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Desert Locusts in Africa: a Disaster?

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*Migrating locusts, especially the desert locust (*Schistocerca gregaria*), have been feared in Africa for thousands of years as famine-inducing pests. Instead of simply waiting for outbreaks to occur, attempts are being made to take preventive action against these pests. Since the breeding areas of the desert locust are distributed across the entire Sahel region, the Arabian peninsula, Pakistan and India, a gigantic logistical and organizational effort is required. Every year, millions of dollars are spent on these preventive control measures, which are still unable to prevent locust plagues completely. The outbreaks in 1987/88 and 1993/94 are the most recent examples. Exactly how large potential disasters caused by gigantic locust swarms may be and whether the effort and expense involved in preventing them pays off economically has never been systematically investigated. The Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) project, 'Integrated Biological Control of Grasshoppers and Locusts', has attempted to assess, on the basis of the available data, what the costs and potential benefits are and to identify the difficulties involved in developing an effective strategy.*

The desert locust (*Schistocerca gregaria*) has been known for millennia as a fear-instilling pest. Its breeding areas range from India and Pakistan to the Arabian peninsula and all the way across Africa to Mauritania, the westernmost country of the Sahel belt. This species is feared principally because of its ability to form gigantic swarms covering an expanse of several hundred square kilometers. These can attack cultivated areas and inflict damage on a spectacular scale (Table 1).

The phenomenon of swarming is based on the ability of this locust species to live in two different so-called phases. If environmental conditions are unfavorable, which is primarily the case when there is insufficient precipitation, then the insects live as isolated, solitary individuals in semi-desert-like areas, which are referred to as recession areas. If there is a period of one or more years without abundant precipitation, then mass reproduction takes place, resulting in a change in the insects' behavior. When they reach a certain critical population density, the insects first enter a transitional phase and then become gregarious. It is in this gregarious phase that swarms of adult locusts and bands of juvenile individuals (hoppers) form. These swarms of literally millions or billions of insects constitute voracious feeding machines of awe-inspiring proportions. During this phase, they are able to leave their original breeding areas and temporarily enter other regions as well, where they can also breed. This so-called invasion area is larger than the

TABLE 1
Crop losses due to the desert locust

Year	*Country*	*Amount of crop eaten by locusts*
1944	Libya	7,000,000 grapevines (19% of total vine cultivation)
1954	Sudan	55,000 tonnes of grain
1957	Senegal	16,000 tonnes of millet; 2,000 tonnes of other crops
1957	Guinea	6,000 tonnes of oranges
1958	Ethiopia	167,000 tonnes of grain (enough to feed 1,000,000 people for one year)
1962	India	4,000 hectares of cotton (value: £300,000)

Source: Steedman (1990)

