PN-ABR-456

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PN ABR-457

AGENCY FOR INTERNATIONAL DEVELOPMENT
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ENTER INFORMATION ONLY IF NOT INCLUDED ON COVER OR TITLE PAGE OF DOCUMENT

1. Project / Subproject Number: 698-0517

2. Contract / Grant Number:

3. Publication Date: September 1993

4. Document Title / Translated Title: Same as Cover Page SEA-Mozambique

5. Author(s)
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2.
3.

6. Contributing Organization(s)
- USAID/ Mozambique
- The Government of ~~Mozambique~~ the Republic of Mozambique
- AID/ AFR/ AA/ DRCC's NELSH project

7. Pagination:

8. Report Number:

9. Sponsoring A.I.D. Office: AFR/ AA/ DRCC

10. Abstract (optional - 250 word limit)
Please use First Paragraph of the Executive Summary P. 1.

11. Subject Keywords (optional)
1.
2.
3.
4.
5.
6.

12. Supplementary Notes

13. Submitting Official: Alise Lanoche

14. Telephone Number: 702-235-5419

15. Today's Date: 5/18/94

DO NOT write below this line

16. DOCID

17. Document Disposition: DOCRD [ ] INV [ ] DUPLICATE [ ]

AIS 590-7 (06/93)

SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT FOR POTENTIAL USAID ASSISTANCE TO LOCUST/GRASSHOPPER CONTROL OPERATIONS IN MOZAMBIQUE

United States Agency for International Development

Mission to Mozambique

In Cooperation with

the Government of the Republic of Mozambique

Maputo, Mozambique

September 1993

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ACRONYMS AND ABBREVIATIONS

AChE	Acetyl-cholinesterase, a blood enzyme, tested for exposure to pesticides
AELGA	African Emergency Locust/Grasshopper Assistance Project - AID/Washington
AID/W	U.S. Agency for International Development, Washington, D.C.
APHIS	Animal and Plant Health Inspection Service of USDA
BOROR	State owned agrochemical distributing company
CFR	US Code of Federal Regulations
CNA	Commisão Naçional do Meio-Ambiente (National Commission for the Environment)
DDP	District Plant Protection Representative
DNFFB	[National Directorate of Forestry and Wildlife]
DPA	Provincial Agricultural Directorate
DSV	Departamento de Sanidade Vegetal (Crop Health Department, Plant Protection Department)
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
FAO	Food and Agriculture Organization of the United Nations
GRM	Government of the Republic of Mozambique
GTA	Groupo de Trabalho Ambiental (Environmental Working Group)
ha	hectare
IFAD	International Fund for Agricultural Development
INIA	Instituto Naçional do Investigação Agronomica (Institute of Agricultural Research)
INTERQUIMICA	(parastatal agrochemical importing company)
IPM	Integrated Pest Management
IRLCO/CSA	International Red Locust Control Organization for Southern and central Africa
IITA	International Institute of Tropical Agriculture
km	kilometer(s)
l	liter(s)
LOMACO	(private company importing and distributing pesticides in association with GRM
mg/kg	milligram per kilogram (body weight)
MOA	Ministry of Agriculture
MPCU	Migratory Pest Control Unit of the DSV
NEMP	National Environmental Management Plan (equivalent to National Environmental Action Plan)
NGO	non-governmental organization
OLIMA	A program initiated by Ciba-Geigy to boost farmers' productivity through incentives
PEA	Programmatic Environmental Assessment
ppm	parts per million (1 part/1,000,000 concentration)
PVO	Private Voluntary Organization
REDSO/ESA	Regional Economic Development Support Office for Eastern and Southern Africa
SEA	Supplementary Environmental Assessment
SEMOC	Sate owned seed distributing company

UNDP	United Nations Development Program
ULV	Ultra-low volume application of pesticides (normally 1 liter per hectare or less)
USAID/Mozambique	USAID Mission to Mozambique, located in Maputo
USDA	U.S. Department of Agriculture

ACKNOWLEDGEMENTS

The preparer of this SEA would like to thank USAID/Mozambique, for scheduling meetings in a professional way and for making his stay in Mozambique pleasant. GRM's MOA-DSV, MOA-BOROR, Interquimica, MOA-DNFFB, MOH, CNA, and organizations such as FAO, World Bank, Food for the Hungry International, and World Vision as well as private companies, including Ciba-Geigy, Shell Chemicals Mozambique, ICI, and LOMACO deserve thanks for their willingness and time for interviews. Last but not least, the author would like to extend his appreciations to Ms. Mugey Acera for her commendable assistance during his TDY.

PREFACE

This Supplementary Environmental Assessment (SEA) complements the USAID's Programmatic Environmental Assessment (PEA) for Locust/Grasshopper Control Programs in Africa and Asia (TAMS/CICP, 1989) and shares some commonalities with the Programmatic Environmental Assessment of the USAID/Mozambique Transition Development Program (July, 1993) and the subsequent SEA on Pest and Pesticide Management for Mozambique (Fischer et al. 1993). This SEA was prepared by the AID/W (AFR/AA/DRCO) Assistant Technical Advisor to the Africa Emergency Locust/Grasshopper Assistance (AELGA) Project, Dr. Yeneneh T. Belayneh, with assistance from the USAID Mission in Mozambique, and with documents and first hand information obtained from the Government of the Republic of Mozambique (GRM). The SEA was first drafted in July of 1993 and was then reviewed by the Africa Bureau's Environment Unit and by AELGA. List of persons contacted while drafting and finalizing this SEA is provided in Appendix A.

This document reflects the current description of the Mozambique Crop Protection Service for locust/grasshopper management and control operations. It contains the best available analysis of environmental impact and possible strategies for mitigating such impacts. It provides recommendations on training programs in improved safety, public health and environmental protection, as well as support for early survey and prompt treatment programs. It emphasizes the use of alternatives to the chemical control and underscores the importance of judicious and environmentally sound approaches to the use of pesticides whenever and wherever necessary.

This SEA fulfills the requirements by the USAID to provide funds for any possible programs related to locust/grasshopper management and control activities in Mozambique.

1.0 EXECUTIVE SUMMARY

This Supplemental Environmental Assessment (SEA) complements the Programmatic Environmental Assessment (PEA) for Locust and Grasshopper Control in Africa and Asia (TAMS/CICP, 1989). It provides specific information on the country profile and agro-ecological regions (zones) related to the locust/grasshopper problem and control in Mozambique. It furnishes information on program operations and options regarding locust and grasshopper control interventions, and identifies foreseeable significant effects the operations may have on the environment and on target populations.

This SEA is a prerequisite for any pesticide-related assistance to be given to the host country by the USAID as part and parcel of the USG's action plan for pest and pesticide management programs in Mozambique. The information given in the SEA is intended for use by USAID/Mozambique, the Mozambique Department of Plant Protection (DSV), and/or the NGO/PVO community, in the process of designing locust/grasshopper management programs which may involve USG assistance. The SEA may be amended whenever valuable information that can be utilized in the process of designing sound locust/grasshopper management programs becomes available and when such information necessitates an update.

If USAID chooses to participate in a locust/grasshopper assistance program, it is important that support be coordinated with other donors and the GRM to achieve desirable results and to make a significant impact. **The NGO/PVO community and regional locust control organizations are likely to play key roles in Mozambique.** Assistance for such a program should emphasize the principles of IPM, in which all available management resources are considered. While probable crop loss will be a criterion for USAID involvement in control efforts, sustainable infrastructure development and cost/benefit ratio will also be considered. Participation by USAID in emergency operations will be carefully tempered with an examination of what long-term benefits will be achieved in addition to an insect population decrease. USAID will normally emphasize good survey and use of non-chemical control methods whenever and wherever possible.

IMPACTS OF LOCUSTS AND GRASSHOPPERS ON CROP PRODUCTION IN MOZAMBIQUE

Locust/grasshopper problems are often manifested in Mozambique. Certain parts of country, including southeastern Nampula and Zambezia, eastern Sofala and Inhambane, south-eastern and central Tete and southern Maputo provinces have experienced periodic outbreaks and regular invasions by locusts and grasshoppers. Most recently, in March/April of 1993, a wave of grasshopper outbreaks affected more than four provinces, including Sofala, Nampula, Zambezia, and Cabo Delgado. It is highly likely that such outbreaks will continue to occur, calling for appropriate interventions. Furthermore, periodic requests for technical assistance, equipment, pesticides and application services are likely to follow.

Though not well documented, locusts/grasshoppers are known to cause serious economic losses in the agricultural sector of the country. Currently there seem to be few initiatives in the areas of locust/grasshopper research in Mozambique. Research should be initiated in the areas of pest and pesticide management in Mozambique to determine the level economic losses caused by locust/grasshopper infestations and to develop better decision-making tools for their control as part of the overall pest management program. Strong collaboration between GRM (DSV and other divisions of the MOA, the CNA, etc.), the NGO/PVO community, the University, as well as commercial private sectors should be established and maintained in order to improve the current delivery and control operations.

PREVENTION AND EARLY WARNING

Working with these other players, A.I.D. could be influential in promoting linkages and collaboration between the different sectors, including GRM, private sector, NGOs and international organizations and donor agencies. Nevertheless, A.I.D. should ensure that requests for assistance are objectively justifiable, based on reliable data that would reflect perceived level of damage and associated requests. Under such circumstances, A.I.D.'s focus should be on prevention and early season intervention rather than late season treatments, which should be minimized to the extent possible.

Moreover, the level and means of response should be based on careful analysis of habitats to be treated, and the need for such measures should be established. A.I.D. should encourage DSV to prepare annual work plans describing intended campaign operations and ensure how the SEA recommendations will be carried out (Recommendation 37). The use of meteorological data coupled with information based on greenness maps and other remotely sensed data as a means to enhance early warning systems, should be strengthened, and their implementation as a tool for surveillance be encouraged.

CAPACITIES AND NEEDS OF THE CROP PROTECTION DEPARTMENT (DSV)

Mozambique's DSV, formed during the colonial era, is headquartered in Maputo, with stations located in each of the ten provinces and phytosanitary bases in the districts throughout the country. The DSV is composed of seven units, i.e., Plant Quarantine Unit (also includes Phytosanitary and Nematology), Pesticides Unit, Migratory Pests Unit, Biological Control Unit, Weed Control Unit (not fully established), Entomology Unit, and the Administrative Unit (Appendix B). The DSV is staffed with the head of the department, six unit heads, ten provincial representatives and a number of district technical staff and assistants. The Department's migratory pest control unit is basically responsible for addressing problems associated with locusts, Quelea birds, armyworm, and rodents.

The level of expertise in the DSV in general and migratory pest control unit in particular needs to be strengthened. Expertise is most limited in areas such as ecotoxicology, environmental monitoring, and pesticide management, including disposal of obsolete pesticides and pesticide containers. Any efforts to strengthen the DSV and migratory pests unit should go far beyond locusts/grasshoppers and other migratory pests and should deal with the full range of pest problems known to cause economic damage. In addition, pest management staff should also be strengthened in specific areas, including survey and monitoring, crop loss assessment, and insect pathology. Mozambique's DSV and associated units could, without any doubt, benefit from technical assistance and training opportunities in the fields of pest and pesticide management, environmental impacts and risk assessments and related fields that may be made available from agencies such as A.I.D., USEPA and also from USDA in collaboration with USAID/Mozambique. Staff training should reflect the country's needs for and be based on priority areas.

DSV is currently being supported by the Danish Agency for International Development Assistance (DANIDA) through their Crop Protection Department Strengthening Project. This project was initiated in 1991. It is planned for three years, with the possibility for two three-year term extensions. This SEA commends the move taken by DANIDA and believes that it should be emulated by others. The efforts taken by NGOs, private organizations and firms, including pesticide companies, in training farmers and agricultural advisors in pest identification and control, safe use and handling of pesticides, are all encouraging and need to be continued.

ROLE AND CAPACITIES OF THE NGO/PVO COMMUNITY

International humanitarian assistance PVOs have been playing a prominent role in Mozambique's reconstruction and development. Seven PVOs are now implementing agricultural development activities which presently or potentially involve pest management and/or pesticides. Others are proposing involvement in the near future. Recent outbreaks of grasshoppers, such as those in the Beira region (see Sect. 4.3) involved the PVO community heavily, because these organizations have the mandate and infrastructure to address such problems in general; however, in most cases, they still need specific technical strengthening in pest and pesticide management.

Indeed, requests by PVO agronomists for USAID authorization of pesticide use in their programs triggered a complementary SEA to this one, under the Programmatic Environmental Assessment for the USAID/Mozambique Transition Program (Chemonics et al. 1993; Fisher et al. 1993). Proposed pesticide use patterns by PVOs are confined to crop production and the control of veterinary diseases spread by other arthropod parasites of livestock. PVOs would need to work closely with the DSV, and regional locust control organizations should there be occasion to be involved in control of migrant or outbreak pests. Both the present SEA and the SEA by Fisher et al.

(1993) would need to be taken into account in developing operations plans (See Recommendation 37).

IPM IN LOCUST/GRASSHOPPER CONTROL PROGRAMS

DSV is currently showing keen interest in pursuing IPM programs in fields such as classical biological control of the cassava mealybug, stalk borer control and other areas. This interest presents an excellent opportunity to develop research programs and design locust/grasshopper control strategies and tactics. Therefore, it should be encouraged and extended to include other practices such as biological, agronomic and cultural control methods.

DSV with the help of the DANIDA project is also involved in training field technicians and farmers representative in pest and pesticide management practices, including proper pest control methods, survey and assessment techniques. DSV, in collaboration with relevant organizations, should enhance training farmers and extension agents to master techniques that will help minimize infestations via identifying, and elaborating appropriate alternative methods through applied research. Increased farmer involvement, particularly early in the development of locusts/grasshoppers, can prevent the need for increased pesticide use later. This is especially true for alternative control techniques, such as cultural control, habitat modification by inter-cropping in which, for instance, weeding of crops and margins of fields appears to be effective in reducing numbers and damage of certain species of grasshoppers.

ENVIRONMENTAL REGULATIONS

Mozambique does not yet have legislation that is fully empowered to execute environmental protection duties. The Commission for National Environment which was formed in 1991 is currently responsible for coordinating environmental activities. Like all other governmental agencies in the country, CNA is understaffed and lacks experienced environmental specialists. However, with technical and financial assistance from the World Bank, the UNDP and other donors, the Commission is in the process of putting together a National Environmental Management Plan with the development of the National Environmental Action Plan anticipated to be in place within the coming year or two. USAID could support the provision of appropriate expertise and capacity-building measures to enable the GRM fully develop and implement functional environmental regulations which are adequately integrated with sustainable economic development objectives.

Fragile habitats, including aquatic ecosystems, such as estuarine and riverine habitats, should be protected from pesticide applications. In the case of aerial application, buffer zones of at least 2 kilometers surrounding areas to be protected should be established. The existing environmental/pesticide regulations

Maputo city, in the heart of residential areas and near a river, should be moved elsewhere and the storage facilities, including the warehouse, should be properly inspected by the MOA, MOH, and other appropriate experts (e.g., FAO) to meet the minimum standards. The current facilities should be improved. Furthermore, proper disposal of obsolete pesticides stocks should be undertaken by using the best available technology suitable for the local situation, as determined by special assessments.

In 1990, initiatives were taken by Shell Chemicals of Mozambique in collaboration with MOA, in which 95,000 kg of a mixture of obsolete DDT and monocrotophos -- with sand that was used to remove the pesticide, and old containers -- were professionally cleaned up and packed for shipment to the U.K. for ultimate disposal in a high-temperature incinerator. The Shell/MOA initiative is currently being duplicated by other private chemical companies, such as Ciba-Geigy, which are working on buying back their old products from original purchasers for proper disposal as part of their product stewardship strategy. Such initiatives should be encouraged and extended to remove other stocks. **USAID/Mozambique could consider supporting a feasibility study on options for safe and appropriate disposal techniques.**

Empty pesticide containers normally should be triple-rinsed, punctured and/or crushed and buried. They should never be recycled unless reused in pesticide formulation under strict supervision and only when appropriate facilities are available. The use in construction and for other purposes which involves high probability of human contact is strongly discouraged. As much as possible, container sizes should be compatible with reuse requirements. Making pesticides available in small containers (e.g., one liter size), increases the potential for subsequent use in cooking or storage of water, and should be minimized. Their use should be under strict supervision of the DSV and NGO/PVO staff and other appropriate bodies. In addition, the DSV should periodically inspect the pesticide formulation and reformulation facilities to ensure proper handling and packaging procedures are in use.

IMPACTS MONITORING & MITIGATION

Monitoring environmental impacts of pesticides, including adverse effects on non-target organisms, is a valuable means of detecting their possible misuse and of mitigating the potentially adverse impacts. Such activities should be integrated as part and parcel of any pesticide use program. The results of these monitoring activities could be used in the planning and implementation phases of locust/grasshopper control programs to minimize environmentally damaging operations.

Exposure to pesticides and the risk of unexpected acute chemical poisoning is most likely to occur with handlers, applicators, pilots, and pesticide formulation plant workers. Monitoring applicator exposure through cholinesterase levels has

preventive value and such procedures are currently being practiced on a regular basis by some pesticide formulation plants (e.g., Shell Chemicals of Mozambique). To the extent that these procedures are not in place in other pesticide formulation plants (e.g., at the BOROR formulation plant at Mashava), they should be instated and carried out on a regular basis.

In areas of extensive pesticide use, environmental samples analyzed for residues would be a valuable basis for assessing exposure. In such areas, residue analysis should be carried out to determine the most appropriate means of pesticide delivery. These activities should be the collaborative work of DSV, MOH-National Laboratory for Water and Food Hygiene, and also with the involvement of the private pesticide companies. The technical capacity and equipment needs in Mozambique for residue analyses should be strengthened to provide future services in residue analyses and other related services.

2.0 PURPOSE AND PROCEDURES

2.1 Background

In 1987, due to an outbreak of both grasshoppers and locusts in Africa, the Administrator of the U.S. Agency for International Development declared an emergency waiver of the Agency's environmental procedures governing the provision of pesticides. The temporary waiver permitted A.I.D. to provide assistance for procurement and use of pesticides for locust/ grasshopper control according to best available practices. However, with the waiver came a mandate to develop a so-called Programmatic Environmental Assessment (PEA) of Locust and Grasshopper Control in Africa/Asia. This PEA was to provide the context for rational pesticide use, and to lay out measures to mitigate potential negative impacts. The PEA was completed in draft in 1988, and approved in May 1989.

The Administrator's waiver expired on August 15, 1989. Thereafter, all countries involved in locust/grasshopper assistance operations were required to develop country-specific Supplemental Environmental Assessments (SEA) in the context of the PEA. With the expiration of the Administrator's waiver, any future A.I.D. assistance for procurement and use of pesticides had to fully comply with the Agency's Environmental Procedures. The PEA, and the country-specific SEAs, have served as the basis for satisfying these environmental procedures. The SEAs contain country-specific environmental information and provide guidance on environmentally sound management procedures for pesticide use in a particular country. In Africa, SEAs have already been put in place for Burkina Faso, Cameroon, Chad, Eritrea, Ethiopia, Madagascar, Mauritania, Mali, Morocco, Niger, Senegal, Sudan and Tunisia. In the Asia/Near East region, Afghanistan, India, Jordan, Pakistan and Yemen have or are developing SEAs or their equivalent.

Mozambique is among the countries in Africa where chronic locust/grasshopper problems are often manifested. Certain parts of country, including southeastern Nampula and Zambezia, eastern Sofala and Inhambane, south-eastern and central Tete and southern Maputo provinces have in the past experienced periodic outbreaks and occasional invasions by locusts and grasshoppers. For instance, in 1988 and in March/April of 1993, a wave of grasshopper outbreaks affected more than four provinces, including Sofala, Nampula, Zambezia, and Cabo Delgado (e.g., see end of Sect. 4.3). It is highly likely that the outbreaks will continue to occur, calling for appropriate interventions. Furthermore, periodic requests for technical assistance, equipment, pesticides and application services are likely to follow.

Because of occasional invasions and outbreaks of locusts/grasshoppers, and their potential impact upon food security more attention should be given to locust/grasshopper problems. Despite the fact that locusts and grasshoppers are part of the agro-ecology of Mozambique and occasionally cause substantial damage to

agricultural crops, currently the country possesses limited capacity to monitor and regulate their activities and to carry out control operations. Much of the capacity available in terms of human resources and commodities is often geared towards protecting crops. For instance, it is estimated that some 90% of the pesticides consumed in Mozambique go into cotton production. This puts much of the food crops under serious threat from pests, including locusts/grasshoppers. Given the current conditions in Mozambique, it is likely that A.I.D. will receive requests for locust /grasshopper control, and it is probable that these requests will include pesticide use.

Therefore, USAID and the Government of Mozambique should take the initiatives to assess the conditions under which these commodities and services will mostly likely be used and search for alternative control options in line with the principles. Based on these investigations alternative means should be devised in line with the principles of IPM. This becomes especially important in sensitive and fragile ecosystems. Moreover, the goal of any short- and medium-term U.S.-funded assistance for locust/grasshopper management should focus on ensuring food self-sufficiency and sustainability in the country, particularly focusing on small holdings and family farms. In the event that provision of pesticides is contemplated by USAID/Mozambique for locust/grasshopper control, this SEA in combination with the PEA fulfill the requirements of USAID Environmental and Pesticide Procedures. **For USG assistance in this matter to be rendered, the SEA will need to be linked to a Plan of Action developed by the GRM and/or PVOs as appropriate.**

2.2 Drafting Procedure

A.I.D. Environmental Procedures (22 CFR 216.3(a)(4), describes the process to be used in preparing an Environmental Assessment. The rationale and approach for the country-specific Supplemental Environmental Assessment (SEA) are outlined in cables State 258416 (8/12/89) and State 275775 (8/28/89).

This Supplementary Environmental Assessment (SEA) was produced beginning with a visit to Mozambique in July of 1993 by Dr. Yeneneh T. Belayneh, Assistant Technical Advisor to the Africa Emergency Locust/Grasshopper Assistance (AELGA) Project (now resident in the Africa Bureau's Disaster Response Coordination Office (AFR/AA/DRCO), with logistical support from USAID/Mozambique and the AELGA Project.

Field trips and site visits were undertaken to obtain first hand information for the preparation of this document. A later visit to Mozambique by Dr. Walter I. Knausenberger (Environmental Advisor, AFR/ARTS/FARA) in November 1993 helped maintain the consistency between this SEA and the PEA for the Transition Program (Chemonics, et al. 1993) and with the SEA for Pesticide Use under the PVO Support Project (Fisher et al. 1993)

2.3. Related Assessments

The overarching previous assessment concerning locust/grasshopper control operations and the primary supportive document is the Programmatic Environmental Assessment (PEA) for Locust and Grasshopper Control in Africa/Asia (TAMS/CICP, 1989). The PEA covers grasshopper and locust control operations in Africa and the Asia. This SEA complements the PEA, and should be considered an integral part of it. The SEA deals with country-specific environmental issues not addressed in the PEA.

