zambia and brown locusts have appeared in Botswana and South Africa, where there are fears that rains in late autumn could bring the most serious outbreak of all. For the first time in 40 years, grasshoppers and all four species of locusts active in Africa are posing a serious threat simultaneously. In all, a score of countries in Africa are menaced.

The current focus of attention is on the countries of the dry zone south of the Sahara where the next few weeks will tell whether the present infestations will escalate to plague proportions. International relief agencies have rallied behind efforts to prevent the summer generations of insects from getting out of control. Countermeasures, however, are hampered by the effects of the lapse of time since the last locust emergency.

Locust control organizations in the region have lost their operational edge and research on the insects has lagged. Insecticides used in the past have been indicted as unsafe and alternatives have not been tested in Africa for effectiveness and safety.

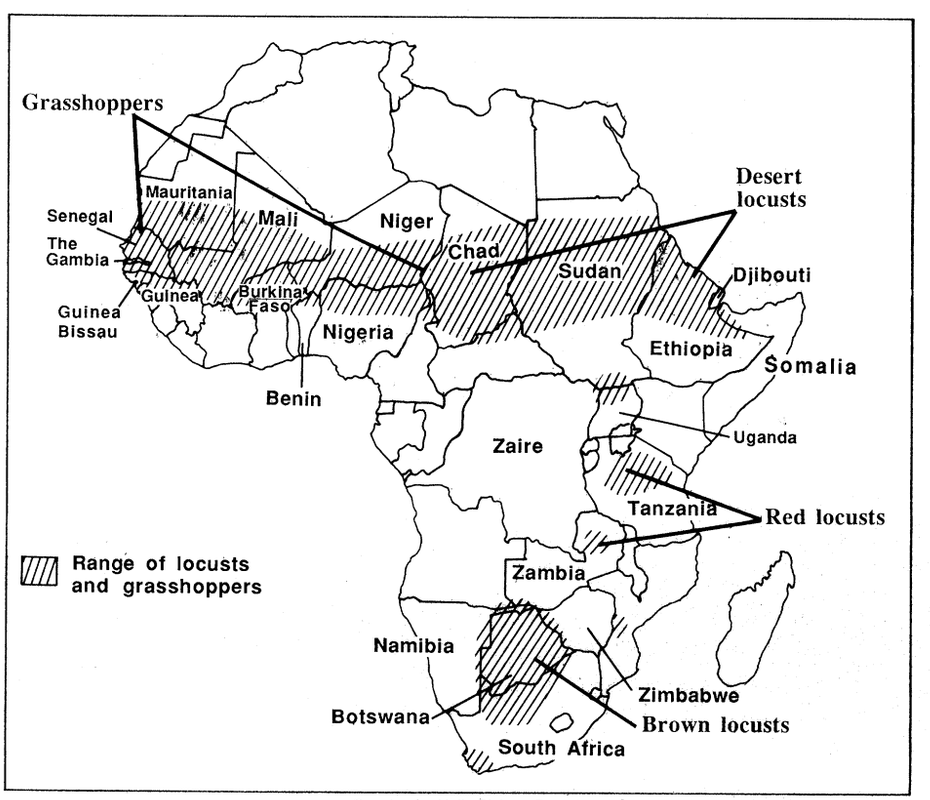
The last great locust threat in Africa began in the twilight of the colonial era and ended after most African territories had achieved independence. A sustained assault by desert locusts began in 1948–49 in the Arabian peninsula and ended in the middle 1960's, affecting countries from West Africa to India. In that period, colonial locust-control agencies, notably British and French, were supplanted by a combination of regional organizations specializing in control of one species of insect* and the national pest control agencies of the newly independent countries. There was also a major move toward the internationalization of locust control, with U.N. organizations supporting a variety of technical assistance, research, data gathering, and training functions. During the desert locust plagues of the period, control operations were regarded as increasingly effective.

The mid-1960's was the beginning of a recession period for locusts, with the long stretch of generally dry years that ensued seen as the main factor in preventing serious outbreaks. There were some locally serious infestations in 1974 and 1978–79 linked with sporadically better rains, but the problem was not widespread.

