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East Africa High Commission:
(1C) The Desert Locust Survey
and Control

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Mr. Walter S. Rogers
Institute of Current World Affairs
522 Fifth Avenue
New York 36, New York

Dear Mr. Rogers:

The objectives of the Desert Locust Survey and the Desert Locust Control are implicit in their titles: to gather the knowledge necessary ultimately to solve the problem of desert locust plagues, and more immediately to minimize the damage of the insect to crops in East Africa and other areas. The protection of the crops of East Africa from locusts involves operations and research throughout a geographical area considerably larger than the three territories together. The far greater part of locust control and survey efforts is carried out in northeastern Africa and parts of the Middle East. All of the farmlands of East Africa are potentially in danger from desert locust plagues, one of which in 1928-1929 reached southward through the three territories almost to the border of Portuguese East Africa. The program to prevent by scientific means the repeated devastation of crops is of concern to all the East African territories, each of which is primarily dependent upon agriculture for its sustenance and trade. The extent of the problem is illustrated by the fact that the operations and/or advice of the Survey and Control were effected during the year 1952 in Persia, Saudi Arabia, Libya, Oman, Kuwait, Eritrea, Aden, Somaliland Protectorate, Somalia, Ethiopia and Kenya.

An East African Anti Locust Directorate was established in 1943, as a joint organization, financed by H.M. Government, Kenya, Uganda and Tanganyika to combat locust invasions then threatening East Africa. At the inception of the High Commission the Directorate became one of the services scheduled to be administered by it. Though immediate threat of invasion did not exist at the time, it was felt that a survey of the habitat and habits of the insect should be observed to determine the areas and times of swarming and intensive breeding. The Desert Locust Survey was evolved for this purpose out of the old Directorate and was financed for a period of five years by a C.D.&W. grant and contributions from the Governments of East Africa, Eritrea, Somaliland, Somalia, and Tripolitania (now Libya).

After the work of the Survey had indicated the possibility of an invasion in 1950, approval was given, at discussions attended by the already concerned representatives and by representatives from Egypt, Ethiopia, and Italy, for the creation of the Desert Locust Control. This organization was to be a mobile force to prevent or to combat the invasions, set up for a full scale effort to last three years and an additional two years with a perhaps smaller force for "mopping up." The Control organization was originally planned to have two senior officers and a clerical staff of eight officers at its Nairobi headquarters. The headquarters group subsequently was enlarged to include twenty-two officers, with the increase explained as being necessary because of the

increased paperwork and accounting necessary by peacetime standards. (The earlier wartime organization had operated with military assistance under wartime accounting procedures.) At the end of 1952 the Control Force alone numbered 152 officers and was operating 475 motor vehicles and two aircraft.

As "scientific and research services" the Desert Locust Survey and the Desert Locust Control Organization come under the Administrator, in his capacity as one of the Principal Executive Officers of the High Commission, answering regarding administrative matters through him to the High Commission. Scientific and operational control of these services, particularly of the Control organization is exercised to a great degree by committees and executive arrangements more representative of the diverse contributors of financial support. An Advisory Committee meets annually to discuss policy and draw up draft estimates, leaving the day to day oversight to a smaller Executive Committee. After the inception and initial growth of the Control organization demands upon the time of the mainly voluntary membership of the Executive Committee became excessive and provision for more executive control and decision from within the Organization was made through the appointment of two senior officers.

The Survey includes, besides a Headquarters at Nairobi with administrative offices and facilities for the direction of anti-locust measures staffed by some 10 Europeans, a field laboratory in Eritrea, a unit investigating hopper behavior, two basic (topographical, botanical, etc.) reconnaissance units, mobile specialized units investigating the behavior and movements of adult locusts, and various ad hoc units to conduct field research and experiments, such as the group which tested the successful aircraft insecticide spraying methods near Wajir in 1952.