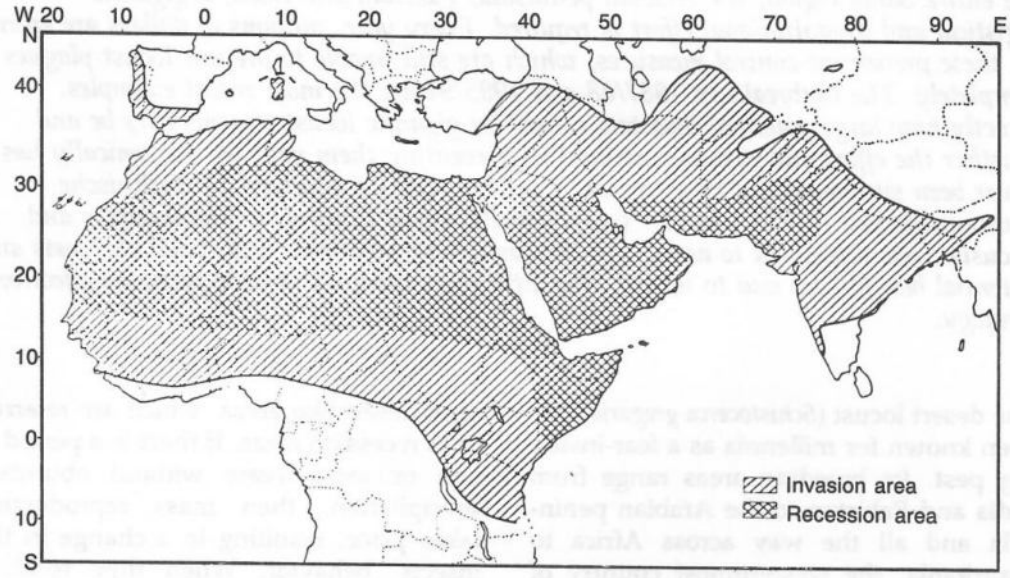

FIGURE 1 *Recession and invasion areas of the desert locust (Steedman, 1990)*

recession area (Figure 1).

Mass reproduction takes place irregularly. Since the 1970s it has only been observed twice, namely with a large outbreak in 1987/88 and a smaller one in 1993/94. In the past, attempts were made to cope with these outbreaks using mechanical control techniques. But since these were typically not applied until a locust outbreak had already begun, only relatively modest successes were achieved. As technological advances were made, there was a shift toward using more sophisticated means to control locusts. Today, highly potent insecticides are applied using portable devices, vehicle-mounted sprayers, or even airplanes and helicopters. At the same time, it has grown increasingly important not merely to combat plagues directly but instead to prevent them.

IS EARLY DETECTION BETTER THAN CONTROL?

The Anti Locust Centre in England and, later, the Food and Agriculture Organization of the United Nations (FAO) have tried to establish an effective early warning system. This system is based on reports submitted by all the affected countries, which are centrally organized within the FAO, and to an even larger extent on the monitoring of climatic data captured with the Meteosat satellite. A bulletin is regularly issued to ensure that the data flow back to the affected countries. The system is only as good, however, as the data which are fed into it. Observations can only come from the countries if these are financially and logistically in a position to carry out complex and labor-intensive surveys in their semi-arid regions. Apart from the lack of funds, which can be compensated for by contributions from donor countries, a major obstacle is posed by security issues.

In the last ten years alone, at one time or another it was impossible to conduct surveys in Somalia, Ethiopia/Eritrea, Sudan, Chad, Niger, Mali and Mauritania. These countries contain the most important breeding areas of the Sahel zone. At the moment it is virtually impossible to carry out surveys in northern Mali because of conflicts between the central government and Tuareg rebels and in Niger they can only be conducted with a military escort. It is also almost completely impossible to collect data in Somalia, despite the fact that critical breeding areas are situated in that country.

Owing to these extremely unfavorable conditions, effective early detection is a virtual impossibility. The situation is aggravated further by the fact that many breeding areas are located in regions so inaccessible that no surveys are feasible. Consequently, looking at things realistically, all that can be accomplished by early detection is to confirm outbreaks relatively early. No truly effective measures can be taken, however, to combat the observed initial swarming tendencies. All that can be done is react to major upsurges and plagues — in other words, after the swarms have already formed. During this phase, however, control is extremely difficult owing to the mobility of the insects. Often enough, the control teams do not arrive at the locations where swarms have been sighted until after they have migrated to other areas. But since desert locusts do not consciously target cultivated areas, swarm formation does not automatically imply gigantic losses, even though this is often assumed. The 1987/88 plague, for example, is not known to have inflicted any major damage. The total harvest was even significantly greater than in locust-free years (Figure 2).