This lull in the locust cycle caused a withering of the control apparatus. In the view of George Cavin, an American with experience in the locust wars in Africa and the Middle East in the 1950's, the control organizations today "have a long way to go" to regain their former effectiveness. Cavin, an entomologist who had a career with the U.S. Department of Agriculture, spent part of this summer in the Sahelian country of Mali for the U.S. Agency for International Development (USAID) overseeing a test of alternative pesticides for use against grasshoppers and locusts.

Until the end of the 1960's the regional control organizations that led the effort in Africa were good at their job, says Cavin. But when the locust threat receded, "the member nations cut back on funding, international support tailed off, and the organizations lost efficiency. Now they are so far down in personnel and equipment that it will take quite a while to get them back to the point where they can do an effective job. The grasshoppers and locusts are going to be back," he says, and he sees a possible return "to the situation of the 1950's."

Not only has the diversion of attention and resources from the control agencies left them short of vehicles, aircraft, equipment, and supplies, but there has been a loss of expertise, from the locust hunters in the field who knew the breeding grounds to the scientists who had made careers on research on the insects. The deficit in experience extends to the political sphere. As one U.S. official put it, "Only a few gray-haired am-



Drawing by Holly Bishop. Based on information from USAID and other sources.

*Desert Locust Control Organization for East Africa (DLCO-EA), International Red Locust Control Organization for Central and Southern Africa (IRLCO-CSA), Organisation Commune de Lutte Atiacridienee et de Lutte Antiaviare (OCLALAV), Organisation Internationale Contre le Criquet Migrateur Africain (OICMA).

bassadors around here remember what it was like."

When the potential for a large-scale resurgence was recognized last year, much ground had to be made up. In the current effort, the U.N.'s Food and Agriculture Organization (FAO) assumed responsibility for raising funds and coordinating control activities. The FAO has established an Emergency Center for Locust Operations in Rome and appointed an able pest control entomologist, Lukas Brader, as director. By U.N. standards, he has been given extraordinary latitude—for procurement of pesticides and equipment, for example—and is reported to be using it effectively.

In West Africa, the regional organization charged with controlling the grasshopper, OCLALAV, has been financially starved. As a result, control measures are organized mainly on a country-by-country basis. The FAO plays a coordinating role, but donor organizations have been cooperating with individual governments in the region to develop action plans and share costs.

In Senegal, for example, the government and major donors agreed on a three-stage operation aimed at bringing grasshoppers and migratory locusts under control. The United States is shouldering the $1-million-plus cost of the four-engine spray planes which anchored the first phase. Canada is funding four crop-dusting planes to take care of smaller infestations in the second phase. Ground spraying by the Senegalese pest control service and hand spraying by farmers is called for in the third phase. The government of Senegal is buying the malathion for the initial spraying operation and other donors are funding various parts of the program.

In Senegal, the main quarry is *Oedaleus senegalensis*, the eponymous Senegalese grasshopper that does not develop swarming behavior (see box) but does move in huge numbers. The grasshoppers range over the dry zone in West Africa, appearing first in late spring in the south after the rains

Going With the Wind

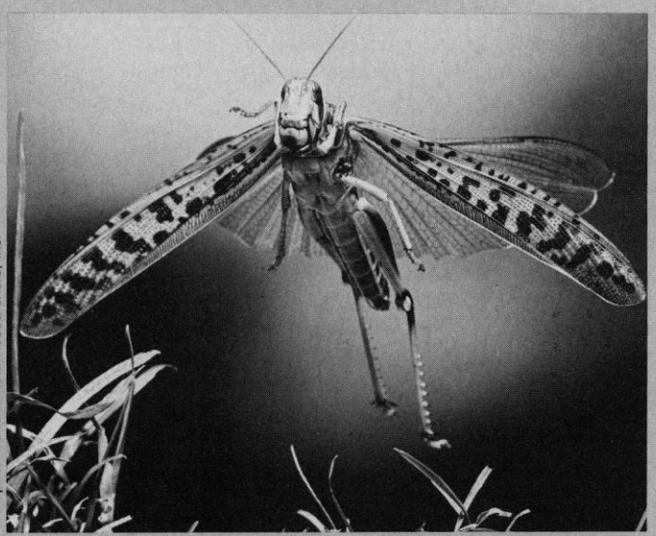
Why do locusts periodically congregate into destructive migratory swarms? The basic insight into the alternation between invasion and recession is that a locust may go through its life cycle either as a solitary insect or as part of a swarm depending on the conditions under which it grows to maturity. Author of the so-called phase theory in the 1920's was Sir B. P. Uvarov. A White Russian émigré, Sir B. P., as he was called, was the guiding spirit of the Anti-Locust Research Center in London that became a world focus for information and research on locusts after World War II when the desert locust, *Schistocerca gregaria*, was on the loose in Africa and the Middle East and under close surveillance and study.