The Control organization has a headquarters at Nairobi, staffed by some 22 officers. Operations are directed by the Chief Locust Officer, executive and financial matters being the charge of a second senior officer. The headquarters functions are sectionalized under headings of finance, staff, transport, stores and records. Five major field stations are spread throughout the areas where most control operations are effected in Aden, Eritrea, Ethiopia, Saudi Arabia, and the Somaliland Protectorate, each with a Senior Locust Officer, an Administrative Officer, an Accountant and Transport Officer; two smaller bases are in Kuwait and Oman, each in charge of an Administrative Officer.

The total staff list at the end of 1952 indicated the following postings:

<u>Location</u>	<u>General Staff</u>	<u>Staff for specific research tasks</u>
Survey headquarters	10	3
Control headquarters	21	—
Saudi Arabia	22	—
Ethiopia	20	—
Eritrea	13	4
East Africa	32	4
Somaliland Protectorate	9	—
Aden	10	2
Oman	2	—
Kuwait	2	—
Somalia	1	—
Tripolitania	—	2
Attached to Anti-Locust Research Centre, London	—	2
	<u>142</u>	<u>17</u>

In addition 18 personnel including one research officer were listed as being on vacation leave, sick leave, or pending posting.

The physical plant of the unit, besides the buildings, offices and housing of the various headquarters and field groups, included at the end of 1952 475 motor vehicles, 6,950 tons of bran bait, 780 tons of insecticide, and 141 spraying and dusting machines distributed throughout the operational areas.

The expenditures of the East African Anti-locust Directorate in 1948 totalled £36,488, including £27,405 spent on the 1947/1948 Anti-locust Campaign and £9,083 recurrent expenditure on the proposed Desert locust Survey. Expenditures of the East African Desert locust Survey in 1949 and 1950 were as follows:

	<u>1949</u>	<u>1950</u>
Administrative Headquarters		
Recurrent	10,608	12,336
Extraordinary	<u>7,985</u>	<u>7,642</u>
Total	18,593	19,978
locust Survey Teams		
Recurrent	31,302	26,244
Extraordinary	<u>7,724</u>	<u>7,644</u>
Total	39,026	26,244
Research Expenses	837	4,568
Extraordinary - Control Measures	18,205	404,478
Liabilities of E.A. Anti- locust Directorate	2,546	
Oman Team		
Recurrent		3,875
Extraordinary		<u>135</u>
Total		<u>4,009</u>
Total Administrative Headquarters, research expenses and survey teams	58,456	54,799
Total extraordinary control measures	18,205	404,478
TOTAL	<u>79,207</u>	<u>459,277</u>

The most striking feature is, of course, the very high expenditure on extraordinary control measures in 1950 - 88 percent of the total expenditure in that year - which mounted during 1950-1952 after the inception of the Desert locust Control to the much higher figure given below. The Revenue of the Survey was less than £2,000 over the two year period, 1949 and 1950.

Net recurrent and extraordinary expenditures of the headquarters and survey teams and research expenses of the Desert locust Survey in 1948, 1949, and 1950 - £9,084, £54,728, and £54,316 respectively - were covered by C.D.&W. Schemes R. 354 & A and D. 1204 & A, under which 40 percent of expenditure was

met by a direct grant from H.M. Government, 24 percent from C.D.&W. funds, and 36 percent by contributions from the East African territories.

Net expenditures on extraordinary control measures in 1949 (£18,205), covered by C.D.&W. Scheme D. 1255 &A., were provided by contributions in the same proportions, 40, 24, and 36 percent respectively from H.M. Government, C.D.&W. funds and the East African territories. Net expenditures on extraordinary control measures in 1950 (£404,469) were covered by two other C.D.&W. Schemes, D. 1498 and D. 1498A. Scheme D. 1498 covered expenditure of £126,210 of which about 36 percent was a direct grant from H.M. Government, 12 percent a contribution from C.D.&W. funds, and 51 percent contributions from the East African territories. Scheme D. 1498A covered expenditure of £278,259, of which about 30 percent was a direct grant from H.M. Government, 27 percent a C.D.&W. grant, and 42 percent contributions from the East African territories. Of the total net expenditure on extraordinary control measures in 1950, 32 percent was provided by a direct UK grant, 23 percent from C.D.&W. funds and 45 percent by the East African territories.