PREVENTION AND CONTROL STRATEGIES

Both the FAO and most of the affected countries have proclaimed preventive control to be the most important method and they are also practising what they preach. Preventive control involves travelling to potential breeding areas at the beginning of the rainy season to conduct surveys and, if critical population densities are encountered, to initiate control measures immediately. Some surveys are also carried out with helicopters, which can be employed in areas that are inaccessible to ground vehicles. It is laborious and costly to conduct surveys in the semi-desert areas of the Sahel, especially when using helicopters. And even when surveys are conducted thoroughly, it is only possible to find some of the locusts. In most cases, therefore, reproduction of the insects cannot be significantly reduced by combating those that are found. Besides the fact that many areas are inaccessible, work is often

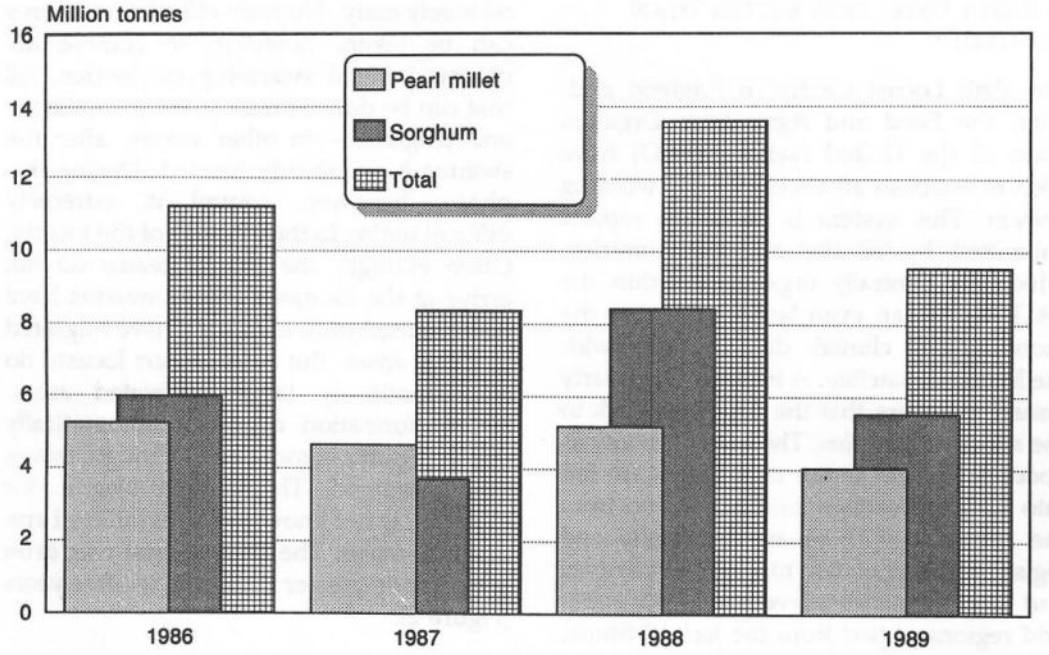

FIGURE 2 *Cereal production from 1986 to 1989 in the countries of the Sahel (Data: FAO Yearbook)*

impeded by difficult security situations.

In the past, supraregional organizations were responsible for monitoring the breeding areas. Foremost among them was the Organisation Commune de Lutte Antiacridienne et de Lutte Antiaviaire (OCLALAV), which embraced the countries of western Africa. Owing to financial difficulties caused by the failure of member countries to make the pledged financial contributions, however, OCLALAV was unable to carry out its intended tasks. It was almost completely dissolved a few years ago and all of its branch facilities in the member countries were handed over to the respective national crop protection services. Nor is the situation much better with the other supraregional organizations. The bottom line is that early detection and preventive control are now almost entirely up to the affected countries themselves, confronting them with major financial, staff and logistical problems that cannot be solved unless support from donor countries is forthcoming.

If there is a plague, the crop protection services of the affected countries take action, receiving support on a case-to-case basis from supraregional organizations like the Desert Locust Control Organization for Eastern Africa (DLCO-EA). Control measures are often enacted in an unsystematic manner, responding to swarms as they are reported. For the most part, the control measures in the Sahel are extremely poorly organized. (The locust control campaigns in Northern Africa, India and Pakistan are better organized.) There are also differences in the strategies applied. Whereas in many countries a control team is dispatched every time a report is received, even unconfirmed ones, in other cases control measures are carried out at strategically important sites. In all cases, the operations are logistically very demanding. In addition to the immediately incurred costs, there are also other expenditures in the form of regular

financial contributions to the above supraregional organizations.