Other pertinent assessments in regard to the locust/grasshopper control situation in Mozambique include:

(1) The Africa Emergency Locust/Grasshopper Assistance Mid-term Evaluation (with specific-country case studies for Chad, Mauritania, and Cape Verde) (Appleby, Settle & Showler, 1989);

(2) USAID. 1990. Proceedings of a Workshop on Disposal of Obsolete Pesticides and Pesticide Containers. Niamey, Niger.

(3) FAO/SADCC Sub-Regional Workshop on Pesticide Management for SADCC member States. Harare, Zimbabwe. 20-27 May, 1991 (including Mozambique);

(4) other Supplemental Environmental Assessments for Locust/Grasshopper Control: in Africa, they exist for Burkina-Faso, Cameroon, Chad, Ethiopia, Eritrea, Madagascar, Mali, Mauritania, Morocco, Niger, Senegal, Sudan, and Tunisia; in the Near East and Asia, SEAs are in place or in preparation for Afghanistan, India, Jordan, Pakistan, and Yemen;

(5) USAID/Mozambique's Transitional Development Program - Programmatic Environmental Assessment [TP/PEA] (Chemonics et al., 1993; Knausenberger 1993)

(6) Mozambique: the present environmental situation. A synoptic survey financed by the Norwegian Agency for Development Cooperation (Environmental Working Group 1990).

(7) AELGA Project Assessment, Alan Schroeder (1993).

(8) Fisher, H. H., Patricia C. Matteson and Walter I. Knausenberger (1993). Supplementary Environmental Assessment of Pest Management and Pesticide Use in the Private Voluntary Organization Support Project (656-0217), USAID/Mozambique - Supplemental to the Programmatic Environmental Assessment of the USAID/Mozambique

Transition Development Program; USAID/Mozambique and AID/W (See the References for additional citations.)

2.4 Analysis and Document Preparation

The above documents have been used in the preparation of this SEA and are often relied upon without citation. Some internal USAID/Mozambique data are also used without citation. Other relevant documents are cited in the text when supportive data is used.

Other documents which deal with the locust/grasshopper situation vis-a-vis environment, ecology, and biodiversity of Mozambique that were consulted in the preparation of the SEA include the World Bank/Government of Mozambique's National Environmental Management Plan for the Environmental Support Project; and the IUCN (International Union for Nature Conservation) Conservation Monitoring Centers' Mozambique: An Environmental Profile; Pesticide Legislation; Ohio State University Study on Agricultural Input Distribution and Marketing in Greater Maputo; Mozambique - the present environmental situation, NORAD. Most of these documents are fully cited in the reference section.

3.0. ENVIRONMENTAL REGULATIONS

3.1. A.I.D. Environmental Procedures

It is A.I.D. policy to ensure that any negative environmental consequences of an A.I.D.-financed activity should be identified and mitigated to the fullest extent possible prior to a final funding and implementation decision. This document covers specific environmental consequences involved with chemical pesticide use, and necessary safeguards and mitigation for any future control programs. Pesticide related activities will, therefore, be addressed in line with A.I.D.'s Environmental Regulations and Procedures. In addition, alternatives to the chemical pesticide are highly recommended when found to be appropriate, and can be part of an IPM program.

3.2. Mozambique's Environmental Regulations

Mozambique does not have any fully functional environmental procedures or National Environmental Action Plan (NEAP) or anything similar to A.I.D. Environmental Procedures. A National Commission for the Environment (CNA) was established in 1989. The Commission is yet to be developed into an organization fully empowered to address relevant environmental issues, including industrial and agrochemical wastes disposal. Its current activities are mainly focused on coordinating preparation of the National Environmental Management Plan (NEMP) and other similar functions as the commission itself has yet to be fully developed.

Currently CNA has a very limited staffing level; there are no well-trained and specialized staff who have the capacity to address major environmental issues and problems. However, with assistance from the World Bank, the UNDP, and other donor agencies, the NEMP is being drafted. This plan will attempt to address various aspects of the environment including urban, rural, agricultural, industrial, biodiversity, water and coastal management, legislation, institution strengthening, resettlement, etc. The Commission hopes to see NEAP in place within the next two years or so.

3.2.1. Other Environmental Regulations in Mozambique.

Mozambique has a number of national parks, game reserves, protected forests, and aquatic habitats that are and need to be protected by law to be free from pesticide related activities. The National Directorate for Forestry and Wildlife (DNFFB) has the mandates for designating areas susceptible to pesticide applications. The protected species are covered by a series of guidelines which control hunting and fishing. In addition, detailed environmental procedures are being drafted by the DNFFB in collaboration with USAID, World Bank, International Union for Nature Conservation (IUCN), to develop procedures that will protect critical habitat and regulate their exploitation.

4.0 COUNTRY PROFILE AND DESCRIPTION

4.1. Physical Location, Climate, Soils and Vegetation

The Republic of Mozambique is a country situated on the east coast of southern Africa between latitudes 11 and 27 degrees south and longitudes of 30 to 41 degrees east. The country has a total land area of 801,590 sq km which includes some 13,000 sq km of inland waters, such as man-made Lake Cahora Basa and other lakes such as Niassa, Chilwa, Chiuta and Amaramba. The following, including Figures 1-5 and 11, is drawn mainly from the preliminary survey by the Environmental Working Group (1990).

Mozambique is situated between the Indian Ocean and the central land mass of southern and central Africa. It borders with Tanzania to the north, Malawi and Zambia to the northwest, Zimbabwe and South Africa to the west, Swaziland to the south and the Mozambique Channel to the east (Figure 1). The topography of Mozambique is such that there is a steady rise in elevation from the coastal plain in the east to the mountains in the west with the main rivers flow eastward towards the Mozambique Channel.

Climate:

The major climatic factors that affect both agro-ecological zones and associated activities and subsequently pest population dynamics include rainfall, temperature, humidity and wind speed.

Mozambique can be divided into four major climatic zones based on the humidity index: a) the arid-zone (characterized by low rainfall - <500 mm per annum); b) the semi-arid zone (characterized by moderate rainfall - 500 to 1,000 mm per annum); c) the sub-humid zone (characterized by high rainfall - 1,000 to 1,400 mm per annum) mainly along coastal strip and in uplands; and d) the humid zone (characterized by higher rainfall - >1,400 mm per annum), the uplands of Upper Zambezia and western parts of Manica provinces (Figure 2). The variation in the relative annual average humidity is 60 - 80% for the country, which indicates that a large stretch of the country, particularly along the coastal line, is more or less sub-humid described under section c above.

Rainfall:

There are two distinct rainfall patterns in Mozambique: 1) the hot season rains and 2) the cool season rains. The latter type is predominant along the coast south of 19th S latitude, in Zambezia province and areas of higher altitude around Espungabea in Manica province.

In general, the average annual rainfall pattern shows a gradient from the sea to inland, with the average rainfall ranging from 350 mm at Pafuri in Gaza to 2,348 mm at Taciane in Upper Zambezia in the mountains, with the average annual precipitation in most areas ranging between 1,000 mm to 1,400 mm. The number of days that receive rainfall increases northwards in the country, whereas the frequency of heavy rains increases southward in the country.

Temperature:

The average annual temperature is very much influenced by the physical features and the proximity to the sea. Upland regions and southern coastal areas have temperatures below 23 degrees Celsius (around 73 degrees Fahrenheit). Average annual temperatures at Chicoa in Tete province and at Pemba in Cabo Delgado province exceed 26 degrees Celsius (79 degrees Fahrenheit). As for the rest of the country, temperatures vary between 23 and 26 degrees C, with a mean monthly temperature of 24-28 degrees C and mean minimum monthly temperature around 19-22 degrees C.

Wind Speed:

The average wind speed varies from 2.5 to 9.4 kph, higher in the Ulongue-Lichinga stretch in Tete and Niassa provinces, and along the coast. Wind speed is relatively low in Zambezia and in drier parts of Maputo and Gaza provinces.

Soils:

Soils of Mozambique show great diversity and variability, very much influenced by climate and geological activities. The major soil type of Mozambique are:

- Alluvial and hydromorphic soils. These soils are characterized by immature soils derived from river, lake and marine unconsolidated sedimentary materials; often occur in flood plains of the major rivers such as Umbeluzi, Maputo, Incomati, Limpopo and Zambezi.

- Verti-soils. Verti-soils are characterized by materials derived from limestones, lava; and generally found along the north-east coast and in the Buzi flood plains west of Beira, as well as in the south in Moamba and Sabie regions.

- Sandy soils. These are characterized by materials Karroo sedimentary rocks, quartz-bearing crystalline rocks, lava and from other sedimentary rocks, largely found in most of the southern part, middle Zambezia, Nampula, and Cabo Delgado regions of the country.

- Hydromporphic (soil formed at the presence of excessive moisture by inhibiting aerobic actions) and salty sandy soils are mainly found in the coastal plains and depressions and in the Limpopo river region.

- Red clay soils. These are deep and well-drained soils mainly derived from quartz-bearing crystalline rocks, young sediments and sedimentary rocks. These soils are found in the northern part of the country.

- Shallow (lithoidal soils). These are derived from consolidated materials and occur in the mountains and very dry plateau regions and are found in the south and northern parts of the country, very favorable for cattle production.

Vegetation:

Mozambique's natural vegetation is as varied as the soil types, geology, altitude, latitude, and major climatic factors. Although there are diversified vegetation types in the country, the major groups are: 1) forests, 2) woodland, 3) grasslands (pasture) and 4) mangroves (Figure 3).

Forests:

There are two major types of forests in Mozambique: A) partially evergreen forest and B) deciduous forests. The partially evergreen forests are found in areas which receive >1,200 mm of rain per year, mostly in the plateau and middle plateau regions of the central and northern parts of the country and in the transition zone to mountain forests. The deciduous forests occur in areas of the country which receive 600-900 mm of rainfall per year. These forests are most common in the lower Zambezi, middle Zambezi and its tributaries.

Figure 1. Base Map of Mozambique Showing the Ten Provinces and Their Capitals.

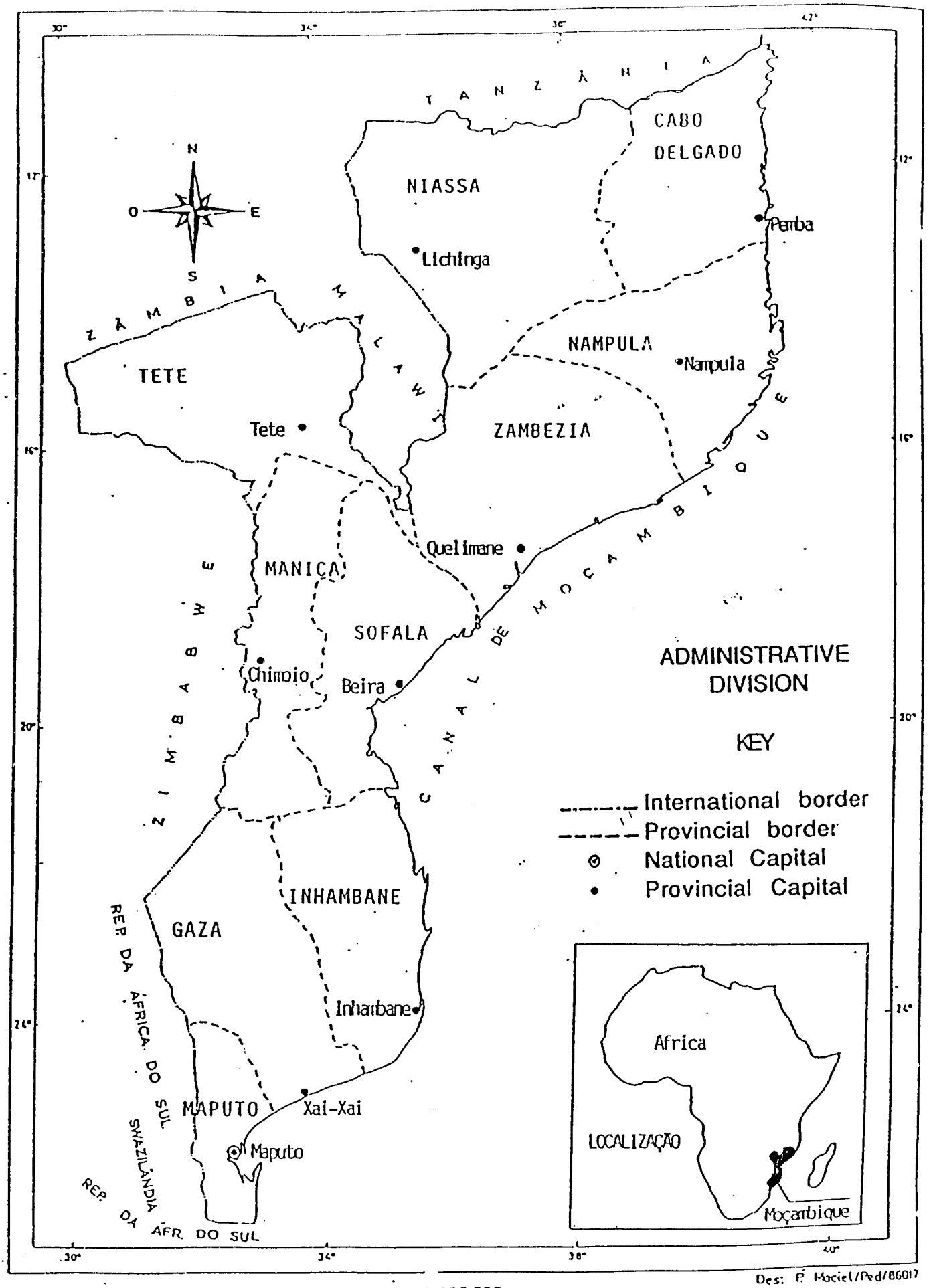


Figure 2. Major Climatic Zones of Mozambique

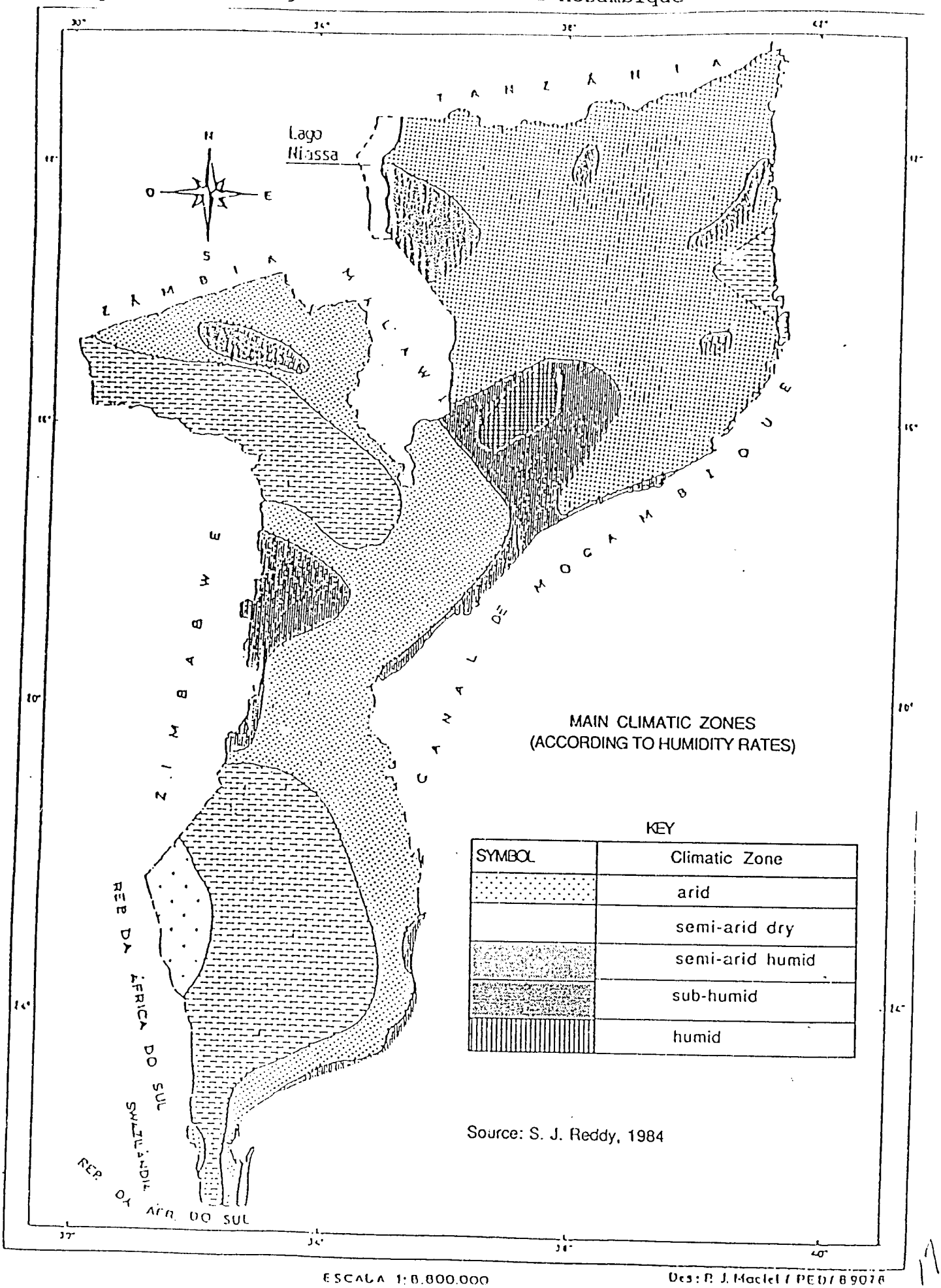
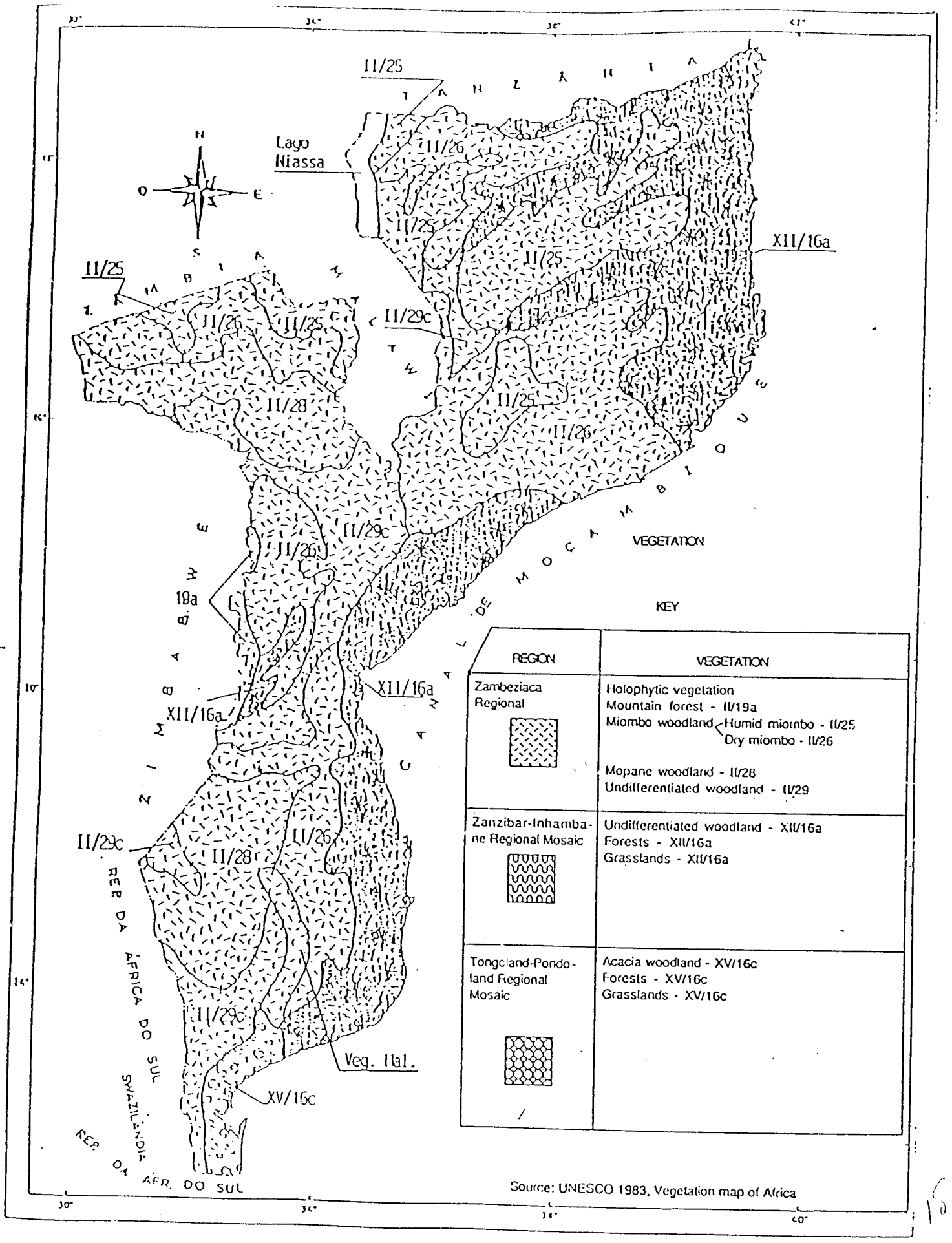


Figure 3. Vegetation Map of Mozambique



Woodlands:

There are four types of woodlands in Mozambique: A) Miombo woodland (this is found in Nampula, Montepuez, and southern Niassa regions), B) Mopane woodland (this vegetation type covers most of the land mass, particularly of the main river valleys, i.e., Incomate, Limpopo, Save and some parts of the Zambezi valley and its tributaries), C) Undifferentiated woodland (this is found north of the Limpopo river and is distinguished by the absence of Miombo and Mopane, and D) Acacia woodland (this occurs mainly in the souther part of the country, near the border with Republic of South Africa and Swaziland, where the rainfall varies between 600 mm and 1000 mm, and is considered as a transition vegetation).

Grasslands/Pastures:

Major grassland vegetation are found in flood plains, swampy areas and wetlands, in savannas, in shallow drainage courses and in marginal areas, plateau regions.

4.2. Agro-ecological Zones and Agricultural Resources

Mozambique's major agro-ecological zones are pretty much determined by its unique location on the continent and the many rivers (Save, Limpopo, Zambezi, Sabie, Umbeluzi, Incomate, and Maputo) that traverse the country (Figure 4).

Mozambique is predominantly an agrarian country. Agriculture, forestry, and wildlife are the backbone of the country's economy. These sectors alone contribute more than 80% of the livelihood of the population.

The major agronomic food crops of Mozambique include rice, maize, sorghum, mallets, cassava, peanuts, sunflower, tomatoes, and potatoes, among others. Industrial crops include cotton, sisal, and sugarcane. Cashew nuts and cotton are also grown as cash crops by the different sectors (Appendix F). Cassava and cashew are mainly grown by family farmers and are widely used as food sources.

Agricultural practices in Mozambique are diverse with considerable amount of land being irrigated or having the potential for irrigation schemes existing almost throughout the country (Appendix G). Such schemes often required large quantities of agrochemical inputs including pesticides which are used for the control of pests such as locusts and grasshoppers.