In 1948 and 1950 half of the amount provided by the East African territories was contributed by Kenya and one-fourth each by Kenya and Uganda, but in 1949 - even though the original estimates followed this principle - the contributions were not made in these proportions.*

The Desert Locust Control Organization, which came into operation on October 1, 1950, spent from that date to December 31, 1952, on locust control, approximately £2,250,000. This sum was made up of contributions by the three East African territories, by Eritrea, Kuwait, Somaliland Protectorate, Sudan, Tanganyika, Tripolitania, Uganda and the United Kingdom.

The operations of the locust control are somewhat military in character, involving firstly intelligence of the locust locations and of their vulnerability (if in hopper-stage), and secondly the mounting of logistical efforts of varying size - transport, weapons and men - against the hopper bands or swarms. It is now accepted that the locust must be sought out and its numbers thinned in its breeding areas, considerably before it arrives physically in a crop area. The purely defensive measures employed in earlier years are not considered adequate. The two main factors determining the intensity and scope of a plague are the migrations of the locusts and their need of warm damp soil to breed. If the intelligence of location and breeding propensity is delayed in receipt the difficulty of the subsequent control operation is greatly increased; if its arrival is timely the locusts often can be destroyed in the early hopper stage, when they are more concentrated and less insecticide is required. A review of some of the control operations from 1950 through 1952 will provide illustrations of a need for improved intelligence and the development of more intimate area-knowledge and other means of forecasting breeding locations.

Sometimes, with weather unfavorable to breeding, the swarms tend to become dissipated and spent before reaching the East African farming areas.

* The amounts contributed by the three territories were as follows (£):

	<u>Kenya</u>	<u>Tanganyika</u>	<u>Uganda</u>	<u>Total</u>
1948	25,200	12,600	12,600	50,400
1949	20,018	9,989	13,603	43,610
1950	142,124	71,060	71,061	284,245

This was the case in October-November of 1950 when swarms moving down the Somali peninsula towards British East Africa were met with poor breeding conditions and gradually diminished. The effects of the adverse breeding conditions, and of concurrent control operations in Ethiopia and Somaliland could not be predicted, however, and the defensive disposition in Kenya of 13 officers, vehicles, and supplies of bait and insecticide was assumed necessary and was carried out.

During 1950 and early 1951 some 4,000 hopper bands were destroyed under the Organization's advice by a force of 14 Italians, 800 Somalis, 270 camels. A large effort was also required in the Sudan, involving the use of 192 vehicles and 1,500 tons of bran bait, to meet an unexpected invasion from the Red Sea coast due to abnormal rains. In answer to a request from Tripolitania an officer of the Organization visited and recommended operations against the infestation there, which was also met with local personnel, using some 140 tons of BHC bran bait. The late 1950 effort in Saudi Arabia was also large, involving the use of 430 tons of bait in the destruction of some 7,300 hopper bands. In early 1951 the situation in Africa, partly as a result of these and earlier operations, was considered under control; but there remained a threat of invasion via the Arabian Peninsula by swarms then infesting Persia, Pakistan and India.

Included in the operational experience gathered during this season were some observations of locusts breeding in areas apparently rendered favorable by irrigation in Abyan, Aden. Abnormal breeding on the horn of the Somali Peninsula was also observed but unfortunately not by a specialist who could attempt to assess the cause.