WHAT DOES CONTROL OF DESERT LOCUSTS COST?

One basic problem associated with the economic analysis of desert locust control is the lack of suitable figures. This is due, on the one hand, to the irregular occurrence of plagues and, on the other, to the complexity of the subject matter. How can control of a band of larvae in the Tamesna Desert of Niger, for example, be brought into direct relation with potential damage? In a recent study, Herok and I have come to the conclusion that none of the usual procedures can be effectively applied to assess the magnitude of the risk that desert locusts will induce disastrous crop failures (Herok and Krall, in press). Since virtually no dependable figures about destroyed harvests and other damage are available, we have taken a different approach, although it too suffers from a number of inadequacies.

On the basis of the available figures about the costs of surveying control measures carried out between 1986 and 1993, and data on sighted larvae bands and locust swarms between 1939 and 1985, model calculations were performed. The following parameters were incorporated into the calculation:

— costs of a control campaign;
— affected land area;
— value of the threatened crops;
— potential crop losses; and
— effectiveness of control measures.

Figure 3 shows the results that were obtained for different levels of control effectiveness and potential losses. The figures clearly demonstrate that with these crops, which for the most part are not very valuable (Table 2), a positive cost-benefit relationship results only at a very low monetary input or if very optimistic assumptions are made (i.e. a high potential loss level and highly successful control measures). At annual costs of more than US$10 million annually for all of the affected African countries, the return on investment hardly justifies the outlay. According to FAO information, the average yearly contribution by donors to desert locust control in the past ten years has been US$25 million.

DISCUSSION

As we have seen, the control of desert locusts represents a unique case within the context of pest control. It is difficult or impossible to carry out economic analyses at the operational or even the national level. An enormous area must be studied, making it extremely difficult to obtain reliable figures. Since the damage caused is heterogeneous in nature (in other words, exhibiting an asymmetrical distribution), average figures can only be employed cautiously.

It can be regarded as relatively certain that desert locusts do not pose any risk of a large-scale disaster. Yet, on a smaller scale, the threat can and must be interpreted quite differently. If a region is massively attacked, serious supply shortages can result unless losses are compensated for at the national level. But monetary compensation through a program similar to the hail insurance available to European farmers is hardly feasible in Africa at this time. Theoretically, however, this would be a sensible approach, since continuously practiced early detection and control measures are very cost-intensive. In the years 1986–1989, nearly US$300 million were spent in Africa and the Arabian peninsular for locust control. This is a great deal of money for the (typically) very extensively grown crops of the Sahel (Office of Technology Assessment, 1990) (Table 2). Kremer has shown, for Mali, that 90 per cent of the funding for the