Mozambique is considered to be a sparsely populated country, with some 15.3 million inhabitants with a birth rate of 45/1000 and death rate or 19/1000 and a net annual increment of 2.7% projected to reach some 25.4 million by the year 2010. Over 87 percent the population live in rural areas and derive their livelihood from agriculture, an activity which accounts for 40-50% of the GDP and

generates nearly 80% of the export earnings. Figure 5 indicates the geographical distribution of the population.

Cattle and small ruminants are the most common livestock in Mozambique. There are over 650,000 head of cattle and 300,000 head of small ruminants. There are three cattle production areas: south, central, and north. South covers the region south of the Save river and includes, Maputo, Gaza, and Inhambane provinces and this is where nearly 75% of the cattle production is concentrated. The central zone includes Sofala, Manica, Tete and part of Zambezia provinces and contain about 18% of the cattle (Appendix H).

The northern zone is from the northern half of Zambezia province to Rovuma River, as this area is a tsetse infested zone only about 6% of the cattle in Mozambique is found there. Cattle production is carried out by the family sector and the commercial sector which includes both the state and private entrepreneurs. It is worthwhile to note that all of these animals are maintained on natural pasture although the commercial sector is more systematic thus indiscriminate application of pesticides for locust and grasshopper control in pasture land will considerably impact the animals and humans.

4.3. Locust and Grasshopper Species and Activities in Mozambique

Coming out of a war that ravaged the country for nearly two decades, Mozambique is currently not self-sufficient in agricultural production and depends on food aid from donor organizations and NGOs. Therefore, any factor, such as drought or blight, is considered a major economic and social threat. Any additional loss from locust/grasshopper damage both in terms of food crops as well as pasture could only aggravate the current situation in the country.

Although not well documented, a number of locust and grasshopper species of economic importance are known to be found in several localities, if not through out the country, in Mozambique. The distribution of the different species of locusts and grasshoppers and areas which are frequently affected by their invasions and outbreaks are shown in Figures 6, 7, 8, and 9.

The most common locust and grasshopper species in Mozambique include the:

- African Migratory Locust -- *Locust migratoria migratorioides*,
- Brown Locust, *Locustana pardalina*,
- Red Locust, *Nomadacris septemfasciata*,
- Green or Edible grasshopper, *Homorocoryphus nitidulus*
- grasshopper species *Cataloipus* spp., *Kraussaria* spp., *Ornithacris cyanea* (often confused with *N. septemfasciata*), *Cyrtacanthacris* spp., *Phymateus bacatus*, *Lanurckiana* spp., *Diabolocatantops* spp., and others.

Figure 4. Agro-Ecological Regions of Mozambique

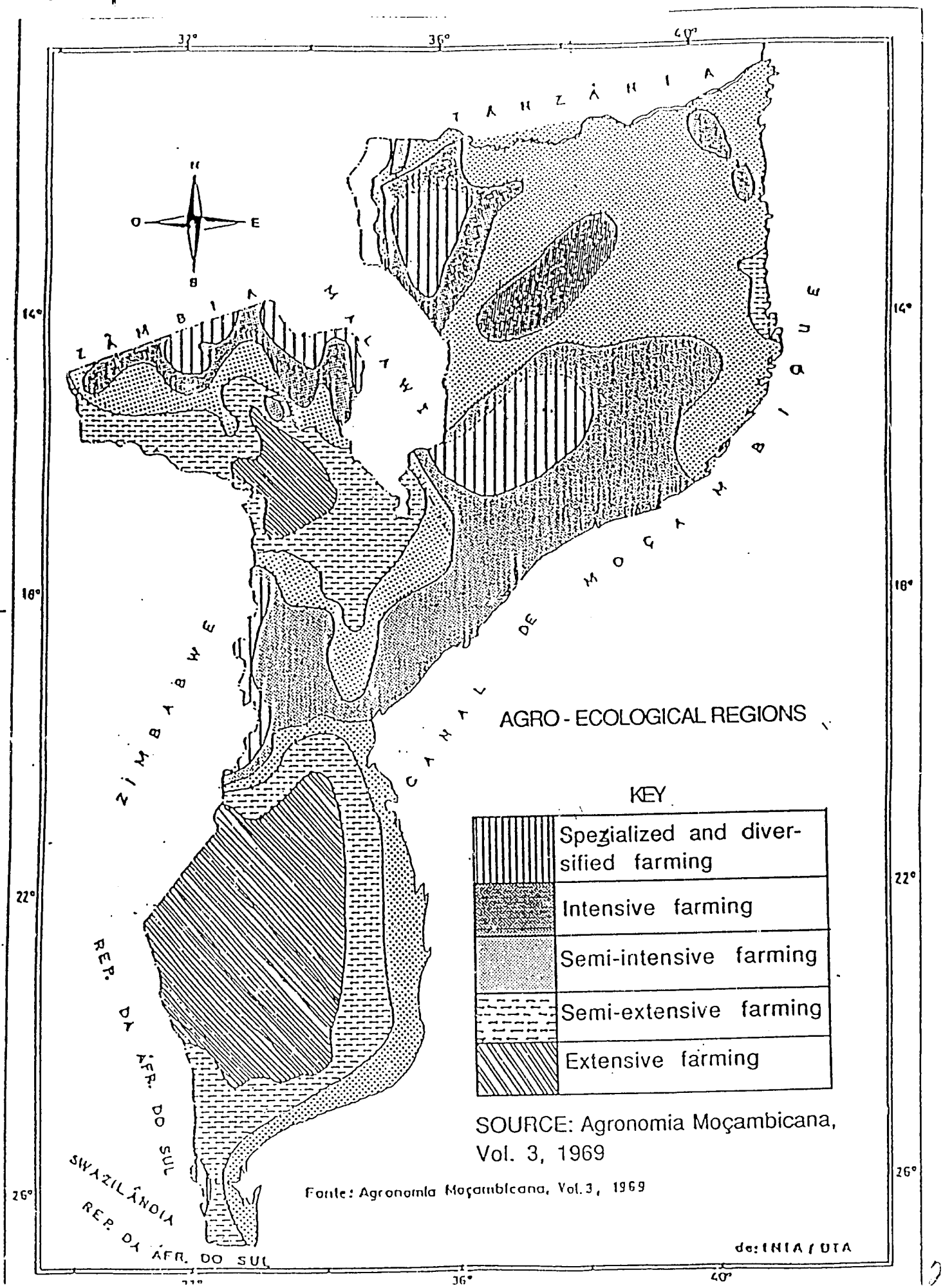


Figure 5. Geographical Distribution of Population of Mozambique

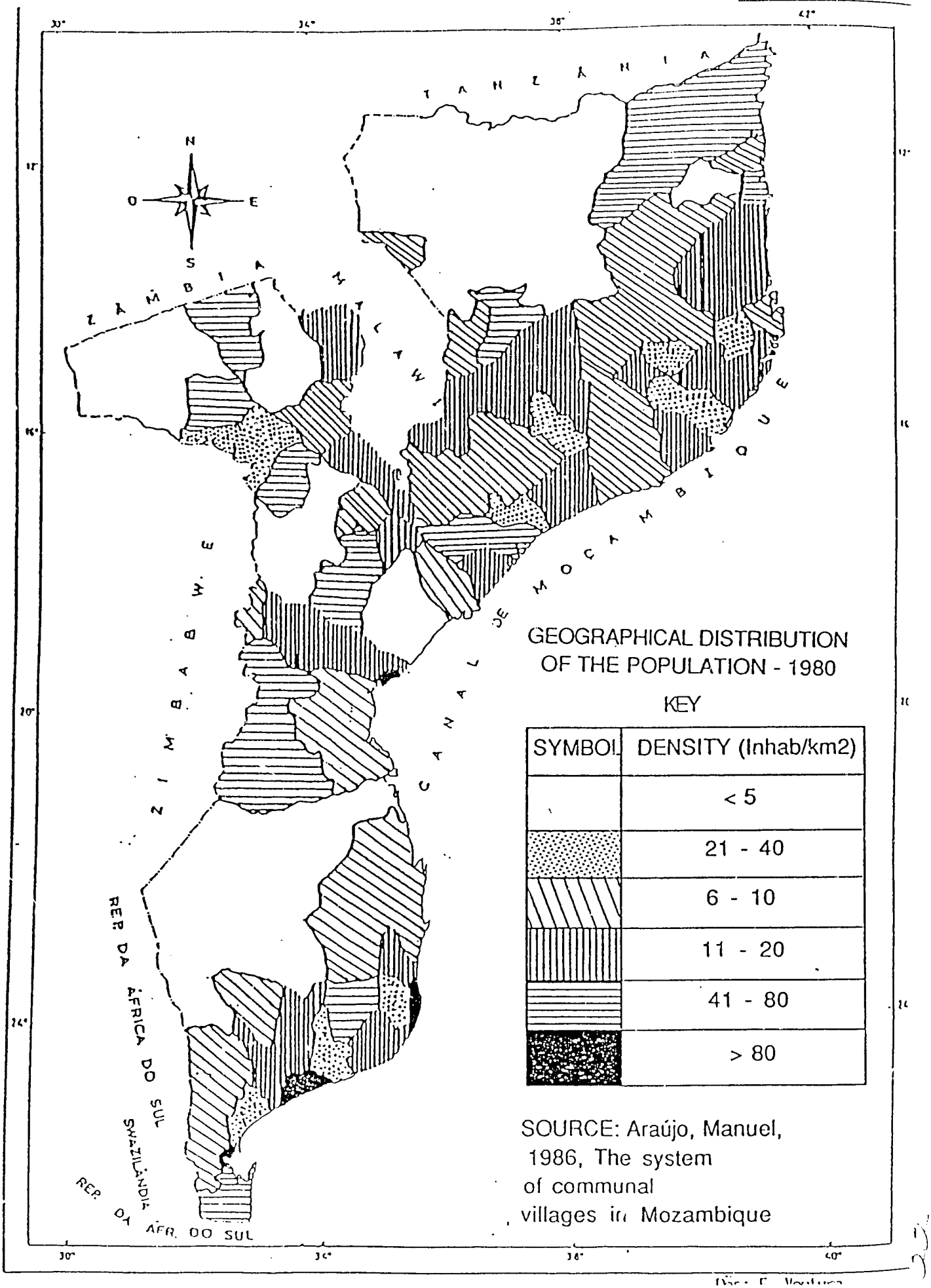


Figure 6. Distribution of the African Migratory Locust, Locusta migratoria migratorioides in Mozambique

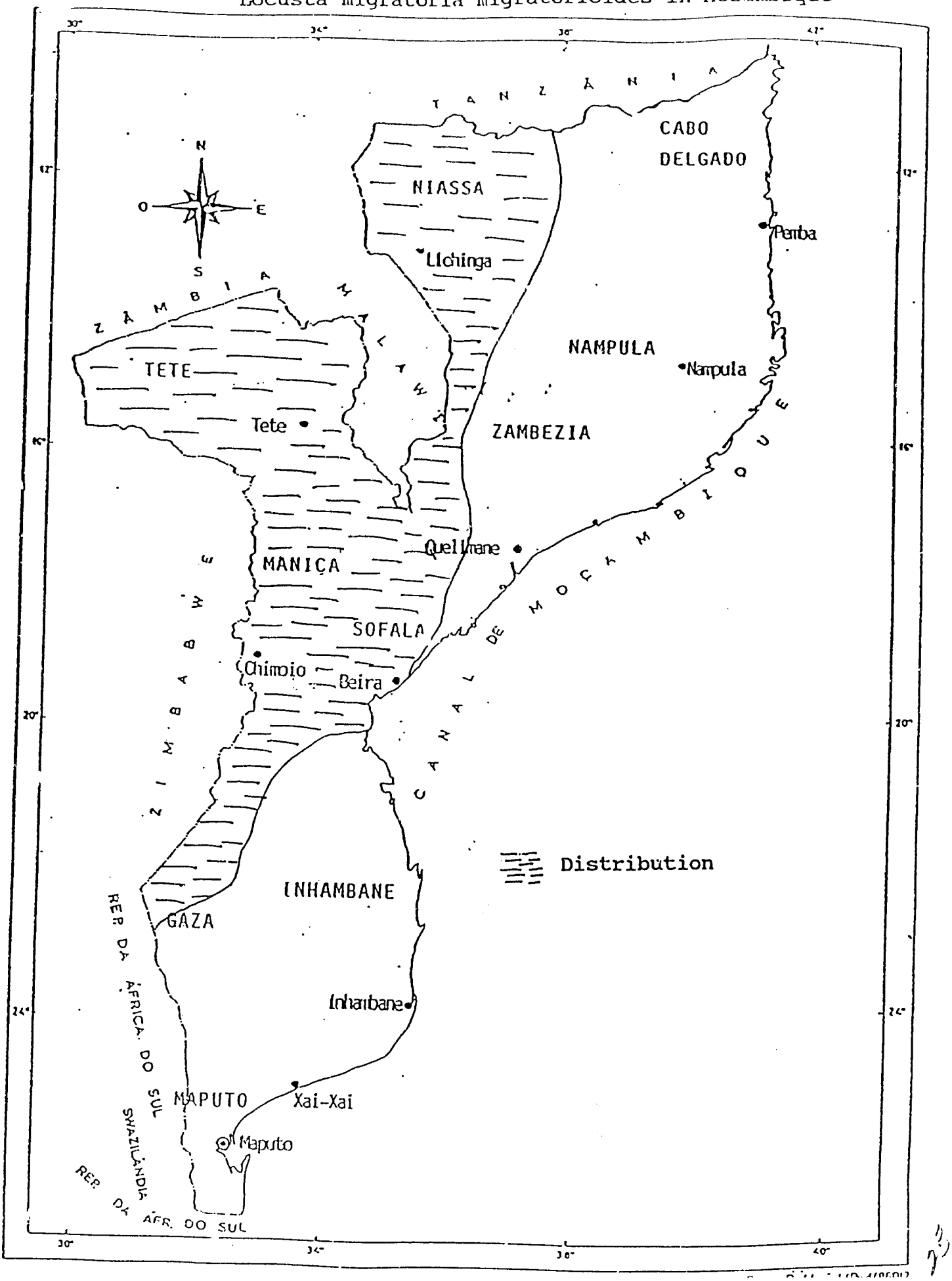
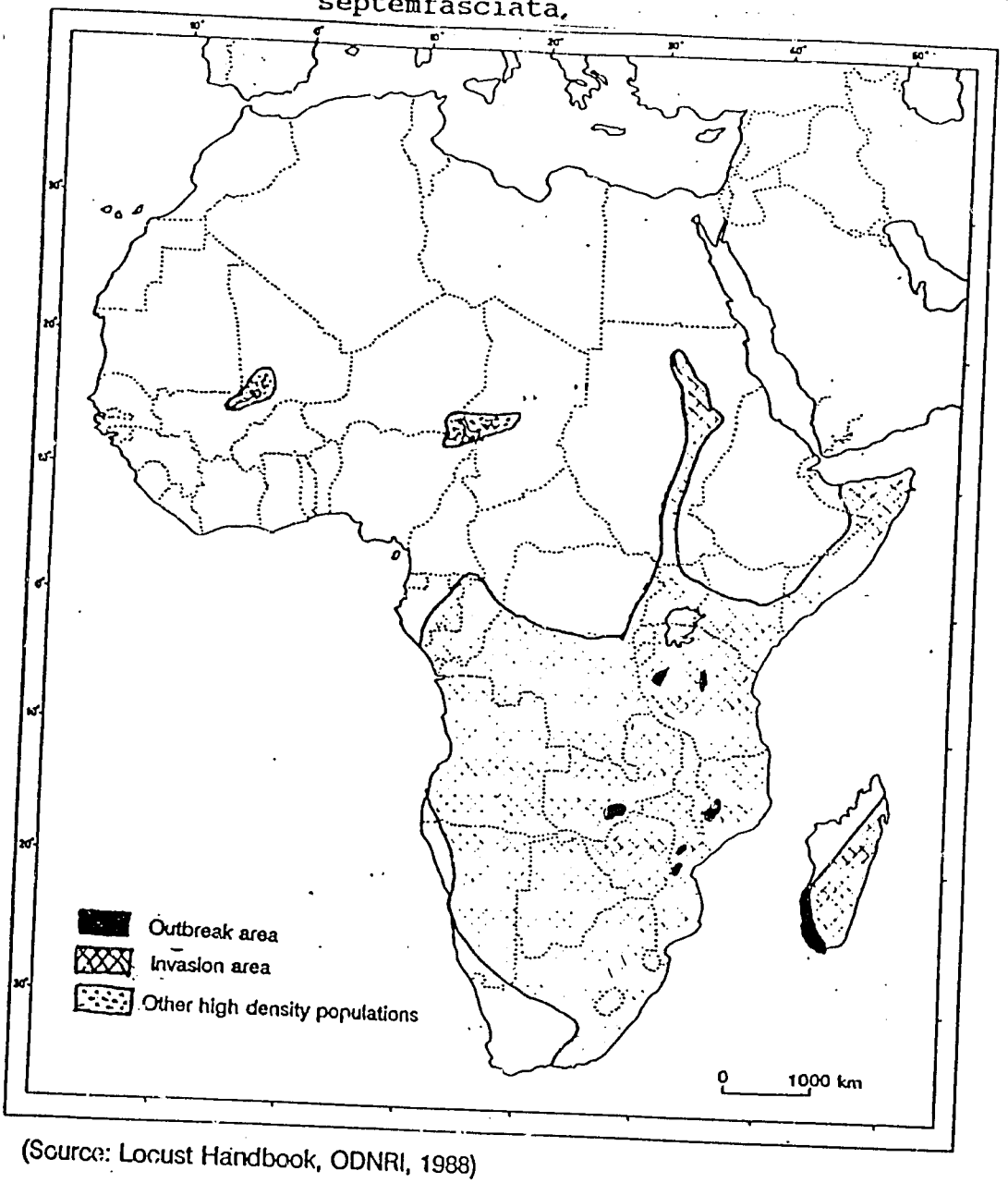


Figure 7. Distribution of the Red Locust, Nomadacris septemfasciata.



(Source: Locust Handbook, ODNRI, 1988)

Figure 8. Outbreak and Invasion Areas of the Red Locust in Mozambique

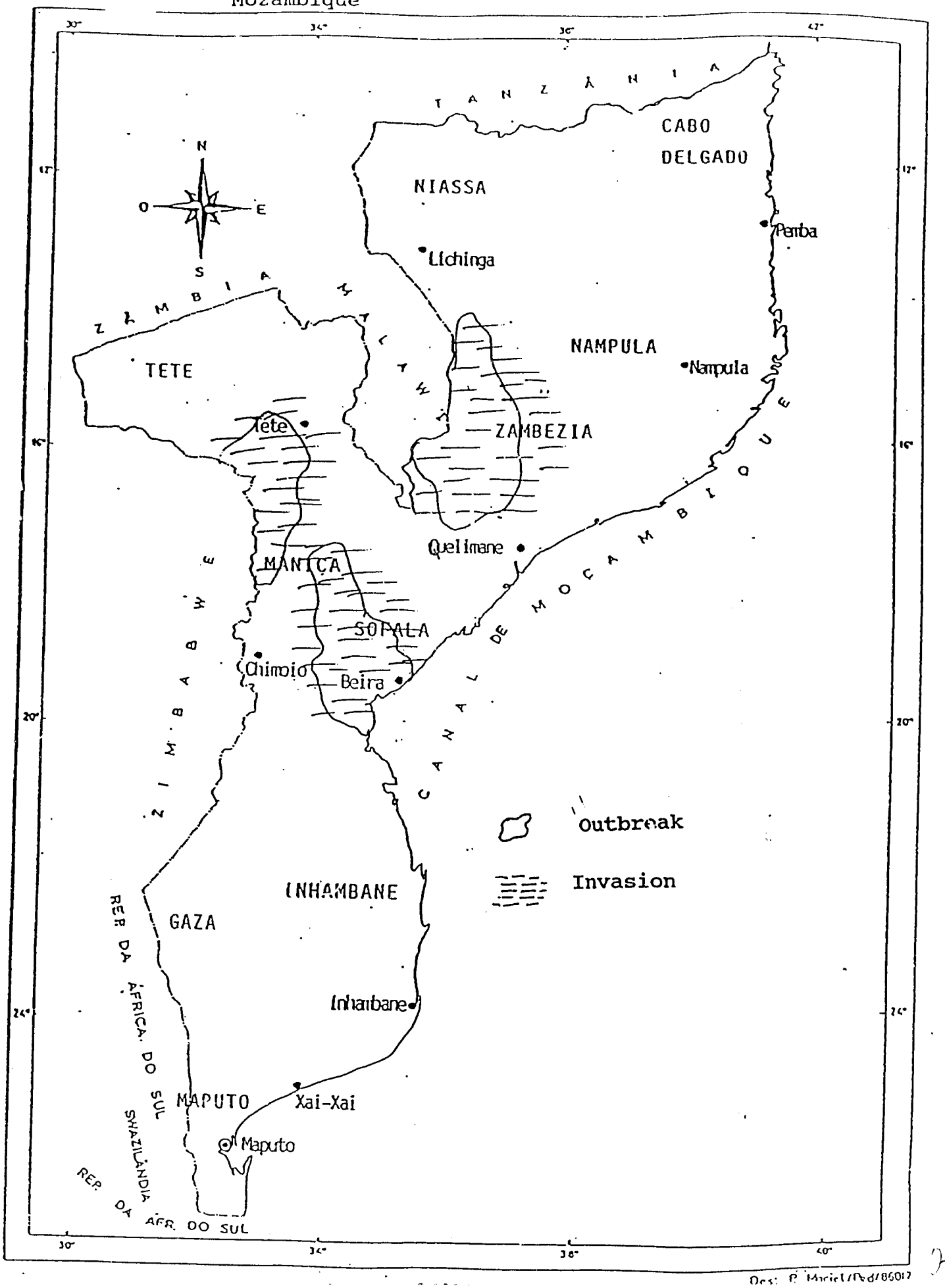
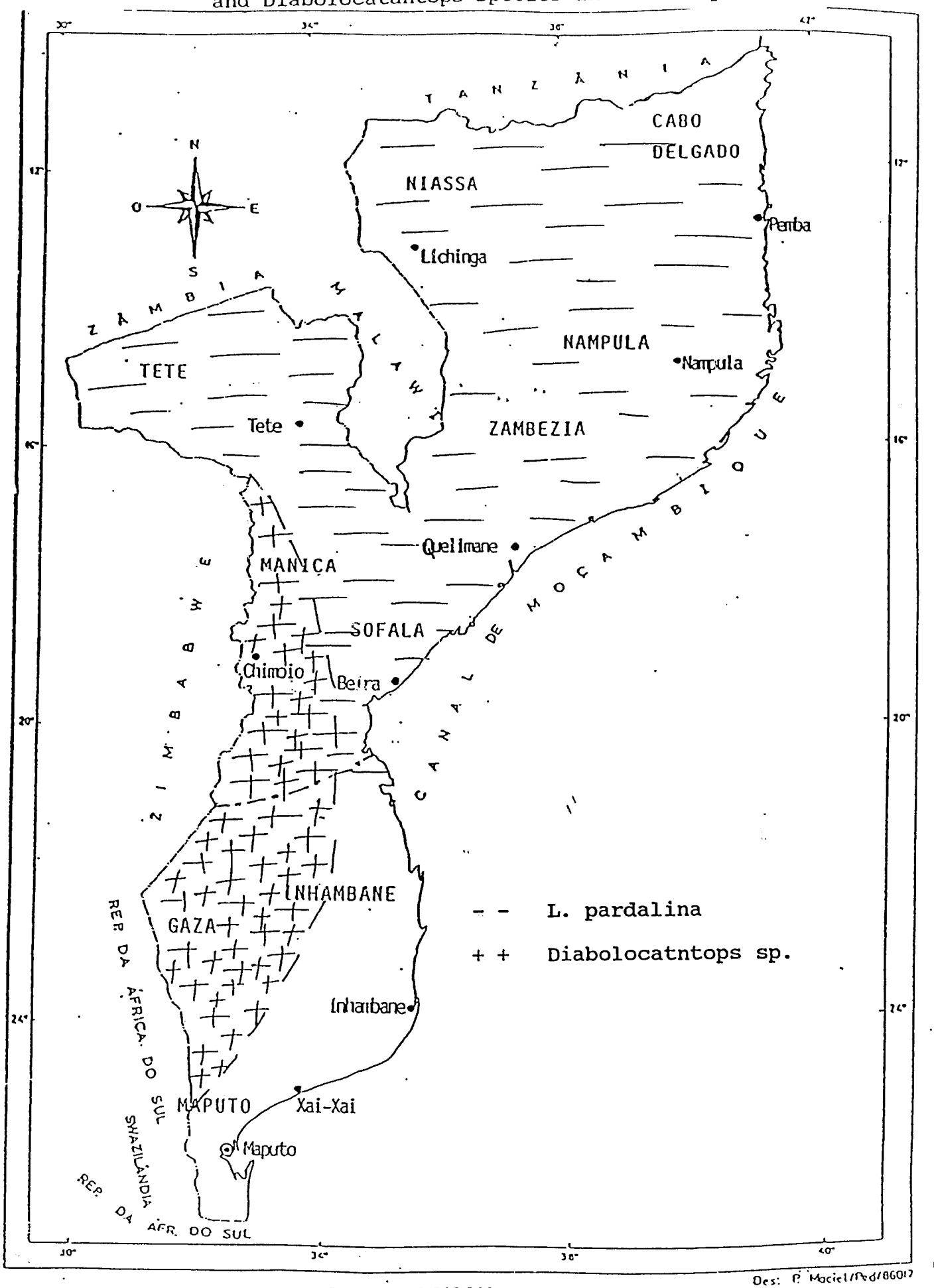


Figure 9. Distribution of Brown Locust, Locustana pardalia and Diabolocatantops Species in Mozambique



Mozambique has often experienced intermittent locust and grasshopper infestations and serious outbreaks over the past several decades. Mozambique's physio-climatic conditions, including rainfall, temperature, vegetation often create conducive conditions for locust/grasshopper outbreaks. Insect infestations are compounded when productivity is lowered by other factors such as drought, plant disease or other pest damage. Mozambique will probably continue to experience future problems from the Migratory and Red Locust as well as with grasshopper infestations. While the level at which such problems occur is difficult to predict, especially given the seasonal migrations and dispersions in the region, major outbreaks can be prevented by vigorous survey and early treatment and proactive programs.