In periods of recession, locusts exist as isolated individuals, spending their lives near their breeding sites. David A. Nickle, a Department of Agriculture research entomologist at the Smithsonian Institution with a special interest in locusts in Latin America, says that change occurs when the insects are crowded and a group hormone takes effect, altering their physical appearance and behavior.

For the locusts' gregarious behavior to proceed to the swarming stage, this crowding must start while they are in the wingless, nymphal stage after hatching and persist as they go through a series of molts. In the gregarious form, locusts differ from their solitary counterparts in coloration and body proportions and, for example, have higher metabolic and oxygen-intake rates. Their behavior is also described as much more active and "nervous."

Hatching typically occurs after rains have begun and new vegetation has emerged to provide food for the young hoppers. Good rains, therefore, are thought to provide the conditions for large populations and thus contribute to swarming behavior.

The extraordinary mobility of the desert locust also has a meteorological basis. A veteran of the locust campaigns of the 1950's, atmospheric scientist Carl I. Aspliden, says that in their travels the locusts follow not instinct but the weather cycle. Aspliden headed a U.N. Food and Agriculture Organization–World Meteorological Organization technical mission in the mid-1950's to assist in combating the desert locust plague. The task was to gather data on and study rainfall and windflow. The work made it possible to "plot the locust cycle," says Aspliden.



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A desert locust swarm might start from Saudi Arabia in April or May and fly across the Red Sea on the trade winds to Sudan. In the area of Khartoum the swarm would encounter southwest winds, and where the two windflows converge rain would fall. The locusts would then lay eggs, burying the egg pods in the sand, some 100 eggs to a pod. "Six weeks later the hoppers come out and the ground is black with them." says Aspliden. When the survivors are ready to fly, "you now have a divergence, and they go with the winds." These may disperse the locust as widely as from northern Nigeria to Algeria and Morocco.

The potential for destruction is appalling. A locust weighing 3.5 grams will eat its own weight each day. And Aspliden says that a swarm may number a billion insects and 100 swarms may be on the move during a plague.

Locusts need warm temperatures to fly—24° to 25°C (75° to 77°F)—and have to land at night when the air cools. But they can settle on the sea, staying afloat by stacking up on each other. Aspliden says he knew of swarms landing in the Atlas Mountains in North Africa, being covered by snow for weeks and then taking off again and flying. They are prodigious travelers; a swarm may cover 200 miles a day while moving 2000 miles. Aspliden notes that there are records of desert locusts winding up in Scotland. ■ J.W.

begin, then riding the monsoon winds north to the fringe of the Sahara where they lay eggs. Toward the end of the rainy season, when the winds reverse, a new generation of grasshoppers moves south.

The grasshoppers favor grasses as food, but when these are depleted they shift their attack to crops, and are particularly partial to millet, the major grain crop for Senegal's subsistence farmers. The control strategy with grasshoppers is to conduct spraying operations before they begin their move southward. If the grasshopper hordes in Senegal elude the big spray planes, the effect on this year's harvest could be devastating. U.S. Agency for International Development officials report that spraying operations in the north killed 90 to 100% of the hoppers and that both farmers and government officials are calling the project an unprecedented success. The final verdict will depend on the impact on crops of the grasshoppers' progress south.

In Sudan, signs of a potentially serious locust threat have been present this summer. George Schaefers, an entomologist at the New York State Agricultural Experiment Station at Geneva, says that there is a great increase in grasshoppers and more locusts in evidence than for a number of years, but you can't say there's a locust plague." Schaefers traveled to Sudan to make a locust reconaissance for USAID, returning in mid-September. He says that "the conditions are right" for an escalation and in the absence of adequate control operations "could get out of hand."

Schaefers notes that a serious problem in the area is that Eritrea, which borders on Sudan, is the site of a bitter separatist uprising against Ethiopia and Sudan itself is fighting insurgents in its southern provinces. Both areas are reported to have serious locust infestations, which, if untreated, could become major threats to the region. Access by antilocust forces appears prohibitively hazardous.

