

RNRKS PROJECT COMPLETION SUMMARY SHEET

Date Sheet completed: 31 July 1998

Project Title: Statistical analyses of Desert Locust movements and their determinants

DFID Project Reference No: R6809

RNRKS Programme: Crop Protection

Programme Manager (Institute): Dr S Eden-Green, NR International Ltd

Sub-Contractor (if relevant): Natural Resources Institute

RNRKS Programme Purpose: Impact of migrant pests on crop production minimised

RNRKS Production System: Semi-arid

Commodity Base: Semi-arid cropping systems

Beneficiaries: The immediate beneficiaries will be the direct users of the forecasting tools developed, the Desert Locust forecasters at FAO. Ultimately, subsistence growers will benefit from improved pest monitoring and forecasting systems which will permit more appropriate and timely control operations, disseminated through national extension officers and locust control and monitoring operations.

Target Institutions: FAO

Geographic Focus: Africa and Middle East

	Planned	Actual
Start Date:	1 October 1996	20 January 1997
Finish Date:	31 March 1998	31 May 1998
Total Cost:	£35,508	£35,508

1. Project Purpose:

The purpose of this project is to develop statistical analyses of locust movements in synoptic weather situations (in particular Mediterranean cyclones and desert depressions) in order to improve forecasting of movements in these systems and promote improved survey and control strategies in locust-affected countries.

2. Outputs:

Output 1. Patterns of Desert Locust movement and associated weather identified.

From an examination of the principal published material relating to the genesis and movement of Mediterranean depressions and North African cyclones a set of seven typical weather system movements, determined by season and air mass type, has been identified.

The locust literature review has extracted all written case studies on movements where depressions have been implicated (approximately 90 reports). Cyclones affecting Desert Locust movements may be divided into several types on the basis of location. Mid-latitude cyclones in the Atlantic Ocean are often responsible for locust movement off the coast of west Africa to outlying islands and further afield. However, cyclones which occur on the Inter-Tropical Convergence Zone (ITCZ), Saharan and Mediterranean cyclones, are often responsible for redistribution of locust populations between seasonal breeding areas. These observations on cyclone location and tracks match the findings of the meteorological literature review. This information has been used in conjunction with the locust case studies and locust movement factors described below.

Output 2. Statistical analyses of the probability of Desert Locust movements in the identified weather situations.

Preparation of case studies has involved examining 24 situations of locust movement during recession and plague periods for 14 years between 1958 and 1989. Following the advice of a statistician, reports of first appearances of adult locusts per 1°square were extracted over 5-day periods,

throughout the Desert Locust area. These occurrences were plotted on a 1°square grid, coded on the basis of population behaviour (swarming or non-swarming populations). This size of grid was used to minimise the loss of movement data. Weather data were also examined on 5-day intervals and were extracted from surface synoptic charts based on a 5°square grid (the maximum resolution of the available weather data). Daily data, at 00.00 GMT, were extracted for each day over the 15-year analysis period. The occurrence of any depressions, cold fronts or warm fronts within the analysis area was recorded, as was the number of times a 5°square was 'occupied' by any one of these features. Frequency maps of the occurrence of locust data and weather features were produced.

In order to determine whether or not periods of locust movement could be identified for swarming and non-swarming populations, locust and weather data were integrated. From this, locust movements relating to the frequency of depressions and depression-related features were extracted. It was found that during recession periods the spatial and temporal resolution of the locust data was poor, due to the low level of locust populations and the infrequency of surveys at these times. The analysis has, however, confirmed that long-distance movements of swarming populations is possible on these weather systems, especially in the eastern Mediterranean: for example, swarms moved 1150 km across Saudi Arabia between 2 and 8 February 1952.

Output 3. Exploration of the successful integration of locust and weather relationships into appropriate forecasting tools for SWARMS GIS.

Importing the weather and locust data into SWARMS is possible, but there is still a need to demonstrate the usefulness of these data to SWARMS users. It has not yet been possible to arrange this formally. In addition, during the life of the project, considerable effort has been devoted to developing another PC-based locust information systems (RAMSES - Reconnaissance and Management System of the Environment of *Schistocerca*). The data derived during Project R6809 are also suitable for inclusion in this system, thereby making them more available to a wider audience of regional and country locust information officers than originally thought.

3. Contribution of Outputs to Project Goal:

[Have the outputs of the project been achieved? In what way has the project contributed to meeting the RNRRS goal.]

The results of this work will greatly enhance existing knowledge of the relationship between Desert Locust movements and the weather systems which enable them. This in turn will promote the development of more reliable forecasting models for use in FAO Desert Locust forecasts and enable control operations to be planned and targeted with greater accuracy.

4. Publications:

None

5. Internal reports:

19996/7 Annual Project Report: March 1997

1997/98 Quarter 1 Report: June 1997

1997/98 Quarter 2 Report: September 1997

19978/98 Quarter 3 Report: January 1998

1997/98 Annual Project Report: March 1998

6. Other dissemination of results:

None

7. Follow-up indicated or planned:

The preparation of a paper outlining these results, for publication in a refereed scientific journal, is planned and due to be completed by March 1999.

Work is also in progress to assimilate the results into the system.

8. Name and signature of author of this report:

Dr Peter J A Burt