The population fluctuations of locusts/grasshoppers often makes it difficult to accurately predict the intensity and location of future outbreaks. A preventive rather than curative approach should be the focus of individual farmers and the DDP (DSV with appropriate donor assistance when the magnitude of the problem is too great for the Mozambique Migrant Pest Control Unit (MPCU) and in the case of the Red Locust, Beira-based Red Locust Unit of the International Red Locust Control Organization for Central and Southern Africa (IRLCO/CSA) headquartered in Lusaka, Zambia).

Whatever the level of infestation, active coordination between USAID, other donors, and participating organizations is essential. Support for MPCU programs involving training, control operations, management planning, survey, and early season intervention should be emphasized. Considerably less emphasis is placed on late season emergency operations which may involve large-scale aerial pesticide spraying. Because early season control operations can prevent late season emergency operations which will likely involve significant amounts of pesticides, preventive oriented operations are less expensive in terms of environmental impact and operational costs.

Mozambique does not seem to be a primary or major breeding area for the locust species that are known to invade southern African countries. However, localized breeding areas for the Red and Brown locusts are known to exist in the western borders with Zimbabwe, Zambia and Malawi, and along south-western border with South Africa. Threatened from African Migratory Locust as well as Red and Brown Locust invasions from its neighboring countries, Mozambique remains within the danger zone, the major threat being from the African Migratory Locust, Locusta migratoria migratorioides. The African Migratory Locust (due to its ability to increase population numbers rapidly), and the green grasshoppers, Homorocoryphus spp. that are often found attacking a wide variety of graminaceous crops, including rice, maize, mallets, sorghum, etc., are considered important locust/grasshopper species in Mozambique.

The African Migratory Locust has both a solitary and gregarious phase. During unfavorable environmental conditions, the locust will be in the solitary phase, with small populations residing in isolated locations. During this phase, the locust does not cause noticeable damage on major food crops, as it feeds primarily on grasses. This seems to be the phase at which African Migratory Locust most commonly occurs under Mozambique's agro-climatic conditions.

With the change in climatic conditions, temperature and rainfall becoming favorable, weeds and other grasses become abundant, leading to a sudden increase in the number of locust populations, causing a phase change from solitary to gregarious. The gregarious populations move together, allowing increased opportunity for reproductive activities, and causing major crop damage when a swarm moves into an agricultural area.

This species can potentially have four generations per year; one during the dry season, and three during the wet season. Population numbers will remain fairly stable during the dry season generation, but will fluctuate either positively or negatively during the wet season. With favorable environmental and breeding conditions, significant population increases can occur with each succeeding generation during the wet season. When gregarized, population numbers can increase so rapidly that immediate control operations are required.

Although the Red Locust and the Brown Locusts are not considered very important, it is well known that they often do occur in quite appreciable numbers and inflict substantial damages to a number of crops.

In Mozambique, grasshoppers do often occur in quite large numbers and can cause considerable economic damage. For instance, in the 1993 cropping season, a very serious outbreak of the edible or green grasshoppers, Homorocoryphus nitidulus, occurred in rice growing areas in Cabo Delgado, Sofala, Nampula and Zambezia provinces (Figure 10). Particularly in Sofala province near Beira area, over 15,000 hectares of rice was reported to have been attacked at an early milk stage and the entire crop was reported devastated.

4.3.1. Locust/Grasshopper Management - Overview

The Migrant Pest Control Unit (MPCU) is one of the seven units of the Department of Plant Protection under the Directorate for National Agriculture (DNA) of the MOA. Mozambique's MPCU was established in 1986. The MPCU is supposedly responsible for all migrant pests, including locusts, **but not grasshoppers.** Grasshoppers are within the mandate of general plant protection and are handled by the DPA and DDA extension workers and farmers. MPCU, like all other units, is understaffed, under-equipped and possesses

limited capacity to handle any such problems should they occur on a large scale.

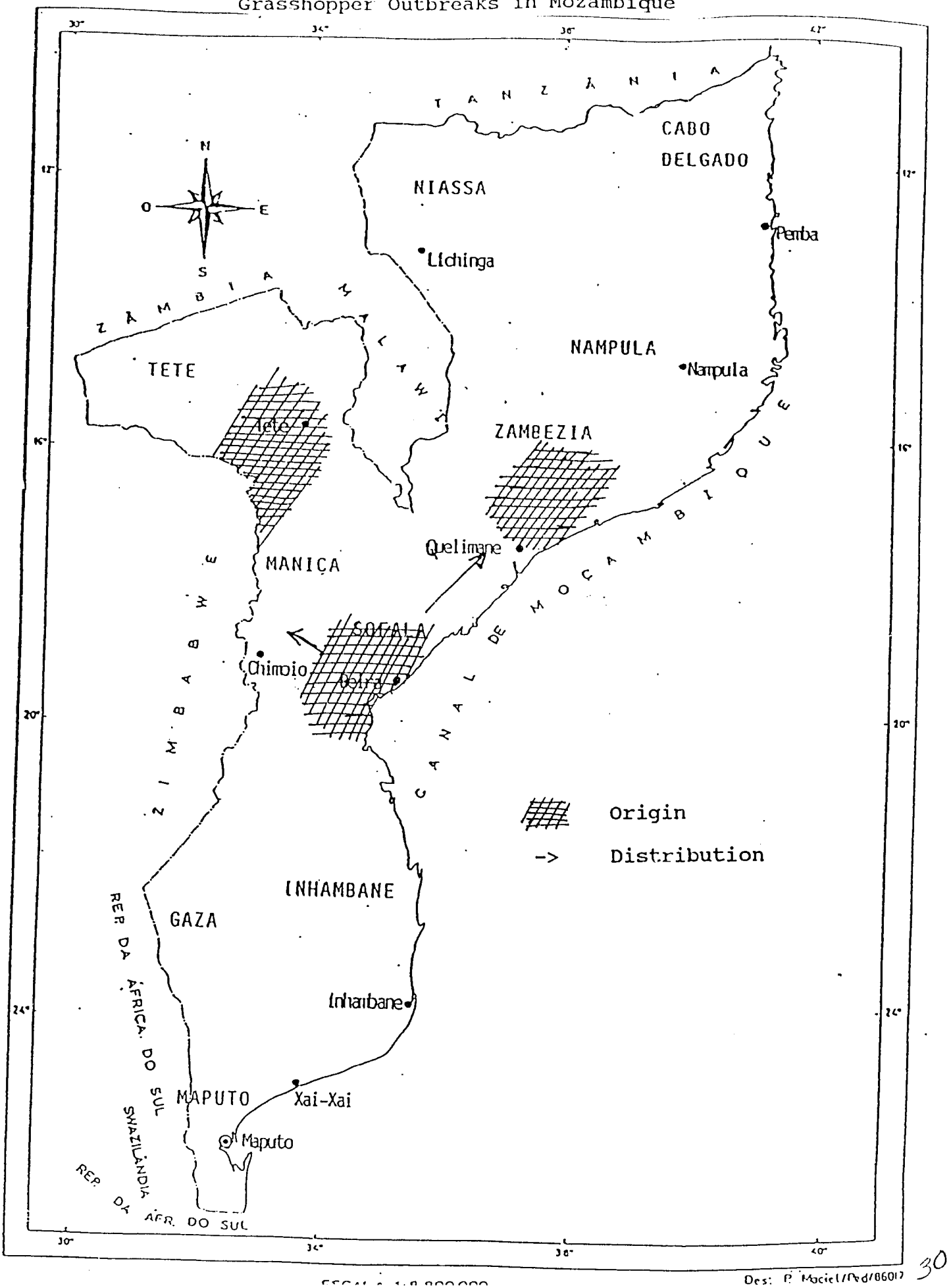
Over the past few years, the MPCU and the DSV have been benefitting from support through a project by the Danish Agency for International Development and Cooperation (DANIDA), with some support from the FAO. Although these Agencies have provided appreciable assistance and services to the national pest management operations, they are only beginning to have substantial impacts on the status of indigenous institutional capacity.

In the past, A.I.D.'s direct intervention against locusts/ grasshoppers in Africa has been largely in the emergency control of swarms, with some preparedness (e.g., research into alternatives control technologies) and capacity building activities. This approach carries excessive costs and has limited overall impact. Furthermore, such intervention is environmentally costly because of the enormous quantities of pesticides that are sometimes used. A more reasonable approach is preventative control by an adequately developed crop protection service, which supports farmers and NGOs as necessary in their control efforts. This approach relies heavily on good survey, immediate and targeted intervention, and control actions that are aimed at hopper bands rather than against flying swarms. In addition, alternative methods to chemical pesticides, including biological control and habitat modification, should be attempted whenever possible.

The nature of locust/grasshopper population dynamics makes preventive actions in breeding areas desirable. Maintaining populations in a recession through the use of IPM tactics and minimal application of pesticides should be the strategy of choice. The historical locust and grasshopper breeding/outbreak sites in Sofala and Tete provinces must be surveyed on a regular basis, with spot treatment operations conducted as required to keep populations in the solitary phase.

The Migratory Locust is part of the natural ecology of Mozambique and periodic upsurges can often be considered as a normal part of the biological system. However, with the introduction of agriculture, this locust often readily takes advantage of croplands which are placed in their natural habitat. With the security situation gradually improving, more and more people are returning to their original farmlands. This will create favorable conditions which will lead to pest outbreaks and resurgences, including locusts and grasshoppers.

Figure 10. Origin and Distribution of the 1993 Locust and Grasshopper Outbreaks in Mozambique



Locust/grasshopper infestations are not easy to predict in advance. Rainfall distribution and subsequent vegetation that follows seem to be the best single predictor, but locusts and grasshoppers often occur in patterns not obviously related to any easily measured factors. Because of this, surveillance is essential for the design of tactics to maintain low locust and grasshopper populations and to prevent outbreaks. Because rainfall and the vegetation that follows it is important, satellite derived greenness maps may be utilized as additional guidance to strengthen visual surveillance.

Field survey is essential in any locust/grasshopper management program and must be given high priority by both the recipient country and donors. Included in the survey program must be a sound knowledge of the pest's biology, and an understanding of the relationship of environmental conditions with the pest's population dynamics.

For organizational purposes, the FAO should be considered the official donor coordinator for locust/grasshopper control activities on behalf of the GRM and FAO should be supported in continuing that role. In addition, the MPCU should be encouraged to work closely with the FAO and other donors to insure that repetition of unneeded material or pesticide donations and excess stock build-up does not occur.

Locusts/Grasshoppers vary over a wide range of population levels in their natural habitat, depending upon rainfall and other climatic and environmental conditions. A migrating infestation of locusts/grasshoppers, depending upon wind conditions and movement patterns, can have a significant impact on agriculture, because crop infestation levels depending upon the numeric density and life stage of the insect. Although major outbreaks are sporadic and will fluctuate greatly over periods of five to ten years, if not longer, locust/grasshopper populations do occur almost every year to some degree in various locations.

For locust/grasshopper management purposes, potential impact on ultimate crop yield can be classified according to levels of infestation. These levels are quantified in relation to the intervention threshold level. The intervention threshold (also called economic threshold) is very specific to the crop, life stage of crop, insect species, and insect life stage.

Ideally, the DSV is expected to maintain an ongoing insect management program during periods of normal pest levels. This program should include efforts to reduce human health risk, protect environmentally sensitive habitats, and minimize pesticide use through cultural, biological and traditional means of control. In decisions on assistance to the DSV for locust/grasshopper management activities, USAID will examine both the pest situation and the capabilities of the DSV. Decisions will be made in such a way as to minimize the amount of pesticide used. The USAID/Mozambique

participation in a locust/ grasshopper management program should be depend on the severity of the problem, as well as the extent to which such assistance will make the DSV more sustainable. The actual level of intervention should be determined by locust/grasshopper density, crop conditions, DSV capacity, environmental conditions, and the potential for a major outbreak.

Prior to U.S.-funded assistance, a thorough analysis of needs is necessary. In evaluating areas of assistance, USAID/Mozambique, in order to be responsive to the requests of the GRM and NGOs/PVOs, must further ascertain what materials and capacity the DSV and NGOs already have, and what other donor supported programs are planned or implemented. Supplying the DSV with pesticides and materials in excess of objective need, or poorly planned training, will not assist in managing locusts/grasshoppers. Preferably, USAID/Mozambique should verify the existence of the problem, possibly through an independent assessment with the assistance from AID/Washington (and expertise of the AELGA project) and/or REDSO/ESA.

If a situation calling for USAID-assisted intervention occurs, all possible safeguards must be implemented in order to protect crops and the environment and to minimize hazards to humans.

However, during a large-scale pesticide application operation, the rate of accidents, overuse of pesticides and use of incorrect formulations are likely to increase, because of the increased pesticide use and the pressure of panic treatments. The most important function of the GRM under these conditions is to institute greater local control (for example, use of Village Brigades), communicate effectively with the affected population, to describe the necessity of the emergency measures, and to ensure to the extent possible the safety of the population and the environment. Operations at a local level, accompanied by appropriate training in pesticide use and safety, is greatly preferred to massive treatments by large aircraft.

The position of USAID/Mozambique on pesticide application is to support the judicious use of such chemicals for the control of economically important pests. The first line of defense must be field survey work to monitor the population level of a particular pest and the potential injury that it will cause. Proper monitoring will generally allow sufficient time to plan a strategy of control. Survey operations will also alert officials should pests be breeding at a faster rate than expected, or if a significant migration has occurred. The first line of defense is spot treatment by ground application methods. This involves manpower-intensive measures to directly attack the sites of the infestation at its early stages. Aerial application is considered a last resort. This control measure is used when all others have proved ineffective or the magnitude of the threat exceeds the indigenous DSV capacity for ground control.

The DSV is structurally under the Ministry of Agriculture's Directorate for National Agriculture (Appendix B). The MPCU falls within the DSV. The level of staffing and access to necessary equipment and other resources has made it very difficult for the DSV to effectively respond to a request for pest control activities. DSV currently functions under a very small budget of 125,000,000 Meticais which covers running cost (3,500 Meticais = 1 USD) and the overall budget (exact figure not available) allocated for material and equipment is far below the minimum requirement to fight any pest upsurge including locusts/grasshoppers.

Since vigorous survey and early season management can save both valuable funds and resources, and is considered to be far more environmentally sound than late-season emergency operations, it is recommended that the GRM more adequately support DSV survey operations. However, the reality is that additional donor assistance will likely be required to ensure a reasonable level of survey and management capacity within the DSV. **With regard to U.S.-funded assistance involving chemical pesticides, the information, recommendations, and regulations discussed in this SEA and the PEA must be taken into account in design and implementation of any assistance campaign. An Action Plan would need to be developed** (See Rec. 37).

Ideally, by developing a strong base of trained personal and a well-maintained fleet of sturdy vehicles and equipment, the DSV will be able to hold impending locust/grasshopper outbreaks to a minimum. This will result in considerably less pesticide being used than if these pests were allowed to reach high population levels. In this regard, it is especially important to involve villagers and farmers living in invasion areas in early season control endeavors. These types of efforts, combined with improved legislation and regulations will greatly lessen potential negative environmental impact of pesticide use. Any assistance A.I.D. can offer to build such an institution, with full participation and involvement of the Mozambique DSV and INIA, as well as NGO/PVOs, would be a far more effective investment than the immense amounts which have been spent on past emergency operations (with little effect on sustainable capacity and infrastructure).

The main elements to be included in locust/grasshopper survey programs are:

- Full knowledge of the spatial and temporal distribution of the pest species.

- Monitoring of environmental conditions and changes which might lead to increased numbers of pest species. This will require an adequate knowledge of pest species biology, the status of environmental conditions, and how these conditions can be augmenting or limiting factors.

- A vulnerability assessment in terms of crops threatened by the pest species, including relative importance of crops, and the crop stage of development, including an understanding of the vulnerability of the human population likely to be affected.

- The availability of pest management support resources to be mobilized for control: pesticides, application equipment, as well as logistical and technical support.

4.3.2. Locust/Grasshopper Crop Loss Assessment

Records on crop losses from locust/grasshopper infestations in Mozambique are lacking due to a number of reasons, such as security problems, lack of trained staff, facilities, equipment, etc. However, there is a general understanding that these pests do cause significant crop loss and therefore must be controlled. The amount of crop yield that is lost due to an infestation of these insects is a particularly important parameter and should be determined as soon as possible to assist in the decision as to both the level of funding needed, and the amount of pesticide to be used. Crop loss information is needed to guide both the Mozambique DSV/MPCU and USAID (as well as other donors) to provide appropriate response. Once the infestation levels can be related to yield loss (i.e., economic injury and threshold levels are determined), management operations can be refined to better handle the situation.

In addition to national aggregate crop losses, consideration also needs to be given to the social and economic costs of grain distribution even when losses to individual farmers or villages may be small. Even if the overall crop loss is low, some localized areas, especially in the central and northeastern parts of the country, may experience high losses. Costs of grain transport over long distances may be more expensive than those of a locust/grasshopper control program. Losses in grasslands are more difficult to assess than in croplands, because the impacts are on wandering grazing animals, and are thus are more indirect.

It is oftentimes the case that crop losses will vary geographically. The distribution and success of control efforts among the regions of Mozambique in proportion to infestation levels are not uniform from year to year. Reliable crop production data are currently unavailable. If estimates of locust/grasshopper infestations and efficacy of control efforts were to be kept over a period of years for each region, a much better estimate of cost effectiveness could be made. Such data should be compiled, analyzed, and made available for appropriate planning and designing of pest management programs.

4.3.3. Farmer and Villager Involvement

Organized groups of farmers can play a very crucial role in locust/grasshopper prevention and control campaign operations. In countries of the Sahel, for example, trained groups of farmers, termed village or farmer "brigades", are assuming an increasingly large proportion of the crop protection treatment effort nationally. In recent years, the area treated by farmers has exceeded that done by the Crop Protection Services with aircraft- and vehicle-mounted spray equipment. Farmers increasingly also are carrying out survey work, monitor pest situation, protect crops and evaluate impacts. Empowering villages to take charge of their crop protection needs is consistent with practices of democratization. Yet, significant challenges remain to make the village brigade approach sustainable. Thus far, being mostly subsistence grain farmers, they are highly dependent upon external inputs. Also, it exposes the farmers to greater pesticide risks than before.

In Mozambique, the programs that are being conducted either in collaboration with local farmers, or for farmers, are a good start (e.g., OLIMA by Ciba-Geigy, demonstration trials by World Vision, Food for Hungry International, and other NGOs and donors). These programs together with the existing, but insufficient, programs of the MOA/DSV can be used as the threshold for further training and establishment of village (farmers) brigades or comparable entities. These should be intensified to include other areas such as pesticide application technique, etc. A.I.D. and the FAO have substantial experience in "Train the Trainer" programs which can be applied successfully in Mozambique.

Programs can be devised to include issues most pertinent to the prevailing conditions in Mozambique and could be designed in collaboration with DSV, pesticide companies, UEM, etc. The training programs may be incentive oriented to increase participation and efficiency of the participants (OLIMA - Ciba-Geigy is worth examining as a good example in this regard). These programs should be continuously monitored and evaluated and their impacts assessed. Ideally farmer brigades must receive needed materials and technical support within a reasonable time frame to achieve crop protection.

An initiative worth drawing attention to in this regard is the plan by WVRD to **develop mobile, rapid-intervention pest control teams operating at the provincial level** (Fisher et al. 1993). Treatments would take place with backpack or ULV-type sprayers. The plan would be associated with a strong training component. While the provision of assistance in this modality may be appropriate enough during larger-scale pest emergencies for farmers otherwise without the means to protect their own crops, it is important to remember that this does constitute a subsidy. Not only is this not a desirable long-term practice, it requires particular circumspection in terms of avoiding misuse. **For USG assistance to be associated with such an initiative, a separate assessment and action plan will be needed.**

4.3.4. Integrated Pest Management - IPM.

Integrated pest management utilizes all available control methods to achieve the most economically and environmentally sound management program. It is considered to be the preferred approach to pest control. IPM is not an alternative to the use of chemical pesticides; instead it is an integration of methods which may reduce use of pesticides by employing them more judiciously. Determination of intervention thresholds, correct timing of sprays based on pest population dynamics, and use of non-chemical control agents are among examples of modern and prudent pest management methods.