In May-June of 1951 in Aden when some 850 hopper bands were destroyed and some 16 fledgling swarms were attacked with BHC bran bait and with BHC dust, a pressing need for a method to attack mature swarms was strongly indicated. Officers on hand with dusting equipment were unable to operate against the flying swarms. In late 1951 another experience in Aden again demonstrated the need for rapid intelligence (and/or means of destroying mature swarms). Dust used against copulating parent swarm produced only 50 percent kills, and though some 25 tons of BHC bran bait was eventually used the news of the breeding had arrived late and too many of the locusts had reached the flying stage. In September-October of 1951 in the Ethiopian Highlands the value of local experience was borne out. It was learned that motor transport equipment could not be employed in such rough country, and that camels and larger numbers of personnel using primitive methods of baiting and dusting could operate effectively. The officers with experience in the more open areas of Arabia were unable to bring their motor transport closer than a two to three day march from the infested areas; some of the swarms, in areas varying from 2,000 to 9,000 feet in elevation, were never reached or even located.

Difficulties with local tribes and tribal leaders sometimes prevented or hampered work. Some of the escapes of swarms from Somalia in late 1951 were partly due to the refusal of tribal authorities to permit the application of insecticides by machinery. The poor communications, favorable weather for breeding, thick bush which prevented the use of mechanical equipment, tribal opposition, and lack of experience in the area were blamed for a similar failure in the Somaliland Protectorate.

In Kenya, at the end of 1951, breeding was confined to some 650 square miles of Mandera District, which at the time of the discovery of the eggs was isolated by rains with only one Control Officer at hand. Other officers and equipment were flown in, however, and the ensuing campaign resulted in the destruction of some 3,750 hopper bands.

Operations continued on an intensified scale through 1952, with particularly vigorous operations being carried out on Somali peninsula and in Ethiopia. The operations on the Somali peninsula, in which the Italian administration committed a force of 26 officers, 41 vehicles and 370 camels to destroy an estimated 35,000 hopper bands, were credited with having saved East Africa's crops. Success was claimed in keeping large areas virtually clear, and in preventing a serious invasion of Kenya and Uganda in late 1952. The cost of all control measures by the Desert Locust Control, from October 1, 1950 to December 31, 1952, amounted, as stated above, to some £2,250,000.

The Desert Locust Survey conducts its operations in a much less military manner than the Locust Control. Its basic object is to find "a lasting solution to the Desert Locust Problem." As an agency partly responsible for the intelligence upon which the Control agency bases its plans and - more importantly - since it gains its useful knowledge by actual observations of the locusts, it does operate in the field more than in the laboratory. Field research is carried out by small units of two to five officers, who are allowed to tackle one problem at a time. The questions which their research and observations seek to answer pertain to the swarming habits and the vulnerabilities of the insect: "Where and why do locusts swarm?" and "How can they be checked?" are the basic questions.

Mobile research groups follow and observe the swarms, sometimes utilizing aircraft, to try to obtain answers to the first question. A large part of the resources of the Survey, with considerable outside help, have been devoted to such direct observation. These movements have been studied in detail in an attempt to determine their relationship of migrations to weather and climate.

The directional preferences of moving swarms in respect of wind direction and convergence provides one area of inquiry. This is theorized to be related to the need of the eggs to absorb water before they can hatch, since points of wind-convergence often provide a point favorable to precipitation. Scattered locusts are thought also to be drawn together into numbers sufficient for significant breeding by areas of atmospheric convergence such as cyclones. A situation map is maintained to indicate the overall migrations and daily movements observed by the survey units, providing the Control organization with much of its strategic intelligence.

The behavior of adult locusts has been a special field of study, with a special unit assigned. By closely following migrating swarms and maintaining contact with the air speed of locusts has been measured (and found to be 7-11 miles per hour); the relation of flight speed to temperature has been estimated; the overall speed of swarms, portions of which settle from time to time, has been estimated; and the factor of "gregarious allignment" (the tendency of individuals to follow the established course of the swarm disregarding other factors) has been appraised. It was confirmed that locusts take off upwind and turn downwind when the wind exceeds the velocity of flight.