With locusts, as with grasshoppers, the key to control is catching the insects after hatching, ideally in the wingless, nymphal stage. Surveys to identify activity in breeding areas and prompt treatment with pesticides is regarded as essential.

For the United States, the question of pesticide choice for pest control operations is a central one. USAID operates under regulations stemming from environmental concerns that, in effect extend domestic restrictions on pesticide use to U.S. activities in Third World countries.

Concern about pesticides in Africa is well founded. Although most countries in the locust zone have regulations governing pesticide use comparable to those in industrial countries, the frequency with which these regulations are violated is notorious. For example, instructions on application and use of protective garb are often ignored. Even more serious is the reportedly widespread use of stocks of pesticides banned in other countries for their toxicity to humans and persistence in the environment.

The use of modern pesticides in the postwar antilocust campaign is widely credited with making human intervention a factor for the first time in controlling a locust plague. By the 1960's, however, concern was mounting about the heavy use of persistent organochlorine pesticides, particularly about the effects on nontarget organisms of the pesticide most widely used for locust and grasshopper control—dieldrin. Studies conducted from the 1960's on found substantial traces of the pesticide in the tissues of humans living in areas where it was regularly used.

While international agencies expressed interest in identifying replacements for dieldrin, no comprehensive research program to find alternatives was conducted in the 1970's. When the current locust emergency began, the search for alternative pesticides was pressed. USAID, for example, backed the field test conducted in Mali by a three-man team headed by Cavin of three U.S. pesticides. One of them was malathion, used in California's Medfly outbreak and chosen for the Senegal spraying operations.

The pesticide issue exemplifies the problems of discontinuity in antilocust operations in the region. FAO's Lukas Bader has recently been quoted in press reports as saying that African governments had "reacted very slowly to our warning cry," and were responsible for the seriousness of the situation.

A common view among development professionals with knowledge of the region is that the pest control agencies of these countries have adequate technical capacity but lack the resources—vehicles, fuel, chemicals, spraying equipment—to do the surveys and carry out the treatment program required. The breakdown of the regional control organizations is seen as an example of the chronic failure of these very poor countries to pay their dues in regional undertakings.

The current outbreak of locusts and grasshoppers is being treated by international agencies as another disaster in a region where such phenomena are frequent. U.S. participation is anchored by USAID's office of disaster assistance which has the capacity for quick response and the flexibility in use of resources that the occasion requires. At the same time, USAID and other donor organizations recognize that the locusts and grasshoppers are likely to return in force next year, perhaps for several years, and that plagues will threaten again in the future. Discussions are, therefore, under way in USAID, the World Bank, and other donor agencies about action in the longer term.

A major question is whether to help rebuild and maintain an effective antilocust control and research capability in the region. (By all accounts, the Desert Locust Control Organization serving East Africa is the regional organization in best fighting trim. Some observers attribute its resilience to the more recent desert locust visitations and to the organization having expanded its mission to become a multipest control agency.)

The issue is a much harder one to decide than what to do when a disaster occurs, and it poses a typical dilemma in development. Does the cost of maintaining an effective control organization outweigh the risks of being unprepared for the next serious outbreak? ■ JOHN WALSH

Briefing:

ICSU Gives Green Light To Global Change Study

Berne

A new international program of research into the changing relationships between the geosphere and the biosphere, paying particular attention to the impact on these relationships of man's activities, was formally launched last week by the International Council for Scientific Unions (ICSU).

Several delegates to ICSU's general assembly, held at the University of Berne in Switzerland, pointed out the need for further discussion of precise priorities and of the relative emphasis to be given to different scientific disciplines and monitoring techniques. However, broad proposals for what is officially known as the International Geopshere/Biosphere Program—but more frequently either by its initials IGBP, or simply as "Global Change"—were accepted "with enthusiasm" by the meeting.

The total cost of research programs carried out under the framework of the IGBP is likely to be more than $1 billion. Most of this money will have to be raised through national research funding agencies, and—in contrast to its predecessor, the highly successful International Geophysical Year—the IGBP is currently expected to extend over a decade or more.

A steering committee will be established to decide on initial research priorities. This will be serviced by a small secretariat based