IPM can decrease pest losses, lower pesticide use, and reduce overall operation costs while increasing crop yield and stability. Successful IPM programs have been developed for a variety of pests on various crops. Specifics of an IPM program will depend on the crop, cropping system, pest complex, economic values, social conditions, availability of personnel, and other factors and constraints.

IPM is a sensible approach to pest control whereby all existing control methods (pesticides, biological control, cultural control), mitigating factors, environmental concerns, climatic conditions, and ecosystem inter-relationships are integrated to assist in control operation decision making. While pesticides are part of the total IPM strategy, other methods are considered, with the choice dependant on the methods that most closely fit the situation. Timing of pesticide application is an important factor in IPM, with the early season approach favored because of the low amount of pesticides utilized. IPM is not a pest control method itself but rather, a way of considering options available in light of the physical and biological environment.

The principles of IPM are widely accepted among Mozambican DSV and NGO personnel. The DSV has initiated a number of preliminary research and demonstration activities to implement IPM. Furthermore, NGOs and private pesticide companies seem to have realized that IPM and biological control should be the way to go. Issues related to IPM programs and perceptions in Mozambique are dealt with by the SEA to the PEA for the USAID/Mozambique's Transitional Development Program (Fisher et al. 1993).

If USAID chooses to participate in a locust/grasshopper assistance program, it is important that support be coordinated with other donors and the GRM to achieve desirable results and to make a significant impact. In Mozambique, such assistance is likely to involve the PVO/NGO community and regional locusts control organizations. Assistance for such a program should emphasize the principles of IPM, in which all available management resources are considered. While probable crop loss will be a criterion for USAID involvement in control efforts, sustainable infrastructure development and cost/benefit ratio will also be considered.

Participation by USAID in emergency operations will be carefully tempered with an examination of what long-term benefits will be achieved in addition to an insect population decrease. USAID will normally emphasize good survey and use of non-chemical control methods whenever and wherever possible.

5.0. NATURAL ENVIRONMENT, PROTECTED AREAS AND PESTICIDES

Because pesticides will impact both crop and natural ecosystems, natural resource protection is necessary. This can be accomplished by setting aside areas and zones where pesticides are not used, or are severely restricted. Endangered animals and plants need to be considered in regard to anti-locust intervention. Since birds and fish are particularly vulnerable to the direct and indirect impact of pesticides, these organisms need to be given special attention. Areas should be set aside to be protected from pesticide use no matter how great the perceived pest control need. This is particularly relevant for the unique plant and animal species of Mozambique, many of which are threatened. However, basic economic needs contribute to the degradation of the forests, grasslands, and coastal. Soil erosion is rampant, and deforestation will soon be a major problem as many of the displaced refugees are returning to their homeland and back into farming activities. It is extremely important that any U.S.-funded locust/grasshopper control program involving pesticides not contribute further to environmental degradation already underway. Further, the United States should do its utmost to utilize methods and materials, while rendering locust/grasshopper control assistance, which have the least-toxic effects on both crop and natural ecosystems.

5.1. Fragile Ecosystems - Fauna and Flora

The fauna and flora of Mozambique is unique and diverse, with a remarkable degree of endemicity, at the species and at higher taxonomic levels. The great majority of native terrestrial species in all faunal groups appear to be dependent on forested or wooded habitats. These areas, in particular, should be protected to the extent possible from disruptive impacts of pesticides. Effects on non-target organisms could negatively affect those species already severely assaulted by habitat loss and increased predation.

Numerous animal species are listed as endangered or threatened in Mozambique. Some of these species are shown in Appendix I. It should be clearly publicized and legislated that no U.S.-funded pesticides or related operations should take place in or around established critical habitats where such species are known to exist or the most practical measure should be taken under situations that require applications.

While protected areas and animals are covered by several Mozambique's laws and regulations, enforcement usually lacks or is non-existent. Much of the unique flora in being destroyed with increased deforestation as the result of RENAMO guerrillas. It is

likely that deforestation will probably continue to increase as more and more refugees are returning from the neighboring countries of Zambia, Zimbabwe, etc. The listed endangered and threatened species continue to decline despite attempts made to enforce the legislation. Several animal species will likely disappear in Mozambique unless a considerably higher level of protection in brought to bear. Any U.S.-funded anti-locust/grasshopper operation must consider the potential impact of pesticides on already threatened animal habitats. While human life cannot be placed below that of an endangered species, the U.S. should not allow itself to be drawn into a situation that may force such a choice. Here again, early survey and surgical treatment programs can allay such situations.

5.2. Protected Areas

Mozambique has various types of protected areas located throughout the nation (Figure 11). The total land area designated as "protected" covers nearly 92,250 km2, almost 13% of the country's surface land. These areas are classified as: 1) National Parks (Parques Nacionais), 2) Game Reserves, 3) Hunting Areas (Coutadas), and 4) Forest Reserves. There are four National Parks, five Game Reserves, thirteen hunting areas (Coutadas), and fourteen Forest Reserves (Table 1).

When engaging in locust/grasshopper control operations, the U.S. should, at all times, encourage the respect of these and all other potential fragile areas.

Protected areas should be surrounded by a pesticide-free buffer zone at least 2.0 km wide. These are needed to avoid accidental pesticide contamination (e.g., spray drift). Within buffer zones, and in protected areas, priority should be given to the use of alternatives to chemical pesticides, and a monitoring program so that non-chemical alternatives can be applied. Any locust/grasshopper and other pest control programs carried in areas surrounding buffer should be limited to the pesticide with the lowest potential for impact on non-target species and with acceptable efficacy for the target species. Whenever possible, non-chemical bio pesticides should be used in these areas.

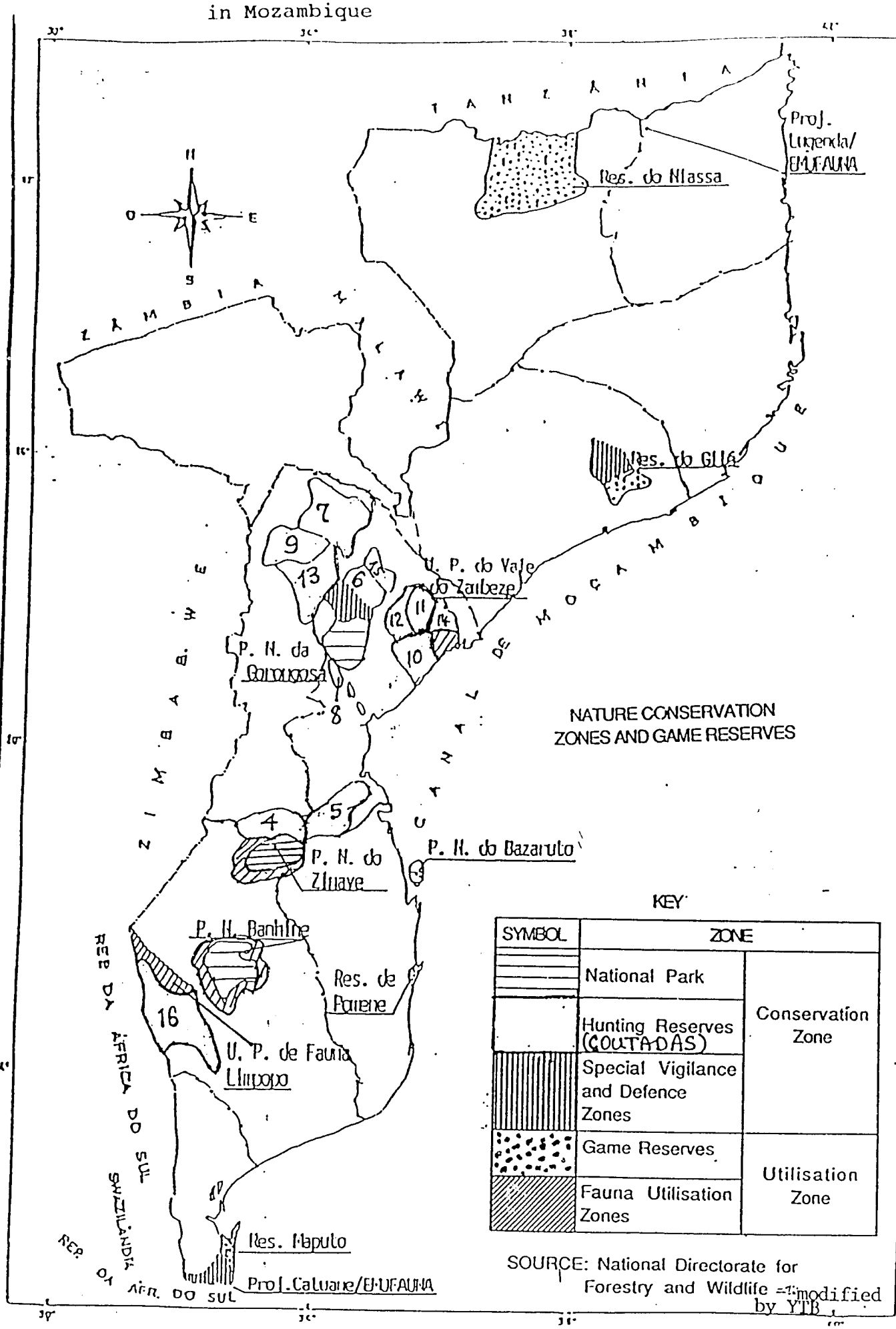
The implementation of fragile area protection programs must be conducted by the GRM itself. Enforcement of regulations to ensure sensitive areas are actually protected is to the ultimate benefit of the people of Mozambique, and must therefore be made a priority. The effectiveness of protection programs is closely linked with integration of local populations to build a feeling of responsibility. Donors should monitor the protection program, assisting it if necessary, and they may even wish to base funding levels on the level of GRM commitment for environmental protection.

Table 1. Classes of protected areas of Mozambique, provinces in which they are located and total surface areas covered.

Class of Protection	Province	Area in km²
National Parks		
Gorongosa	Sofala	5,375
Bazaruto	Inhambane	150
Zinave	Gaza	7,000
Banhine	Inhambane	3,700
	Total	16,220
Game Reserves		
Maputo	Maputo	700
Pomen	Inhambane	200
Marromeu	Sofala	1,500
Gile	Zambezi	2,100
Niassa	Niassa	15,000
	Total	19,500
Reserves (Hunting areas, Special Vigilance and Defence Zones)		
Coutada 4	Manica	12,300
Coutada 5	Inhambane	6,868
Coutada 6	Sofala	4,563
Coutada 7	Manica	5,408
Coutada 8	Sofala	310
Coutada 9	Manica	4,333
Coutada 10	Sofala	2,008
Coutada 11	Sofala	1,928
Coutada 12	Sofala	2,963
Coutada 13	Manica	5,683
Coutada 14	Sofala	1,353
Coutada 15	Sofala	2,000
Coutada 16	Gaza	10,000
	Total	59,717
Forest reserves (14)		2,676
Total area of land under protection		95,067

(Source: Modified from Catterson et al., A provisional program for the forestry/wildlands sector, UNDP/FAO, Maputo - December 1991).

Figure 11. Protected Areas - Biological Resources at Risk and in Relation to Areas of Particular Pesticide Use in Mozambique



SOURCE: National Directorate for Forestry and Wildlife - modified by YTB

5.3. Alternatives to Chemical Pesticides in Sensitive Areas

Farmers living in areas which have been designated as environmentally sensitive should receive training in IPM and the use of control methods which do not involve chemical pesticides, such as pathogens, predators, parasites and parasitoids. These farmers should be encouraged to use traditional methods and should be informed as to how pesticides can be dangerous to both humans and the environment. DSV trainers should have a basic knowledge concerning the relationships between plants and associated animals and the natural balance that binds them together in light of the disruptive effects of pesticides on such balances.

It should also be remembered that several PVOs have in recent years undertaken significant efforts in crop protection research, including evaluation of indigenous and non-chemical methods of control. This activity is reviewed in the SEA prepared under the USAID Transition Program for Pesticide Use and Pest Management (Fisher et al. 1993).

6.0. SELECTION AND MANAGEMENT OF PESTICIDES

6.1. Mozambique Pesticide Regulations

To facilitate the proper and safe use of pesticides, regulations and enforcement are necessary. These regulations cover the importation of pesticides, the distribution to agricultural areas, the actual use of the pesticide, and the disposal of unwanted pesticides and used containers. In essence, pesticide regulations are meant to give the government the mandate to regulate all activities related to pesticides, including importation, distribution, sale and use.

In principle, Mozambique has reasonable pesticide regulatory instruments in place, including a Pesticide Control law enacted in 1987 (see Appendix C). This law controls and regulates, import, sale, distribution and use of pesticides. However, due to shortages of technical staff and expertise at the MOA (Table 2), pesticide regulations are often not properly implemented and enforced. Mozambique laws require the granting of pre-import clearance prior to pesticide import, with the Ministry of Trade issuing permits for importation. Nevertheless, companies such as LOMACO (a joint venture of Lonrho London and GRM) have in the past been involved in illegal smuggling of pesticides from the Republic of South Africa by crossing borders. This was confirmed by the Commercial Director of LOMACO (Mr. Marcos Lucas) while interviewed for this SEA. As the country has very limited manpower to implement its pesticide laws, assistance should be sought from the FAO, particularly in encouraging regional cooperation (FAO/SADCC 1991).

Any locust and grasshopper related assistance to Mozambique by the U.S. that will involve pesticide purchase, transport, application, or disposal, should be controlled, not only by Mozambique's pesticide law and regulations, but also by U.S. pesticide regulations and procedures. Only those pesticides listed on the A.I.D.-approved list for locust/grasshopper control (Appendix D), can be considered, unless this SEA is amended to include other pesticides, for which necessary impact assessments are completed and approved by the Regional Bureau Environmental Officer.

When using pesticides provided by the U.S. or procured with U.S. funds, appropriate instructions and good agricultural practices should be strictly observed. **Inasmuch as several of the USAID-approved locust/grasshopper pesticides are restricted use pesticides in the U.S., it is especially important that only well-trained applicators get involved in the application of these products** (see 6.2.2). Furthermore, no U.S. funds should be used for the purchase, transport, or application of pesticides that have been banned by the EPA.

Finally, it should be remembered that PVOs are assuming an important role in agricultural development and public health during the transition period. The larger ones (e.g., World Vision and Rural Development, and Food for the Hungry International) have respectably-sized technical staffs. Thus they should be constructive participants in any national initiatives with respect to implementation of pesticide legislation, especially in terms of reaching the community level with training and the like. Fisher et al. (1993) describe the PVOs and their involvement in plant protection more fully.

Table 2. Staffing Level of Department of Plant Protection; This table represents only central staff, located in Maputo city and dose not include other DSV technical staff who are stationed at provincial and district offices and phytosanitary posts (Belayneh, 1993).

Section/Unit	No. of Staff	Qualification of Staff[1]	Origin of Staff National/Expat
Administration	1	B.S., seed Pathologist	National
	1	Ph.D.	Expat/DANIDA
Entomology	1	B.S., on a study leave, for M.S.	National
	1	9+3., on a study leave for B.S.	National
	1	M.S., general entomologist	Expat/DANIDA
Biological Control	1	M.S., entomologist	Expat/DANIDA
Plant Quarantine	1	B.S., Biologist	National
(Nematology and Phytopathology)	1	M.S.	Expat/DANIDA
	1	9+3, general sc.	National
Migrant Pests Control	1	9+3, general sc.	National
	1	9+3, general sc.	National
Pesticide Regulation	1	9+3, on a study leave for B.S.	National
	1	M.S.	Expat/DANIDA
Weed (this section is not yet fully formed)	1	6+3	National

[1] 6+3, 9+3 = 6 or 9 years of general education and 3 years of specialized training in the desired field).

6.2 Pesticide Management

6.2.1. Pesticide Procurement and Distribution

Mozambique's pesticide requirements are met through importation of formulated products and in-country formulation of limited types and quantities of pesticides. A state-owned chemical importing company, INTERQUIMICA, has in the past been handling all importations. EMOP, another state owned formulating/manufacturing industry, in addition to other private companies, such as Shell Chemicals Mozambique, takes care of the in-country formulations/manufacturing of pesticides. The former firm no longer plays a major role in the formulation/ manufacturing of pesticides. Distribution and sale of these products have been undertaken by another state-owned pesticide distributing company, BOROR/Commercial. The process of importation, distribution, and sale of agrochemicals was as follows:

> Every year, state owned and private commercial farms, and farmers cooperatives submit their requirements for the following year to BOROR Commercial, with 123 employees. This is done via representatives of BOROR commercial located in each province or district. Then the compiled requirements are passed on to the head office. BOROR forwards the list to the pesticide registration authority for approval. After approval, the list is returned to BOROR. BOROR forwards it to INTERQUIMICA. INTERQUIMICA opens a public bid to all pesticide companies (Ciba-Geigy, ICI, Shell Mozambique, Sumitomo, Mitsui, Agroquisa, etc.) and selects the best bid(s) based on the following criteria: a) low cost, b) product quality, c) timely delivery, d) meeting certain packaging specifications (e.g., different size containers), e) port of delivery, and f) after-sell technical services. Selected bids are forwarded to the Ministry of Commerce which then authorizes the Bank of Mozambique to release funds after ensuring that foreign currency is available. Once pesticides are purchased and imported INTERQUIMICA receives and hands them over to BOROR. BOROR then does the actual sale and distribution.
>
> Locally formulated pesticides are also handled through the same channel. BOROR Industrial, which is under the Ministry of Industry, obtains all the necessary materials for the manufacturing process of pesticides that are needed.

During the 1989/90 and 1990/91 cropping seasons, BOROR distributed through the DSV 6,500 tons of fertilizers, 27,400 kg/l of fungicides, 13,500 kg/l of herbicides, and 95,000 kg/l of insecticides (Appendix J). Currently, BOROR stocks quite a large quantity of fungicides, herbicides and insecticides stored at its south, central and northern stations (Appendix K).

BOROR Industrial manufacturing plant at Mashava, 15 km north of Maputo, also has stocks of various pesticides, including

cypermethrin, endosulphan, sumithion, propanil (Surporcoy), and several others.

Following the Peace Accord that was signed in October of 1992, pesticide importation, sale and distributions have become open to the private sector and **the industry has grown to a $5 to 10 million market**. As a result of free market policy, major private agrochemical companies, such as Ciba-Geigy, Shell Mozambique, Bayer, ICI, etc., are actively involved in Mozambique's pesticide market. The role played by the private sector in pesticide related ventures are encouraging and need to be strengthened (details on the involvement of the private sector in pesticide industry can be obtained from the SEA for the USAID/Mozambique Transition Program PEA (Fisher et al., 1993).

6.2.2. Pesticide Selection

The impacts of pesticides on the environment and associated health risks to humans makes the way pesticides are selected and used an important aspect of management programs. Due to the unique ecology and bio-diversity of Mozambique, pesticides should be used with extra caution, and only when necessary.

To use a pesticide in a specific area at specific times, it is necessary to have detailed knowledge of the physical and chemical attributes of the product, the ecology of the area to be treated, as well as the biology of the target pest or pests. Pesticides intended to be used for locust and grasshopper control, in addition to being approved by FAO, A.I.D, or other regional organizations responsible for the control operation, should possess the following qualities :

- Effectiveness at low application rates;
- None to minimal effects on nontarget organisms, including people and animals, and specifically predators and parasites of locusts/grasshoppers;
- Minimum persistence of residues on and in native fauna, flora, aquatic systems, soil, and crops;
- Low toxicity and ease of handling;
- Good storage capacity and shelf-life;
- Compatibility with existing application equipment.

Although a number of pesticides have been used in Mozambique against locusts/grasshoppers in the past, any pesticide involved in an operation funded by the USG must be approved for use in the United States by the Environmental Protection Agency (EPA). Several approved pesticides are listed in the Programmatic Environmental Assessment (PEA) and this list has been clarified and updated in STATE 118760 (Appendix D), to include nine pesticides. This should be referred to during both the planning and implementation of phases of locust/grasshopper control. In addition, regulations governing

the use of a particular pesticide, as set forth on the label, must be followed.

It is particularly important to note that five (bendiocarb, chlopyriphos, fenitrothion, lambda-cyhalothrin, and tralomethrin) of the recommended, USAID-approved nine pesticides for grasshopper and locust control are Restricted Use Pesticides (RUP) in the U.S. Further, two of the products approved by USAID (acephate and bendiocarb) are apparently not registered in Mozambique. This underlines the need for proper consultation with local authorities prior to making decisions as to use. Also, only properly and fully trained applicators should be using these restricted use products.

Bendiocarb, malathion, acephate, lambda-cyhalothrin and **tralomethrin**) are among the pesticides preferred for use in terrestrial ecosystems and are thus included in the recently updated list of A.I.D.-approved pesticides for locust/grasshopper control.

Acephate would be the pesticide of preference, from an environmental standpoint, for use near aquatic ecosystems as it is less toxic to fish, and is systemic in plants, thus best used for larval control. Acephate can be considered to be one of the safest pesticides in use. However, it should be noted that there is always the possibility for aquatic contamination with any pesticide application; hence care must be taken while handling such products near aquatic habitats.

Carbaryl is toxicologically acceptable, but in certain formulations it is more difficult to store and apply (especially from aircraft), than other approved pesticides and is very toxic to bees. **Diazinon** and **chlorpyrifos** are registered for use and are also included in the A.I.D.-approved list. **Fenitrothion** should be used only with extra precautions and with mitigative measures. This pesticide is known to pose serious adverse side-effects, particularly on avian species. Mozambique has extensive aquatic habitats including rivers, swamps, lakes, artificial dams, and marine habitats. These resources in Mozambique should be protected from pesticide contamination as much as possible and pesticide selection for locust/grasshopper control should be the ones listed as A.I.D.-approved pesticides (Appendix D), particularly when involving funds from USG.

Chlorinated hydrocarbons, such as **dieldrin** and **lindane**, are <u>not acceptable for use under any circumstances</u>, due to their environmental persistence, bio-accumulation, acute toxicity and broad spectrum target range. **It should be noted that U.S.-funds cannot be used in any way whatsoever in connection with these pesticides. This includes funding any aspect of ground application or aircraft which spray chlorinated hydrocarbons, or the transport of such materials.**

Some pesticides in Mozambique are marketed illegally and fraudulently, particularly from South Africa and it is suspected

that such pesticides are not included in the list of pesticides registered in Mozambique (Appendix E). Furthermore, such products may not meet safety and efficacy standards set by the Mozambique's MOA (see section 6.1.). Furthermore, such pesticides may all together be obsolete and banned in the source country.

6.2.3. Pesticide Labeling

Pesticide labeling is a way to give important information to the pesticide user. The label is the main and often only medium for instructing users in correct and safe use practices. The labeling process should go hand-in-hand with in-country pesticide registration. Both registration and proper labeling require good solid legislation at the national level. It is important that the GRM draft further legislation on approval and control of pesticides, including a legal framework that will require more complete pesticide labeling and registration in Mozambique. A strong licensing and labeling program by the GRM would be an important step in achieving safe use of pesticides.