Hopper behavior is another general area of investigation. The clues which the color of a given group of hoppers may offer regarding their immediate proclivities for concentrating have been investigated. Body temperatures were recorded to attempt to determine any relationship between behavior and temperature. Environmental factors affecting population, particularly the effects of bird predators were studied. Attempts were made to determine stages in a plague cycle, to discover, for instance, if a large scattered locust population should be regarded as an indication of a forthcoming plague.

The scientists concerned with both hopper and adult investigations spend a good deal of time in the laboratory. It is claimed that the shuttling of individuals from field to laboratory is both more effective and less costly than would be the establishment of detailed laboratory facilities accessible to the field areas. Benefits also are claimed from the close contact with other scientists working on the locust problem. The Organization report mentions as very useful the studies of metabolism in locust flight being done by a researcher in Copenhagen, who has determined that fat comprises flight fuel of locusts and that the insects' reserves of fat become exhausted in 10 to 13 hours without feeding.

Because large areas of the habitat of the locust are unexplored and unmapped, considerable efforts have been devoted to basic reconnaissance and mapping. One of the officers of the Survey has described the topography and provided 1:500,000 maps of an area of 100,000 square miles in the "Empty Quarter" of Arabia. With the valuable scouting assistance of an aircraft, one reconnaissance unit explored and mapped a good route through the sands from the Hadhramaut to Najran, Saudi Arabia.

Since the locust is dangerous only in the swarming phase, it is the incipient swarming which can be checked most remuneratively. An early idea of altering the prevailing environment along strategic portions of locusts range later appeared to be impracticable in view of the vast areas which would have to be ecologically changed to prevent concentration of the locusts. Some insecticidal means seemed to provide the most likely target for research and experiment. Experiments in spraying insecticide from small aircraft, benefiting somewhat in their planning from previous attempts by other agencies and from the advice of chemical warfare authorities, had demonstrated by the end of 1952 an apparently sound and effective means of control through attacking the mature swarms, previously regarded as invulnerable.

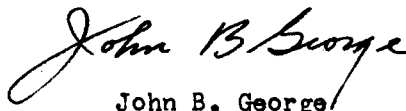
Slow flying aircraft fitted with special spraying equipment devised to lay a curtain of insecticide across the course of the swarm were employed. The major problem of determining the flight-course of the swarm was solved by the slow speed of the aircraft, which allowed appraisals of the movements of individual locusts to be made from the air. Another problem which had deterred earlier experiments, the assessment of air turbulence which could rend the curtain of insecticide, was solved by the use of a prototype counting accelerometer borrowed from the Royal Aircraft Establishment, Farnborough. In an experiment in early 1952 four swarms were attacked near Wajir, using 888 gallons of insecticide in 21 sorties by one aircraft. An estimated 99 percent of a swarm covering 300-400 acres was destroyed with an expenditure of some 340 gallons. A larger experiment late in the year confirmed these results, indicating that with proper use one unit of spray liquid could kill 320 times its weight in locusts. By March 1953 the organization was training and equipping for enlarged exploitation of this technique. A total

of seven aircraft, four of which were provided by the Food and Agriculture Organization and three of which were ordered by the Control Organization, were to be utilized.

The Survey and Control organizations maintain contacts of various sorts in all countries directly concerned with the control of the desert locust which consist of Pakistan, Persia, and India (comprising the Eastern Region); Jordan, Turkey, Syria, Lebanon, and Egypt (or Central Region); and the French African territories (or Western Region). In areas where control operations are effected, mostly in Northeast Africa, the good will of local and tribal authorities as well as the central governments are often prerequisite to effective operations. Besides the actual contact in the field and at regional offices these relations are maintained by means of conferences, and sometimes through advisory and liaison visits.

Coordination with other locust control and research organizations, such as the Anti Locust Research Centre in London,^{and} locust control agencies in other areas is maintained by visits and attachments of personnel. A particularly important function is the contribution of the two organizations to the wider pattern of scientific information and intelligence of locust migrations collated and disseminated through the Anti Locust Research Centre.

Sincerely,



John B. George

P.S.

Sources

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