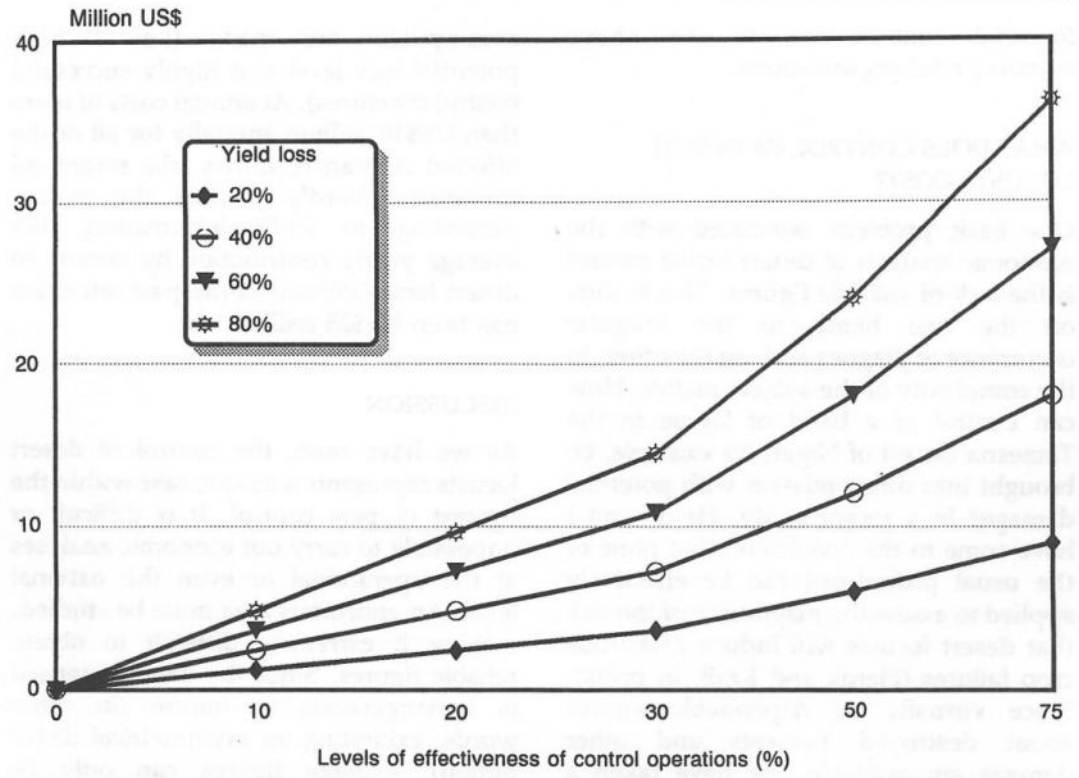

FIGURE 3 *Annual yield losses prevented by locust control for different levels of control effectiveness and loss*

TABLE 2

Important crops threatened by desert locusts in a typical Sahel country (Niger) with total yield (in 1990), average per-hectare yields (in 1989) and average market price (in 1985)

	Pearl millet	*Sorghum*	*Maize*	*Cowpeas*	*Peanuts*
Total yield (t)	1,110,300	283,000	1,800	214,400	7,000
Yield/ha (kg)	340	340	708	145	429
Market price (F CFA/kg)*	80	80	100	120	135

*150 F CFA = 1 DM (1985)

Source: FAO Yearbook

1990 locust campaign came from donors (1992). This is financially unsustainable and stunts the development of other plant protection strategies.

It would also be beneficial to develop an entirely new strategy, getting away from large-scale intensive survey and control measures. After carrying out a sound analysis of all available data, the possibility of restricting surveys to certain representative areas should be seriously considered. Since nearly all of the plagues affecting the Sahel zone emanate from the region around the Red Sea, that would probably be the most suitable region to monitor. The control activities could also

be reorganized by taking a regionally differentiated approach instead of combating every swarm sighted, even in the most remote areas. While doing so, the importance of protecting crops should always be kept in mind. Since the mass reproduction of desert locusts probably ceases by itself, in every case, without having to be actively combated, the view that failure to implement control measures would lead to an exponential growth of the locust population is unfounded. Indeed, since the massive application of insecticides leads to considerable potential, and in many cases real, environmental damage, it is urgently necessary to cut down on their use.

Do migrating, swarm-forming locusts constitute a potential cause of disaster? Certainly not throughout large regions, but definitely on a smaller scale. It is doubtful, however, whether this potential threat is large enough to justify the expenditures that are now being made with the consensus of donor and recipient countries. In the medium term, it would be better to introduce some form of insurance cover for affected rural families, since this solution would definitely be much more cost-effective than the control strategy being applied today. In addition, it would be much less dangerous for the environment and, if well organized, safer for the affected families. The current strategy fails both to prevent plagues and to compensate families which have suffered crop losses.

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