The pesticide product label can be effectively used to communicate a number of important properties of the pesticide and precautions appropriate to its use. In addition to directions for use, the label should include needed protective measures, first aid measures, precautions recommending against use in certain environments, methods of container disposal, and application rates for particular pest species.

Although Mozambique's Pesticide Regulations requires standardized labeling, those pesticides that are illegally smuggled into the country often times do not fit the criteria. In general, pesticides in the original container carry a label with adequate information for application. Some labels, though not all, contain some information on first-aid or disposal. Some of the pesticides stocked by BOROR are in containers that have either lost their original labels or have been stored for such a long time, or mishandled, exposed to sun so that they are faded and illegible.

While labeling must be specific to local needs and the social environment of Mozambique, the FAO has prepared a global set of guidelines which can assist a labeling program. In addition to enacting legislation, the GRM should insist that donated pesticides be labeled in comprehensive language as required by donor country law, and be in Portuguese or some other local languages.

6.3 Managing Pesticide Stocks

One of the basic requirements for managing pesticide stocks is a secured pesticide storage facility. Such facility should include:

- a fenced and covered area for the pesticides and a warehouse that is:

1) isolated from dwellings in order to avoid fire, leakage, and contamination of surface and ground water;
2) supplied with water in order to clean spills and fight fire;

3) supplied with a shower for the people who handle pesticides
4) aerated to avoid toxic fume concentration;
5) regularly inventoried;
6) equipped with protective gear such as overalls, boots, gloves, goggles, breathing masks , and respirators;
7) stocked with a first aid kit with antidotes;
8) staffed with trained personnel who are familiar with diagnosis and treatment of pesticide poisoning.

A management system is needed to record the date each pesticide arrived at the facility, how long it stays in storage, and when it is removed for use. In addition, the storage requirements for each pesticide must be posted and known by the management staff. Stored pesticides must be tested periodically to insure that the active ingredient is as described on the label, and that the formulation concentration is correct. Also the disposal of unused and obsolete pesticides, and the destruction of their containers, must be part of the management system.

Success of locust/grasshopper control campaigns depend on availability of pesticides in the areas which need treatment. Pesticides should be placed in safe and secure storage areas as close as possible to agricultural areas which will likely need treatment. In Mozambique, pesticide storage areas are associated with the DSV Operations Bases and DSV Stations. At the DSV Operations Bases, a monthly inventory of products and materials should be made and sent to the DSV in Maputo and to provincial representatives in major operation centers. Distribution of products to bases is done according to need and severity of the locust/grasshopper threat, as well as the degree of isolation during rainy season. Pesticide stocks must be securely in place at bases and DSV Stations before the rainy season.

The pesticide storage facilities in Mozambique range between stable and precarious. Unwanted stock accumulation is a very real problem, as discussed below. A lack of planning and coordination has resulted in stockpiles of pesticides at some bases, and shortages at others. This seems to be a result of a lack of training in the managerial aspects of pesticide storage.

Storage centers maintained by DSV are believed to be somewhat safer than most of the DSV storage areas. Simple storage safety measures could be implemented to greatly increase the efficacy of the DSV storage facilities. These include keeping stocks secured and out of the weather, posting warning signs in Portuguese and other local languages, and preventing the storage of pesticides in living quarters.

In addition to management of the pesticides themselves, the DSV stations must adequately manage pesticide application equipment. Due to inconsistent donor contributions, Mozambique has accumulated several different types and brands of spray equipment. This equipment is rarely interchangeable or compatible in regard to spare parts and repair. Nevertheless, the DSV Stations must work to maintain what equipment it does have, and ensure that it is clean and in good working order.

This SEA recommends that DSV improve its pesticide storage practices. Among the changes that should be instituted are:

1) use those pesticides stored in damaged drums first and handle drums more carefully in the future so they will not become damaged;
2) do not accept any unlabeled containers;
3) store all containers on pallets away from the walls, label all batches with date-in and planned date-out, and practice the principle of "first-in-first-out;
4) impose more rigorous handling practices to prevent spillage; and
5) install a sun shade to minimize direct exposure of containers to the sun. These practices should apply to all storage areas, regardless of size.

6.3.1 Obsolete Pesticides and Pesticide Containers

Due to lack of appropriate technology for safe handling, and because Mozambican farmers often times find alternative uses for them, empty containers are found in and around residential areas. Actually such containers are not fit and should not be used by the farmers for any purpose whatsoever; instead, they should be returned to original suppliers for appropriate use or disposal.

Once the pesticide has been used, the management operation is left with empty containers. Such containers <u>should never be used to store water, food or animal feed</u>. Even though the pesticide is gone, enough residue is left to cause poisoning, especially in the very young or old. Further, small quantities of pesticides will make the human body more susceptible to other diseases.

Several of BOROR's Stations have storage problems mainly due to the accumulation of pesticide stocks which were not used in the prescribed season and thus have become too old to be used or which have been banned and cannot be used. In many cases, containers are deteriorating, and pesticides have leaked into the floors, earth, and local environment, necessitating either disposal and under very few cases repacking. A very good example of sub-standard storage condition was the one observed by the author of this SEA, in a place called Matola, a small town about 15 km from Maputo (Table 3). This storage facility is owned by BOROR. It had a few offices, one 30 m x 50 m x 5 m warehouse. In the warehouse were stored insecticides,

fungicides, rodenticides, eggplant and watermelon seeds (supplied by USAID as part of the "Vegpacks" and distributed to farmers by NGOs during the drought in one-pound and half-pound cans), herbicides, veterinary chemicals, protective equipment, knapsack sprayers, cotton, tires, old files, an office space partitioned by wire screen and a desk and a chair for the warehouse keeper, all in one place. The warehouse had a cemented floor and a tin roof and the roof had holes in it and puddles presumably from rain was observed on the floor and on a few pesticide drums.

The author also visited a private pesticide formulation plant and storage facilities about two miles away from BOROR's storage site. These facilities were apparently in a much better condition. Pesticides were kept in properly labelled containers placed in well-ventilated warehouses. Protective equipment, first aid and cholinesterase test kits were also placed in a room adjacent to the warehouse. Empty containers were clearly labelled and placed outside the warehouse on a concrete floor awaiting disposal and/or re-use.

In Mozambique, empty pesticide containers are reportedly refilled with pesticides, reused by the petroleum industry or are split open to be used for roofing or other construction material. It is recommended that if containers are recycled at all, it be for reuse with pesticide formulations under strict supervision and only when appropriate facilities are available. **The use in construction and for other purposes which involves high probability of human contact is strongly discouraged.**

As much as possible, container sizes should be compatible with reuse requirements. Making pesticides available in small containers, for example, one liter size, which provide an increased potential for subsequent use as cooking or storage of water, should be minimized and their use should be under strict supervision c the DSV or PVO staff and other appropriate bodies. In addition, the DSV should periodically inspect the reformulation facilities to ensure proper handling and packaging procedures are in use.

The system of crop protection in Mozambique, in which all pesticides have been the property of the state, should theoretically result in effective management and disposal of old empty drums. In the past, all containers technically belonged to the government and should therefore be removed from the field when empty. The Ministry of Agriculture in collaboration with previous owners, should ultimately be in charge of disposal of such drums. However, currently, expertise and facilities to handle these drums are lacking.

Table 3. List and Quantities of Obsolete Pesticides[1], Stocked in the Warehouse of BOROR Commercial at Matola - Mozambique (1993).

Local Trade Name[2]	No. Units	Unit (liters)	Total (liters)
Toxafeno (I)	4,428	25	110,700
Maladrex	29	200	5,800
Avirosan (A)	3	100	300
Karatane (F)	4	200	800
Cipermetrino (I)	6	100	600
Dacdiy	5	200	1,000
Diptrex (I)	80	50	4,000
Surporcoy	10	200	1,000
Coeywr Arbun	19	20	380
Abate (I-M)	50	25	1,250
Qualotox (A)	9	200	1,800
Propanil (H)	17	200	3,400
			131,030

[1] These products have been stored for over 10 years (Watt, 1993 personal communication, see list of persons interviewed).

[2] Type of product, if known: A = granivorous bird control (avicide); F = fungicide; I = Insecticide; I-M = Mosquito control

6.3.2. Disposal of Unwanted Pesticides and Empty Containers

Pesticides whose active ingredients have degraded due to heat, humidity or prolonged storage and have lost their efficacy or banned or are undesirable become no longer usable or needed Such pesticides become environmental hazards and need to be disposed. Although a complete account of the total quantity of obsolete pesticides is currently not available for Mozambique, a recent inventory has shown that over 132,000 liters, of which over 110,000 liters is Toxaphene (chlorinated hydrocarbon), exist in BOROR's storage facility in Matola alone (Table 3). As the majority of the obsolete chemicals are liquid products, one disposal method is high-temperature incineration at a suitable facility. Incinerators in Europe or other countries may also be used for disposal operations.

While conducting this SEA, the author learned that private pesticide manufacturers are taking the lead in removing old stocks. Shell Mozambique, for example, has recovered 95 metric tons of obsolete pesticides, mainly monocrotophos and DDT formulations, old

pesticide containers and 35,000 kg of sand that was used to remove the pesticide which have been repacked and are awaiting shipment to the U.K. for incineration. According to the Shell General Manager, the whole process cost the company nearly $400,000 and the shipment is expected to cost at least twice this amount. Another company, Ciba-Geigy, is in the process of buying back some 5,000 to 6,000 liters of monocrotophos that was sold to the District Agricultural Program about 15 years ago and which have become obsolete, for disposal. While these activities are considered responsible and encouraging, the author emphasizes that other companies have shown an interest in proceeding with the disposal tasks at hand.

Although well documented information is lacking, it is reasonable to expect that substantial quantities of obsolete pesticides are on hand in the former state owned large-scale farms. It is clear that Mozambique does not currently have environmentally sound pesticide disposal options. Nevertheless, this SEA proposes that DSV, in collaboration with the MOH and CNA, should take the initiative and approach FAO and international development agencies and donors for assistance with a clean-up campaign.

6.4 Current Pest Management Practices and Options

Numerous non-chemical methods exist for pest management in general, and many have been used successfully against locusts/grasshoppers. For example, crop varieties which develop at different rates from the commonly planted varieties, or which show resistance to insect attack may be applicable in the long-term. Other cultural methods, such as trap cropping, residue burning, trench digging in front of locust/grasshopper nymphal path, and inter-cropping may well have merit as well. Simple techniques such as using protected courtyards for tree seedling nurseries or covering seedlings with mosquito netting can be effective in small scale and limited cases.

Farmer experience with traditional or innovative control methods should be encouraged and incorporated into the overall locust/grasshopper management program. If villagers are recruited to participate in pest control efforts, through village brigades, crops can be protected with a minimum of pesticide use and expense.

Research on the field use of microbial agents in locust/grasshopper control is currently being conducted by Montana State University through A.I.D. funding and by other international organizations. The fungal pathogen Beauveria bassiana has been tested in the U.S. and in parts of Africa for its control potential. Preliminary results from Cape Verde, Mali and Madagascar indicate that Beauveria and Metarhizium can be important biological control agents.

In working with microbial pest control agents, attention must be given to handling and application techniques. Some may have a

short shelf life and must be used soon after production. In addition, the climatic and environmental conditions will impact on the microbial control agent. Formulation appears to play an important part in the longevity of the material under field conditions.

Mozambique's DSV has shown strong interest and inclinations towards adopting IPM programs, including focused development of biological control agents and other agronomic practices in its pest control operations (personal communication with Head of DSV). The MOA's DSV and INIA should be supported in developing applied research programs, including exploration for local and possibly more specific pathogens for locusts/grasshoppers, as well as for other important pests. This could be done in collaboration with the University of Eduardo Mondlane to involve future DSV staff and also involve regional (e.g., IRLCO/CSA) and international organizations that pursue such activities.

Mozambique's rich flora, including considerable number of trees such as neem that are known to posses pesticidal properties, encourages the search for the development of plant-based pest control agents that may posses the potential for use as part of IPM programs. As many of these materials are already being used by villagers as a traditional means of pest control, research in this area could be a worthwhile venture.

Other fruitful research areas might include use of synthetic insect growth regulators. These agents are considered alternatives to conventional pesticides because of their different mode of action. However, there may be adverse impacts on non-target aquatic invertebrates.

Due to their toxic nature, pesticides will have impacts on both agroecosystems and nearby ecosystems. Care must be taken during the handling, transport, application, and disposal process to minimize ecological disruption in both target and non-target areas. In addressing this issue in regard to operational planning, risks to the environment must be considered in terms of early intervention versus reactive large scale operations. The latter would involve considerably greater amounts of pesticide, and correspondingly higher risks.

Because of the additional risks associated with late season control operations, management operations designed to avoid such risks are encouraged. Early survey and pest management can prevent later more expensive control operations, with significantly less pesticide usage. Preventive management operations with attention on survey operations aimed at locating and delimiting pest populations, and spot treatment operations intended reduce population numbers using as little pesticide as possible are favored.

By reducing the number of hectares sprayed, early control operations use less fuel and pesticide. Because the early control strategy potentially involves considerably fewer resources than larger-scale emergency or curative treatments, the DSV would be better able to implement it without donor assistance. This should promote a greater degree of self-dependence and control of the situation by the DSV itself.

If pesticide use is necessary, the type of ecosystem in the treatment area, and associated non-target species should be major factors determining the choice of pesticide. A pesticide's characteristics, such as selectivity, mobility in ground water, persistence, and metabolic products should be considered as important as effectiveness against target species. In addition, alternative application methods should be considered, with ground application having less impact than aerial treatment. Bait application methods have been highly effective in appropriate situations as well, and tend to be less problematic environmentally.

The response of different animals and ecosystems to pesticide exposure varies dramatically. For example, carbaryl has only low toxicity to birds, but is extremely toxic to aquatic invertebrates and certain estuarine organisms. While application of carbaryl may be appropriate in areas providing upland habitat for birds, its application in areas important to waterfowl and migratory shorebirds, such as national parks or reserves in Mozambique's coastal and riverine areas, should be prohibited.

Although this SEA strongly recommends against any pesticide applications in aquatic systems, acephate is relatively nontoxic to freshwater fish and invertebrates and is the least likely of the selected pesticides to have adverse effects on aquatic habitats. Acephate should be one of the preferred pesticides if applications are necessary adjacent to aquatic systems, particularly in and around fragile areas, or critical animal, bird or fish habitat. Due to its mobility in soils, however, acephate has the potential to contaminate ground water.

7.0. PESTICIDE IMPACT EVALUATION AND MITIGATION

7.1 Pesticide Toxicity in Human Populations in Treatment Areas

The potential for adverse effects on human health increases significantly when pesticides use is high. When large areas of the country are treated and large amounts of pesticide products are being shipped, distributed, and applied, the probability of human (and the environmental) exposure is proportionately greater. This SEA advocates prevention of human exposure as the best approach to minimizing adverse health impacts. A major aspect of prevention is to keep locusts/grasshoppers at low population levels with preventative control strategies, through regular survey and monitoring procedures.

This SEA urges training, educating, and supervising the applicators as the most effective way to ensure that exposure of the general population is kept at or below an acceptable level. Such training and supervision has to be a continuous effort and has to be detailed enough to differentiate among individual pesticide active ingredients, formulations, and application methods.

The general public is at minimal risk if the necessary precautions are taken, but should nevertheless be informed about pesticide application against locusts. This can be achieved by a number of means, such as posters, the radio, local newspapers, Televisions. **Currently the MOH's Public Health Unit is undertaking encouraging steps in collaboration with the MOA in education of the general public on the effects of pesticides, and this should be continued and enhanced.** Public health advisories given by radio broadcasts were effective in other countries prior to past aerial applications and should be included in plans for future applications. This is especially important in areas where people may eat locusts/grasshoppers. It also should include public education about the dangers of improper pesticide container reuse.

Pesticide applicators are generally at the highest risk for any adverse effects, and are several orders of magnitude higher than the general population since they are often handling <u>concentrated products</u>; increasingly, this includes ultra-low volume (ULV) insecticides. In addition to the training and supervision indicated above, applicators should be thoroughly familiar with the level of danger from the pesticide, and should be provided with equipment that is in good working condition in order to minimize accidents. Such equipment may include pumps to transfer pesticides, body protection in the form of gloves, aprons and safety shields for the face to prevent dermal exposure and respirators to prevent inhalation boots to prevent pesticide contact with legs and feet.

It is particularly important that some form of protection is worn during the short periods while handling the concentrates. If at all possible, long sleeved shirts and pants should be used, and

washed after each use. Appropriate logos, patches or other attractive designs/messages with teaching value on the protective clothing items can help to induce safe use and care.

Exposure of applicators is mostly through the skin. Though the skin usually provides a significant barrier to the entry of some pesticides, even those penetrate into the body if the contamination is left on the skin. In addition, some pesticides penetrate the skin more readily. Therefore, applicators should wash any exposed areas of their bodies frequently.

7.2 National Capacity in Public Health Provisions

The public health delivery system in Mozambique is insufficient to handle severe pesticide poisoning cases. This SEA has found that there apparently is no single toxicology or related unit in the hospitals in Maputo equipped to adequately address pesticide poisoning. Regional level hospitals do exist, as do smaller village clinics and health centers (Table 4). However, doctors or nurses are not trained to recognize pesticide poisoning and to use drugs and other forms of treatment necessary. All hospitals and clinics in an area which is likely to be involved in a pesticide spray operation should be provided with information materials on the pesticides to be used in the area. The personnel of these centers should be given the necessary training to recognize and treat pesticide poisonings.

Table 4. Basic Data on Health Facilities and Personnel in Mozambique in 1989.

Health Facilities	Number	Beds	Physicians	Nursing/ Cadres
Hospitals:				
Central and	3			
Provincial	7	4,678	249	1,186
Health Unit:				
General	4	612	50	557
District	21	1,784		
Health Centers	224	4,179	30	1,288
Health Posts	934	1,002		

(Adapted from MOH - Planning Department, Maputo, Mozambique, 1989).

Because the local health care system in Mozambique is not equipped to handle serious pesticide poisonings, application crews need to be self-sufficient in handling medical emergencies Supervisors must be familiar with safe handling of pesticides an be able to administer any needed first aid, including antidotes for pesticide poisoning. All who are working with pesticides should be familiar with the early warning signs of poisoning. Workers must be removed from contact with pesticides at the first signs of poisoning.

In conjunction with any A.I.D. assistance regarding locust/grasshopper control efforts, it is important that the Government of Mozambique monitor both human health and the natural environment. In regard to protecting human health, it is necessary to train both the medical community and pesticide applicators of the potential hazards of pesticides, and steps to mitigate any problem that may surface. Application of a pesticide in a given area should be preceded by public awareness and extension activities and education of the users. Mozambique's public must be informed that pesticides are dangerous and that empty pesticide containers should be not be used for food or water storage. A good public information program should include:

- information on the specific pesticides and labels;
- safe methods of pesticide transport and storage;
- measures in cases of container leakage;
- conditions for pesticide use;
- safe use of application equipment;
- prevention of pesticide poisoning.

7.3. Education and Training of Target and General Populations in Pesticide Safety Measures

Pesticide educational programs should also be instituted by Health Engineering and Sanitary Service agents. Health education and extension programs can also provide information on first aid in pesticide poisoning cases. The inherent toxicity of used pesticide containers is an important subject area, and should be specifically directed to women who are apt to use the containers for cooking or holding water. Components of a pesticide public awareness program should include photographs, posters, and prints on cloth. These should be given to agents as visual aids to hang on walls of schools, dispensaries, and on large trees in villages and towns.

Radio broadcasts are an important part of a public information campaign, including pesticide awareness information in the form of brief safety announcements, musical programs, interviews, debates, and dramas. Discussions of pesticide regulations and legislation should also be presented, including information on which pesticides are legal and which are prohibited in Mozambique. This will allow potential buyers and users to know what pesticides should be accepted and what should be refused.

7.3.1. Applicator Safety Training

A.I.D. has supported DSV pesticide safety training in the past in Africa, and has found this to be a useful and often sustainable use of funds. It is important that well trained DSV agents are available in Mozambique to work with any U.S.-funded pesticide donation.

Hands-on pesticide safety and application training courses should be incorporated into the academic course of plant production and protection fields of study. This approach will allow trained individuals to interact with the actual users of pesticides.

Properly trained DSV, and agricultural extension agents are encouraged to work with farmers and village brigades when such brigades are available or with farmers' representatives when the former groups are non-existent, in "Train-the-Trainer" programs. This type of training will allow essential information on pesticide safety and application to reach all who may be working with pesticides.

7.4. Pesticide Monitoring: Human and Environmental Exposure

Pesticides do increase agricultural productivity and are thus a useful part of agricultural production. However, when misused by farmers and other applicators, they can present hazards to the humans and the environment. Often, pesticides intended for agricultural or public health purposes may be misused for fishing, hunting, and general household insect control which increases the hazard of such products. By placing **strong emphasis on "good and safe practices" in pesticide use**, a large step is taken towards mitigation and avoidance of problems in the first place, and this will **reduce the need for initiating resource-intensive monitoring efforts.**

7.4.1. Monitoring Human Exposure

Simple and effective health monitoring of those involved in pesticide handling, application, and storage is essential to a good management operation. This involves teaching all involved with pesticides what the symptoms of pesticide poisoning are, and when first-aid might be required. It is especially important to use behavioral observation to decide if workers should be immediately removed from pesticide exposure.

In addition to the potential for unsafe application, pesticides may also affect public health by being stored improperly. It is important to **keep stored pesticides in good condition, away from humans and other animals.** Any unwanted or leaking pesticides must be repacked or disposed of as soon as possible. Because pesticides have the potential for misuse, it is essential that existing legislation on pesticide use be enforced. While abuse may still

occur, implementation of regulations will provide a sound base for promoting public health and environmental integrity.

It is doubtful that the GRM/MPCU has the capability to routinely monitor either the behavioral symptoms of pesticide poisoning, or such blood-chemistry manifestations such as acetylcholinesterase (AChE) inhibition. Because of this, any pesticide operations should include the testing of pesticide handlers for blood AChE inhibition. This is a fairly simple and inexpensive test, and can be performed by trained health workers in the field. The background cholinesterase level for each person involved with pesticides must be determined prior to exposure, and testing should be performed at intervals throughout the season to ensure that no worker is being overexposed to pesticides. It should be noted that testing AChE is recommended only when pesticides in the organophosphate class are used (malathion, fenitrothion, etc.).

A Lovibond test kit for an initial 1000 samples can be obtained and used for monitoring the individuals most exposed to organophosphate pesticides. The School of Public Health in Maputo is currently sending its students to the MOH and other ministries to do collaborative projects. Likewise, monitoring pesticide impacts on human health could be incorporated into the study programs of the students of this and similar other Schools. Monitoring for actual symptoms of pesticide exposure, and environmental residues after pesticide applications, should also occur.

In areas of wide-spread heavy pesticide use, epidemiological case control studies are often useful to detect untoward human exposure. But such studies are difficult under the most ideal conditions which monitor the health and the environmental conditions of the participating individuals on a regular and continued basis over a period of several years, possibly a life time. This is believed not to be possible in Mozambique at this time. Perturbations of the already complex health conditions of the rural Mozambican population from occasional and minimal pesticide exposures would not be manifested in epidemiological investigations.

7.4.2. Monitoring Environmental Exposure

Measurement of residue levels in the environment can also be valuable information for assessing exposure and determining if modifications to treatment operations are needed. However, Mozambique's DSV does not have either the technical capability or the required equipment to conduct residue analysis for environmental monitoring as well as quality control. It is true that National Laboratory of Hygiene, Food and Water of the MOH possesses a Gas Chromatograph, but due to the heavy demand for it in other analytical work, it seldom accepts requests for pesticide analysis. In any case, anything other than an instrument dedicated specifically to pesticide analytical work would not be advisable.

Measuring pesticide residues in the environment is, in principle, an excellent way of monitoring, and will require a residue analysis laboratory for full implementation. Anti-locust/grasshopper pesticide programs should incorporate residue analysis where appropriate into project plans, and should include qualitative behavioral observations of non-target organisms near any pesticide target areas. Mozambique's DSV applicators must be trained to note unusual behavior among fauna of the area.

Aquatic systems are often critical habitats for sensitive species and migratory birds. Therefore, pesticide use near such habitats should be avoided wherever possible. Care must especially be taken when pesticides are applied during or close to the time of seasonal rains. This may lead to introduction of the pesticide into water supplies or aquatic systems in runoff. Because invertebrates are generally much more sensitive to insecticides than vertebrates, monitoring the observable effects of pesticide use on invertebrates, such as benthic organisms, should be the preferred method for monitoring aquatic habitats. Vertebrates, however, should not be ignored, as pesticide effects on them may be indirect, but no less severe.

A similar monitoring approach should be used for pesticide use in terrestrial ecosystems. Selection of soil microorganisms or other low tolerance invertebrates as indicator species is recommended. Monitoring animals of economic value or threatened status should also be required. In cases where pesticide persistence is an issue, residues should be measured. Populations of vertebrate predators, such as birds of prey, are likely to fluctuate too much to make population counts an effective monitoring tool. However, reproduction monitoring of carnivores (e.g., observations of egg conditions, birth defects, infant mortality) may be a useful tool in determining the effects of pesticides known to effect reproductive success, particularly in cases where baseline data are known.

8.0. RECOMMENDATIONS AND FINDINGS OF THE SEA

8. 1 Outline of Supplemental Environmental Assessment Recommendations

The following recommendations are listed in a fashion consistent with and in same order as the 38 recommendations in the Programmatic Environmental Assessment for Locust and Grasshopper Control in Africa and Asia (TAMS 1989). They are structured to provide a prioritized approach to response in the event the USAID Mission in Mozambique considers support for locust/grasshopper control in Mozambique.

The following list provides the outline of the recommendations as organized in the following tabular presentation, with the topical subheadings.

I. OVERARCHING RECOMMENDATION

- Support locust and grasshopper control programs, with emphasis on Integrated Pest Management approaches.

II. TOP PRIORITY IN OUTBREAK SITUATIONS AND FOR PREVENTION & MITIGATION

- Inventory and mapping procedures
- Mitigation of non-target pesticide effects
- Proper application of insecticides

SECTION III: HIGH PRIORITY TO BE IMPLEMENTED AS SOON AS RESOURCES CAN BE ALLOCATED

- Disposal of pesticides
- Pesticide formulation and management
- Biological control
- Training and human resources
- Economic & cost benefit considerations
- Pesticide and environmental policy
- Pesticide handbook
- Support and training

SECTION V. DESIRABLE BUT NOT OF SAME URGENCY AS THE ABOVE, UNDER OUTBREAK CIRCUMSTANCES

- Proper pesticide storage
- Forecasting & early warning
- Public health monitoring
- Applied research

SECTION VI. PROCEDURES TO FACILITATE AND ACCELERATE DEVELOPMENT AND IMPLEMENTATION OF RECOMMENDATIONS

RECOMMENDATIONS AND FINDINGS OF THIS SEA FOR LOCUST/GRASSHOPPER CONTROL IN MOZAMBIQUE

	RECOMMENDATIONS BASED ON PEA	FINDINGS AS APPLICABLE TO MOZAMBIQUE AND THIS SEA
GROUP I. OVERARCHING RECOMMENDATION		
1	USAID should continue its involvement in locust and grasshopper control. Operationally, the approach to be adopted should emphasize prevention and evolve toward one of Integrated Pest Management.	In principle, this Supplementary Environmental Assessment (SEA) endorses IPM as a strategic approach to crop protection which can also minimize adverse potential impacts of pesticides on public health and the environment. Commitment to IPM can lead to sustainable capacity in the host country to deal with locust, grasshopper and other pest outbreaks which regularly will threaten crop production. It emphasizes building up the longer-term capacities of the farmers, non-governmental organizations and appropriate governmental agencies so that they can assume responsibility for prevention and treatment of outbreaks with an array of options. The GRM Department of Crop Protection (DSV), with the support of DANIDA's Plant Protection Support Project, is strongly committed to IPM. USAID could identify ways to be supportive of the longer-term enhancement of plant protection capacities of NGOs and farmers, such as through its PVO Support Project. It may be possible to identify programmatic linkages with the USAID/Mozambique 1994-1999 Country Program Strategic Plan under development.
GROUP II. TOP PRIORITY IN TIMES OF OUTBREAK		
	INVENTORY AND MAPPING	
2	Inventory and Mapping of Environmentally Sensitive Areas: an inventory and mapping program is needed to determine the extent and boundaries of environmentally fragile areas with respect to probable locust and grasshopper outbreak areas.	While specific areas to be protected in the event of an outbreak can be generally identified (e.g., Figs. 6-11, Section 5), the information available is imprecise. Decrees and legislation that protect conservation areas, including national parks, game reserves, hunting areas (Coutadas), and forest reserves that were passed during colonial period (in 1950's and early 1970's) are still in existence, and an effort to rehabilitate them is underway. In addition, Mozambique is currently working hard to develop a wide range of environmental and natural resources laws and standards. For instance, its pesticide regulations are being continuously improved. This SEA recommends that while the current trend of developing regulations and laws is encouraging, a fully functional regulatory structure should be implemented; this will help minimize adverse side effects that may result from locust and grasshopper control activities and programs.

3	A system of dynamic inventory of pesticide chemical stocks should be developed.	The need for an appropriate inventory and record-keeping system is clear and highly recommended. Given its privatizing economy, Mozambique will need a fully functional pesticide registration, stock survey and management process/system. This is needed at all levels, and would be especially useful to help manage pesticide flows during pest emergencies. It also would reduce the risks of further aggravating the obsolete pesticide stocks problem (Rec. #4) by minimizing the amount that pesticide products becoming unusable and thus needing to be disposed of, and will minimize environmental and health hazards. It is now GRM policy, as a rule, to discourage subsidies for agricultural inputs such as pesticides. An adequate assessment is needed of the pesticide inputs sector as to the respective roles and needs of the private and public sectors. This policy of avoiding subsidies will need to carefully applied in the case of the smallholder farmer.
4	USAID could take active part in assisting Mozambique to identifying alternate use or means of disposal of pesticide stocks.	Mozambique has significant quantities of obsolete pesticides (Sect. 6.3.1). For instance, over 131,000 liters/kg of a variety of pesticides (Table 3) which have been stored for up to 15 years or more by the former parastatal agricultural chemical importation and distribution company (BOROR) (Table 1), which is likely only the tip of the iceberg. Although hard facts were not available during preparation of this document, the author of this SEA has gathered from various sources that substantial amounts of leftover stocks of now-unusable (mostly obsolete) pesticides that need to be disposed immediately probably exist in major agricultural regions around the country. The recent activities of Shell and plans of Ciba-Geigy chemical companies in retrieving (buying back) and shipping old stocks from Mozambique should be encouraged. Appropriate disposal options and technologies that are suitable under Mozambique's conditions should be searched for and used. Moreover, for other stocks that are not currently used for the intended purposes and are anticipated to remain stocked for some time, alternative ways in which they could be put to profitable use should be identified. This might most usefully be done in connection with the FAO Obsolete Pesticide Disposal Project
5	FAO should establish a system for the inventory of manpower, procedures and equipment.	This recommendation holds to the extent that FAO and other regional organizations (such as IRLCO/CSA) relevant to migrant pest control can be involved in strengthening Mozambique's Migrant Pest Control Unit, in collaboration with other sister agencies. The activities of the national level Red Locust unit situated in Beira area needs strengthening, and its mandates need to be revised, to encompass other areas in the country where locusts are threats. USAID/Mozambique may identify ways of being supportive through its PVO Support Project, as the NGO/PVOs in the provinces are most likely to be involved in l/g responses.

	MITIGATION OF NON-TARGET PESTICIDE EFFECTS APPLICATION OF PESTICIDES	
6	There should be no pesticide application in environmentally fragile areas and human settlements.	Any future donations of pesticides for emergency use should be accompanied by an Action (Operations) Plan which specifies that use in protected and other sensitive areas is not allowed, and limiting use in others or requiring appropriate buffer zones. In the case of aerial application where wind-driven drift is likely, a buffer zone of a minimum of 2.5 km wide is recommended; under still-air conditions, a buffer of 500 m may be reasonable. These areas include such as Gorongosa, Bazaruto, Maputo, and other national parks, game reserves, as well as water courses, estuarine and coastal regions. Any program funded by USAID/Mozambique involving pesticide use for the control of locusts and/or grasshoppers should follow applicable Mozambique regulations concerning the protection of designated areas. This SEA supports the GRM commitment to protect the natural environment, and emphasizes the importance of observing such directives in the use of pesticides accordingly.
7	Whenever possible, only those pesticides that have minimum impact on non-target species should be used.	This SEA stresses pesticide procedures that will tend to minimize use and mitigate adverse impacts; the nine pesticides identified in this SEA are the only ones sanctioned thus far by USAID, although FAO and others may endorse the use of others. Research results are likely to identify more environmentally safe pesticides and procedures for the future. USAID/Mozambique may wish to encourage research in Mozambique in the area of biological control, including exploration for indigenous strains of natural enemies of locusts and grasshoppers. Also, investigations are encouraged to identify and evaluate alternative and traditional control methods which could be made more broadly available.
8	Pre- and post-treatment monitoring and sampling of protected organisms and water and/or soils should be carried out as an integral part of each control campaign.	Any control campaign needs to establish whether a treatment has been effective. For major emergency campaigns, pre- and post-sampling is especially important. Special monitoring is important both as a basis for design of effective control operations as a means of establishing statistically verifiable baseline data. In addition, periodic "sampling" observations of gross mortality, populations and behavior should be made at locations of major use of pesticides. The results of ecotoxicological research on locust control chemicals in Morocco and Senegal are becoming available. For example, preliminary results of recent studies in Senegal (FAO's LOCUSTOX project) indicate that some impacts occurred at twice the recommended rate but little impact occurred at the recommended rate of application of the most environmentally detrimental pesticides, routine environmental monitoring of every use by individual farmers is not considered essential. Increased training to prevent excessive use is considered essential, however.

	APPLICATION OF INSECTICIDES	
9	One of the criteria to be utilized in the selection of control techniques should be a minimization of the area to be sprayed.	This could be achieved through a number of operational procedures, including: (1) intensive surveillance to allow preventive, early treatment only when economic threshold is approached, or postponing treatment until densities, damage potential, or gregarization occurs, as the case may be; (2) providing training in how to recognize and define target treatment areas, and educate decision-makers on the importance of reduced use of pesticides; (3) evaluation of effectiveness of treatments to help refine future intervention decisions; (4) identifying areas that should not be treated, or should receive minimum treatment (protected areas, wetlands, etc.) to ensure exclusion of such areas from pesticide treatment; (5) in cases where the decision not to conduct spraying leads to substantial crop loss in a given area, some type of compensation should be given to the affected population.
10	Helicopters should be used primarily for survey to support ground and air control units.	When aerial treatment by helicopter is indicated, it should only be when very accurate spraying is necessary, such as close to environmentally fragile areas or for localized treatment. Helicopters are also useful for pre-treatment surveys and to pinpoint treatment sites. Ground application is the preferred modality in most cases.
11	Whenever possible, small planes should be favored over medium to large two or four engine transport types (for application of pesticides). In all cases, experienced contractors will be used.	Any treatment program in Mozambique should continue to emphasize ground application. Inasmuch as possible, thorough pre-treatment assessment and planning should be done to avoid contact with fragile habitats, such as national parks and game reserves. In any case, large aircraft will rarely be justifiable.
12	Any USG-funded locust/grasshopper control actions which provide pesticides and other commodities, or aerial or ground application services, should include technical assistance and environmental assessment expertise as an integral component of the assistance package.	Significant locust and grasshopper emergencies in Mozambique will, for the foreseeable future, probably require assistance to help farmers avoid catastrophic losses. Any USG assistance is likely to involve the NGO/PVO community, in addition to the various regional locust control organizations, working with the GRM. Specific areas of T.A. particularly for environmental assessment and mitigation will likely be required until such time that Mozambique's environmental regulations and the current regulations on pesticides become fully functional and long-term national capacity is adequate. (See also Recommendations 27 and 30.)

13	All pesticide containers need to be appropriately labeled.	The GRM should emphasize and monitor enforcement of the appropriate section or sections of the current pesticide regulation that deals with this issue -- Ch. IX, Art. 65-71 (see Appendix C).
GROUP III: HIGH PRIORITY, TO BE IMPLEMENTED AS SOON AS RESOURCES CAN BE ALLOCATED		
	DISPOSAL OF PESTICIDES	
14	USAID should provide assistance to host governments in disposing of empty pesticide containers and pesticides that are obsolete or no longer usable for the purpose intended.	Mozambique currently appears to have significant stocks of obsolete pesticides and there is a potential problem in the country that is likely to result from the use of empty pesticide containers for food stuffs, water, etc. **It is encouraging to know that some of these stocks are being handled for appropriate disposal by private chemical companies** (see section 6) and this SEA commends these activities. As a short-term plan, USAID/Mozambique could encourage the MOA and the DSV to survey and monitor obsolete stocks and search for options for disposal or at least mitigate the hazards they pose, preferably by transporting these products to designated centers for appropriate disposal later.
	PUBLIC HEALTH AWARENESS	
15	USAID should support the design, reproduction and presentation of public education materials on pesticide safety (e.g., TV, radio, posters, booklets). This would include such subjects as safely using effective pesticides, ecology, pest management of locusts and grasshoppers and the hazards of pesticides. The goal would be to help policy makers and local populations recognize potential health problems related to pesticide applications.	The current collaborative activities of the MOA/DSV and MOH/DHE in public education through posters and leaflets and by providing pesticide guidelines, and other related activities should be encouraged; capacities of these agencies could be enhanced. (See Section 7.1). Also, emphasis should be placed on safety training among private suppliers of pesticides. Mozambique also needs to strengthen national pesticide organizations, and should work with the private sector to ensure the correct use of imported pesticides. The Association of Agrochemical Importers of Mozambique (the draft constitution of which was still in the hands of the MOA while this SEA was in preparation) will go long way towards giving transparency to the process of pesticide movement into the country.
16	Training courses be designed and developed for health personnel in all areas where pesticides are used frequently.	The collaboration mentioned in Rec. 15 should be extended to the training of the pesticide applicators. USAID/Mozambique should encourage the current plans and activities of the MOH/DHE and MOA/DDP to provide health staff and others who are likely to handle pesticides with the necessary technical knowledge and training to address these issues.

17	Health centers and dispensaries located in an area where pesticide poisonings are expected to occur should be supplied with materials to diagnose and treat specific poisonings.	Collaboration between DSV and DHE already has strong beginnings in Mozambique, as indicated in Recs. 15, 16 and Sect 7.1. The centers and dispensaries should be provided, prior to spraying, with printed materials, training, and with those medicines and antidotes required for treatment of pesticide poisoning cases. **PVOs also should be equipped with small kits with antidotes, and should prominently post telephone numbers for the nearest medical help.**
18	Presently available tests for monitoring human exposure to pesticides should be evaluated in the field. This includes measurement of cholinesterase levels in small samples of blood as a screening test.	This SEA supports the need for well-targeted monitoring of human health impact of pesticide applications. A Lovibond test kit for an initial 1000 samples can be obtained and used for monitoring the individuals most exposed to organophosphate pesticides. The School of Public Health in Maputo is currently sending its students to the MOH and other ministries to do collaborative projects. Likewise, monitoring pesticide impacts on human health could be incorporated into the study programs of the students of this and similar other Schools. This SEA also encourages monitoring for actual symptoms of pesticide exposure, and environmental residues after pesticide applications.
	PESTICIDE FORMULATION & MANAGEMENT	
19	The specifications for USAID-assisted acquisition of locust/grasshopper insecticides could be adapted for all insecticides.	Such specifications should be adapted and used in conjunction with the SEA for Pesticide Use and Pest Management (Fisher et al. 1993) prepared under the PEA for the USAID/Mozambique Transition Program. This would be part of the package for any pesticide related assistance that may be contemplated by USAID/Mozambique, such as through the PVO Support Project.
20	Pesticide container specifications should be developed.	This is an AID/W activity which should be implemented through EPA Pesticide Disposal Guidelines and A.I.D.'s *Pest Management Guidelines* and Pesticide Procurement guidance, consistent with FAO, WHO and OECD guidance. Any changes in EPA's container regulations that are relevant to A.I.D. should be incorporated into the current guidelines. Mozambique's pesticide legislation does provide specifications for pesticide containers consistent with FAO guidelines. Its implementation should be enforced.

	BIOLOGICAL CONTROL	
21	Biological control agents (e.g., insect pathogens and parasites) should be field-tested under Mozambique's conditions (see also Rec. 35)	Studies in the area of biological control should be conducted, particularly in line with the search for indigenous strains of biological control agents for locusts/grasshoppers, including parasites and parasitoids, diseases and predators. It should be noted that the DSV is currently undertaking biological control research on cassava mealybug and other pests by importing parasitic insects. This should be encouraged and extended to include locusts and grasshoppers. Montana State Univerity and IITA have been involved in locust/grasshopper biopesticide research and development, and this needs to be extended to cover Mozambique.
	TRAINING/HUMAN RESOURCES	
22	A comprehensive training program should be developed for NGO, and USAID Mission personnel who have responsibility for locust/ grasshopper control operations. This should take advantage of existing materials and those under development, in order to save resources.	The Operations Handbook (U.S.A.I.D., 1989a) fills this need in part, and this SEA encourages Mission should keep close contact with the AELGA project, AFR Bureau, and also with other Missions and REDSO/ESA who may have the expertise to address this issue. In addition, reference can be made to USAID's Pest and Pesticide Management Guidelines, as well as other documents such as the Pesticide Users' Guide -- Handbook for Extension Workers (Overholt & Castleton 1989), GIFAP's Guidelines series (see Fisher et al. 1993), etc.
23	Local programs of training are needed for pesticide storage management, environmental monitoring and public health.	This should be done collaboratively between MOA/DSV and MOH/DHE, as indicated under Rec. 15, 16 and 17. Furthermore, priority needs to be given to training to ensure the safe and appropriate handling and application of pesticide products, particularly for village/farmers and/or representatives. Also, extension agents are in great need of training.
24	When technical assistance teams are provided they should be given short-term intensive technical training (including language if necessary) and some background in the use and availability of training aids.	Expatriate teams should always be associated with local personnel. Junior personnel should be paired with more experienced personnel. A preferred approach is to select technical assistance teams which have the best possible expertise, familiarity with the local situations, and sufficient language fluency for the tasks to be performed. To the extent that any member has a notable gap in language or facility with training aids, short-term training should be provided, but only as a last resort. If necessary, an interpreter will need to be provided.

	ECONOMIC & COST-BENEFIT ASPECTS	
25	Field research should be carried out to generate badly needed economic data on a country-by-country basis.	Ideally, rational control activities would be based on economic cost-benefit analyses and crop loss assessment, carried out in connection with food security assessments. In practice, economic data is difficult to come by expeditiously with available technologies and systems in time to inform real-time decision-making. This an aspect which should be pursued as resources become available. See Rec. 26.
26	No pesticide should be applied unless a working action threshold for risk of damage by locusts or grasshoppers is exceeded.	While valid economic thresholds cannot be established at this time, ad hoc action thresholds can be developed based on objective analysis of population levels and trends, and crop loss assessments. It is possible to collect semi-quantitative data to determine the extent to which agricultural productivity is threatened and an effort to ensure that declarations of disaster are supported by valid professional judgement. This would ensure minimum pesticide procurement by limiting A.I.D. participation when a reasonable probability of substantial threat to crops does not exist.
GROUP IV: EQUALLY HIGH PRIORITY, BUT OF BROADER RELEVANCE TO OVERALL AGRICULTURAL AND ENVIRONMENTAL PROGRAMS		
	ENVIRONMENTAL POLICY	
27	USAID should provide assistance to host countries in drawing up regulations on the registration and management of pesticides and the drafting of environmental policy.	In African countries, AID/W has worked with EPA to provide experts who are knowledgeable in all aspects of pesticide regulations and policies, including human safety, environmental impact, and use, storage, and disposal. It is expected that expanded interagency interactions will facilitate the implementation of this recommendation. AID/W is also engaged in developing a follow-up mechanism to AELGA. Mozambique does have pesticide legislation and is in the process of developing National Environmental Action Plan. This being the case, USAID's involvement may be to help with the implementation and familiarizing decision makers, the private sector and the general public with these regulations.
	PESTICIDE MANAGEMENT POLICY	
28	A pesticide use inventory covering all treatments in both agricultural and health programs should be developed.	This ia a matter appropriate for GRM action in collaboration with the private sector. USAID/ Mozambique should explore with GRM as to how to improve the extent to which a comprehensive inventory is developed. Such a pesticide inventory program should prevent the build-up of obsolete stocks and contribute to a cost reduction in pesticide use in general.

	PESTICIDE HANDBOOK	
29	USAID should produce a regularly updated pesticide handbook for use by its staff [which would also be of use to PVOs and host country pest management practitioners].	This is a centralized function being accomplished by AID/W. Relevant activities in this area include the following examples: USAID Locust/Grasshopper Management Operations Guidebook (1989); USAID Pest Management Guidelines (1991). An updated list of U.S.A.I.D.- approved pesticides is presented in Appendix D, and a list of other relevant documents in Appendix L. Fisher et al. (1993) outline an appropriate set of country-specific recommendations. Also, the Africa Bureau PVO/NGO Environmental Guidelines provide pesticide use guidance. However, this SEA recommends the production of a Handbook containing health, safety, and environmental assessments of the pesticides in use. This type of information is less subject to change than use and application related data. Updating of the health and environmental safety information would only be necessary when new information becomes available, for example through EPA's Special Review process.
	SUPPORT, TECHNICAL ASSISTANCE AND TRAINING	
30	Appropriate technical assistance, education and training should be provided to the NGOs and crop protection service with a view to making crop protection activities eventually self-sustaining.	USAID/Mozambique policy is to help host countries to help themselves become self-sustaining, emphasizing the role of the NGO/PVO community. All activities in any USAID-supported locust/grasshopper control program in Mozambique should help build farmer-level capacity. DANIDA and GTZ are currently providing technical assistance and materials to strengthen the DSV, which should be encouraged to support capacity-building by the PVOs.
	GROUP V: DESIRABLE BUT OF LESS URGENCY IN OUTBREAK SITUATIONS	
	PROPER STORAGE	
31	The need for more or improved pesticide storage facilities should be determined. Emergency supplies should be pre-positioned outside Mozambique.	Regional pesticide bank(s) should be established in locust/grasshopper affected areas to ensure quick response should outbreaks occur (such as with the IRLCO). However, if existing stocks are determined to be inadequate, supplies should, be built up at times when field observations indicate that a locust or grasshopper problem is imminent.
	FORECASTING	
32	USAID should fund forecasting and remote sensing (FEWS) or utilize IRLCO's and FAO's early warning program.	This SEA recognizes the difficulties inherent in providing for adequate early warning. AID/W and FAO are pursing initiatives in this matter, including application of geographical information systems and remote sensing to forecasting. FAO does not cover the southern Africa region routinely. However, early warning and forecasting systems and greenness mapping are needed in the region. FEWS could potentially play a role in this regard. The IRLCO/CSA may have relevant capacity which could be supported.

	PUBLIC HEALTH MONITORING AND STUDY	
33	In areas of heavy human exposure to pesticides for locust and grasshopper control, epidemiological case-control studies should be implemented.	The PEA argues for such epidemiological case-control studies where the conditions justify them, viz., situations of long-term, widespread heavy pesticide use where well-developed public health monitoring facilities exist. **These conditions do not apply in the case of Mozambique**, thus are not a priority. See Recommendation 18 and Section 7.4.1 for discussion of appropriate approaches to protect applicators, the human population and the environment.
34	Applied research should be carried out on the efficacy of various pesticides and growth retardants and their application.	Mozambique's DSV and INIA are in a position to explore the potential of insect growth regulators (IGRs) and should also search for local strains of biological control agents that can be used in locust/grasshopper control programs.
35	Applied research should be carried out on the use promising botanical pest control agents such as neem as anti-feedants and pesticides.	Although neem is a promising botanical pesticide, anti-feedant and insect growth regulator, it is not likely to be locally available soon as a viable pest control alternative. Research on botanical pesticides should be pursued to determine their applicability to Mozambique's specific conditions.
36	Research should be carried out to determine the best techniques for assessing the impacts of organophosphates used for locust and grasshopper control with respect to the use of these and other chemicals for other pest control programs.	Local ecotoxicological data on this locust and grasshopper insecticides should be developed, and used with the results of such work elsewhere (such as FAO's LOCUSTOX project in Senegal) to mitigate the pesticides' environmental impacts. Deleterious interactions with other pesticides are also possible. For example, the potential exists for helping to induce insecticide (particularly pyrethroid) resistance in malaria mosquitoes in areas where locust insecticides are applied (see Fisher et al. 1993).
GROUP VI. FINAL RECOMMENDATIONS ON PROCEDURES TO FACILITATE AND ACCELERATE IMPLEMENTATION OF RECOMMENDATIONS 1-36		
37	USAID, on the basis of the previous recommendations, should ensure that a Plan of Action is developed, with practical procedures to provide operations guidance in locust grasshopper control to Missions in the field. This Plan would need to involve the PVOs/NGOs.	AID/W has developed a comprehensive Locust/Grasshopper Management Operations Guidebook (USAID 1989), and, mostly under the AELGA project, developed Supplementary Environmental Assessments in 14 countries that are most critical for locust and grasshopper control (see Sect. 2.1). These SEAs contain commitments for future actions. **Country-specific plans of action will be developed to implement those commitments when needed.** The country specific plans of action will be the backbone of guidance for locust/grasshopper control activities. AID/W will work closely with USAID/Mozambique in the development of plans of action as requested, as AID/W has in the development of this SEA.

38	U.S.A.I.D. should promote common approaches to locust and grasshopper control and safe pesticide use among UN Agencies and donor nations. The Mozambique National Environmental Management Plan (NEMP) of the CNA should be used to promote local coordination.	Coordination of efforts is becoming increasingly important because of the increasing number and magnitude of multilateral agreements and follow-up efforts in by various donors. Coordination should occur both at the AID/W level and the USAID/Mozambique level. At the country-specific level, the DSV is the major coordinating body although donors also discuss specific plans with each other. These efforts should be improved for the future and international organizations such as the FAO should be encouraged to play active role.

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APPENDICES

APPENDIX A. LIST OF PERSONS CONTACTED AND PREPARER

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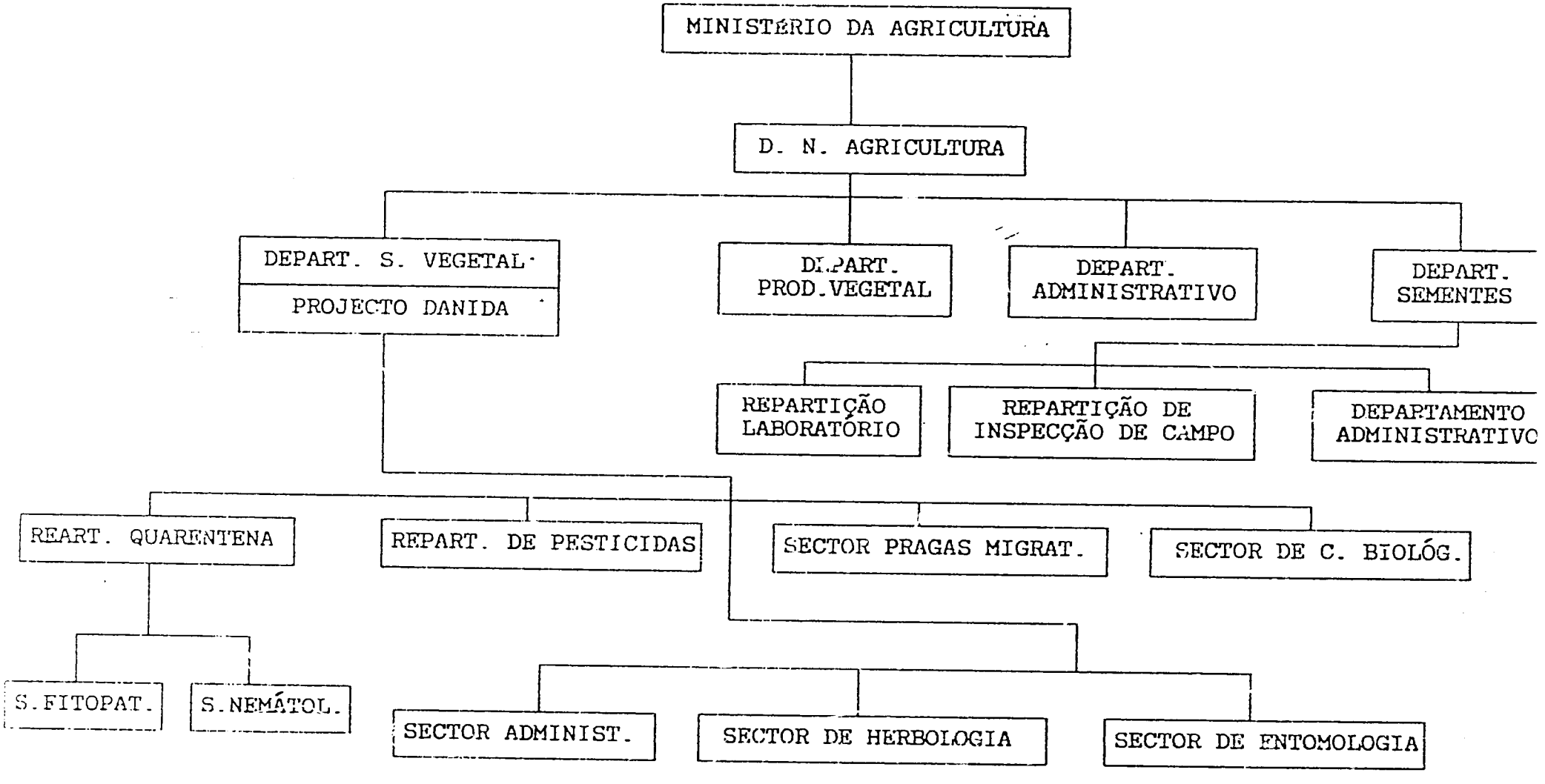
Appendix B. ORGANOGRMA DO DEPARTAMENTO DE SANIDADE VEGETAL E SEMENTES



Appendix C. Mozambique's Pesticide Legislation

Quarta-feira, 30 de Setembro de 1987 — I SÉRIE — Número 39

BOLETIM DA REPÚBLICA

PUBLICAÇÃO OFICIAL DA REPÚBLICA POPULAR DE MOÇAMBIQUE

IMPRENSA NACIONAL DE MOÇAMBIQUE

AVISO

A matéria a publicar no «Boletim da República» deve ser remetida em cópia devidamente autenticada, uma por cada assunto, donde conste, além das indicações necessárias para esse efeito, o averbamento seguinte, assinado e autenticado: Para publicação no «Boletim da República».

SUMÁRIO

Ministérios da Saúde e da Agricultura:

Diploma Ministerial n.º 88/87:

Aprova o Regulamento sobre Pesticidas. (Nova publicação completa)

Por ter sido publicado incompleto o Diploma Ministerial n.º 88/87, inserto no *Boletim da República*, 1.ª série, n.º 30, de 29 de Julho último, volta a ser publicado, ficando sem efeitos a publicação anterior.

MINISTÉRIOS DA SAÚDE E DA AGRICULTURA

Diploma Ministerial n.º 88/87

de 29 de Julho

Nos termos das disposições conjugadas dos artigos 4 e 20 do Decreto n.º 12/82, é aprovado o Regulamento sobre Pesticidas que faz parte integrante do presente diploma ministerial.

Maputo, 30 de Janeiro de 1986. — O Ministro da Saúde, *Pascoal Manuel Mocumbi*. — O Ministro da Agricultura, *João dos Santos Ferreira*.

Regulamento sobre Pesticidas

CAPÍTULO I

Definições

ARTIGO 1

Para efeitos deste regulamento estabelecem-se as seguintes definições:

Adjuvantes — são substâncias tais como solventes, diluentes, agentes tensio-activos ou ingredientes inertes ou outros, incluindo em uma formulação com a finalidade de possibilitar a aplicação do ingrediente activo de maneira homogênea, segura e eficaz.

Boa prática agrícola — emprego correcto e eficaz de um pesticida, levando em consideração as quantidades mínimas necessárias para alcançar o controlo adequado, e aplicado de maneira que os resíduos sejam mínimos do ponto de vista toxicológico.

Concentração — é a quantidade do ingrediente activo no veículo diluente utilizado.

Concentração letal 50 % inalatória (CL 50 inalatória) — é a concentração de uma substância na atmosfera, capaz de provocar a morte em 50 % dos animais testados após uma exposição mínima de uma hora.

Contramarca — os números, letras, palavras ou siglas colocadas antes ou após a marca.

Dose — é a quantidade de produto por entidade tratada ou por áreas.

Dose letal 50 % dérmica (DL 50 dérmica) — é a dose única, expressa em miligrama da substância por quilo de peso corpóreo, que provoca a morte em 50 % dos animais testados após contacto com a pele intacta por um período de vinte e quatro horas, estendendo-se o controle durante catorze dias.

Dose letal 50 % oral (DL 50 oral) — é a dose única expressa em miligramas da substância por quilo de peso corpóreo, que provoca a morte de 50 % dos animais em experiência até catorze dias após administração por via oral.

Embalagem — todo o recipiente destinado a acondicionar os pesticidas e seus produtos formulados.

Embalagem externa — embalagem destinada a proteger os recipientes sujeitos a quebra, deformações e a outras avarias durante o transporte.

Ingrediente activo — substância de natureza química ou biológica responsavel pela acção pesticida.

Intervalo de segurança — é o intervalo mínimo de tempo entre a data de aplicação do pesticida, segundo a boa prática agrícola e a da colheita ou consumo, garantindo uma residualidade inferior a (LMR) estabelecida por este regulamento.

Limite Estranho de Resíduo (LER) — a concentração máxima de resíduo no pesticida tolera no alimento, proveniente de circunstâncias não específicas, expressa em miligramas do resíduo de pesticida por quilo de alimento (mg/kg).

Limite Máximo de Resíduos (LMR) — a concentração máxima do resíduo de um pesticida, legalmente tolerado em um alimento, expresso em miligramas do resíduo do pesticida por quilo de alimento (mg/kg).

Marca — o nome ou a expressão utilizada para identificar comercialmente o pesticida.

Pesticida — substância ou mistura de substâncias de natureza química ou biológica destinadas a controlar qualquer agente patogénico ou outras formas de vida animal ou vegetal prejudiciais à agricultura, pecuária e seus produtos, assim como vectores de agentes patogénicos para o homem e pragas domésticas.

Produto formulado — preparação obtida a partir de produtos técnicos com adição de ingredientes inertes e/ou adjuvantes destinada à aplicação no combate às pragas, directamente ou após diluição.

Produto técnico — produto constituído pelo ingrediente activo e impurezas resultantes do processo industrial de fabrico.

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SECÇÃO IV

Validade do registo e procedimento para a renovação do registo

ARTIGO 12

A validade do registo e da renovação do registo é de cinco anos.

ARTIGO 13

O registo pode ser renovado por um período de cinco anos através de um pedido por escrito da entidade titular do registo, entregue à Entidade de Registo. A Entidade de Registo pode exigir quaisquer informações que considere necessárias para o processo da renovação do registo, ou exigir a alteração do seu rótulo, embalagem ou material de publicidade, antes de efectuar a renovação do registo.

ARTIGO 14

Todos os pesticidas registados no sistema de registo anterior ao presente Regulamento devem ser obrigatoriamente registados de novo.

ARTIGO 15

O procedimento e as prioridades para a renovação do registo nos termos do presente Regulamento serão fixados pela Entidade de Registo.

SECÇÃO V

Anulação do registo

ARTIGO 16

A Entidade de Registo pode anular o registo de qualquer pesticida a qualquer momento, com base em novas informações recebidas ou por qualquer outro motivo. A proposta de anulação do registo será comunicada por carta com aviso de recepção à entidade titular do registo, indicando os motivos da anulação. A anulação ficará pendente durante um período de quarenta e cinco dias a partir da data da recepção do aviso. Durante este período a entidade titular do registo pode reunir os argumentos e informações necessárias para justificar a continuação do registo. Estas informações devem ser entregues em duplicado, ou em triplicado no caso de produtos para a pecuária, à Entidade de Registo, que tomará uma decisão final no prazo de quinze dias. A anulação do registo será publicada no *Boletim da República*.

SECÇÃO VI

Registo provisório de pesticidas

ARTIGO 17

Todos os produtos que não apresentem uma garantia suficiente sobre a eficácia e segurança podem ser registados em forma provisória.

ARTIGO 18

O registo provisório limita a importação e utilização do produto conforme as normas e limitações estabelecidas pela Entidade de Registo.

SECÇÃO VII

Autorização para o uso experimental de pesticidas

ARTIGO 19

Os pesticidas destinados à experimentação e não registados poderão ser importados através de uma autorização para o Uso Experimental de Pesticidas (AUEP).

ARTIGO 20

Para a obtenção da AUEP, as entidades interessadas devem entregar à Entidade de Registo um pedido escrito acompanhado pelos dados indicados no Anexo II do presente Regulamento. Na altura do pedido as entidades interessadas devem efectuar o pagamento da taxa definida pela Entidade de Registo.

ARTIGO 21

No caso do pedido estar incompleto, a Entidade de Registo pode devolvê-lo ao requerente e/ou solicitar as informações em falta dentro de um prazo de sete dias. Uma vez verificadas as informações apresentadas, a Entidade de Registo procederá ao despacho final num prazo máximo de trinta dias.

ARTIGO 22

A validade da AUEP é de um ano, podendo ser renovada através da apresentação de um pedido escrito acompanhado por um relatório sobre as actividades experimentais desenvolvidas.

ARTIGO 23

1. A AUEP limita a importação e utilização do produto conforme as normas estabelecidas pela Entidade de Registo. Estas normas estão sujeitas a alterações periódicas. O não cumprimento destas normas implica a suspensão imediata da AUEP e o não reconhecimento dos ensaios para efeito do registo do produto em causa.

2. Não é permitida a comercialização e venda de produtos importados ao abrigo de uma AUEP.

SECÇÃO VIII

Material de publicidade

ARTIGO 24

Qualquer material de publicidade ou informação técnica relacionada com pesticidas já registados ou não, deve ser aprovado pela Entidade de Registo antes de ser divulgado. Para o efeito, deve ser entregue um pedido escrito à Entidade de Registo, acompanhado por cinco cópias do material proposto. Todo o material deve estar de acordo com as «Guidelines for Advertising Practice in the Promotion of Pesticide Products in Developing Areas of the World», National Agricultural Chemicals Association, EUA, 1983.

SECÇÃO IX

Confidencialidade

ARTIGO 25

Quando determinadas informações forem consideradas segredos industriais, os requerentes devem assinalá-las expressamente em cada página com a indicação «confidencial». As informações assim indicadas serão tratadas em conformidade com as normas aplicáveis.

CAPÍTULO III

Importação de pesticidas

Registo do importador

ARTIGO 26

A entidade que pretender realizar a importação de pesticidas, destinadas à produção ou outros usos, qualquer que seja a sua quantidade, deve solicitar o seu registo como Importador de Pesticidas à Entidade de Registo, e efectuar o pagamento da taxa definida. Após a Entidade de Registo ter efectuado o registo, será emitido um Certificado de Registo de Importador de Pesticidas.

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ARTIGO 40

O pedido de autorização para o projecto de construção, adaptação ou alteração do armazém deve ser apresentado à estrutura provincial do Ministério de Tutela, devendo este enviar no prazo máximo de trinta dias a contar da data de recepção, cópia do processo à DPS que deverá devolvê-la com o seu parecer num prazo máximo de trinta dias.

ARTIGO 41

O pedido deverá conter, além dos documentos e da memória descritiva prevista pela legislação em vigor sobre o licenciamento técnico dos estabelecimentos industriais e do comércio, os seguintes elementos:

— Indicação relativa ao sistema de drenagem dos dejectos e das águas residuais;
— A distância de áreas residenciais ou industriais alimentares;
— Qualificação técnica do responsável do armazém.

ARTIGO 42

O início do funcionamento só poderá fazer-se após despacho final sobre o auto de vistoria dado pela estrutura provincial do Ministério de Tutela apreciadas as opiniões dos diversos componentes da comissão de vistoria, sendo indispensável o parecer favorável da DPS. A vistoria deve ser efectuada num prazo máximo de sessenta dias a partir da data de recepção do pedido.

ARTIGO 43

Para o despacho final aplica-se o disposto no n.º 1 do artigo 37 do presente regulamento.

SECÇÃO II

Requisitos dos armazéns

ARTIGO 44

Os armazéns ou depósitos de pesticidas podem ser autorizados conforme o disposto no artigo 39 deste Regulamento quando:

a) Projectados ou construídos em local apropriado, em terreno não sujeito a inundações, distantes de cursos de águas naturais ou fontes subterrâneas;
b) Situados a uma distância mínima de cem metros de habitações ou de locais onde são produzidos alimentos, rações, ou outros produtos que possam entrar em contacto com pessoas ou animais;
c) Fornecidos de instalações sanitárias funcionantes e adequadas às exigências de higiene e segurança e proporcionais ao número de trabalhadores.

ARTIGO 45

Os armazéns ou depósitos de pesticidas devem possuir as características de boa ventilação, protecção contra a entrada de animais e pessoas, adequado sistema de drenagem e sistema contra incêndios. O responsável do armazém deve ser pessoa habilitada e munida de autorização conforme o disposto do artigo 51 deste regulamento.

ARTIGO 46

É proibido armazenar pesticidas ao ar livre ou em recintos não adequadamente protegidos da água da chuva ou radiação solar.

CAPÍTULO VI

Comercialização e venda de pesticidas

ARTIGO 47

1. Todas as entidades estatais, cooperativas e privados que queiram vender, distribuir ou armazenar pesticidas para comercialização devem obter uma autorização emitida pela autoridade sanitária competente, a nível distrital e da cidade.

2. No pedido de autorização dirigido à autoridade sanitária local deverão constar as seguintes informações:

— Nome completo do requerente;
— Endereço do requerente;
— Denominação do estabelecimento comercial e sua localização;
— Classe toxicológica dos produtos mais tóxicos que se pretende comercializar;
— Medidas de segurança das instalações contra incêndios;
— Nome completo e endereço do responsável do local e habilitações técnicas conforme o artigo 51.

ARTIGO 48

No prazo de trinta dias a partir da recepção do pedido de autorização, a entidade sanitária local deverá executar a vistoria dos locais e controlo das habilitações para emissão da autorização para comercialização e venda, onde deverão constar:

— Denominação do estabelecimento comercial e sua localização;
— Nome completo e endereço do responsável do local;
— Classe toxicológica dos produtos autorizados.

ARTIGO 49

A autoridade sanitária local que emitiu a autorização para comércio e venda de pesticidas pode revogar a referida autorização quando faltem os requisitos na base dos quais foi emitida a autorização.

ARTIGO 50

Os pesticidas da classe I podem ser vendidos somente a indivíduos munidos de autorização específica emitida pela Direcção Distrital de Agricultura, conforme as disposições estabelecidas no artigo seguinte.

ARTIGO 51

1. A autorização emitida pela Direcção Distrital de Agricultura é concedida a indivíduos maiores de dezoito anos e que possuam como habilitações literárias mínimas a 4.ª classe e tenham sido aprovados numa entrevista de avaliação feita por esta Direcção. Na entrevista o indivíduo deve demonstrar que conhece os perigos ligados à detenção, conservação, manipulação e utilização de pesticidas, uso correcto dos mesmos e medidas de prevenção a serem usadas para o seu emprego correcto do ponto de vista agrícola.

2. Esta autorização habilita o portador à comercialização, transporte e utilização de pesticidas.

3. A autorização deve conter o nome completo, data e local de nascimento, residência e fotografia do requerente. Esta autorização é válida por um período de cinco anos e renovável mediante as mesmas formalidades da obtenção. Desta entrevista de avaliação ficam isentos os agrónomos e técnicos diplomados pelas escolas e institutos agrários.

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2. Instruções específicas para cada tipo de formulação, seleccionadas de acordo com os textos de E a L indicados, no Anexo VI.

3. Culturas e campo de utilização constante no registo.

4. Pestes controladas indicadas por nomes comuns ou científicos. Os nomes padronizados no País devem ser utilizados obrigatoriamente.

5. Doses ou concentrações recomendadas expressas conforme a utilização prevista do produto e a indicação NUNCA EXCEDER A DOSE RECOMENDADA.

6. Equipamento e método de aplicação.

7. Número e época (s) de aplicação recomendada(s).

8. Intervalo de segurança.

9. Incompatibilidade com outros pesticidas ou produtos conforme a utilização prevista do produto.

10. Cuidados necessários para evitar fitoxicidade ou dano à cultura e à cultura que se segue na rotação, ou a outros organismos benéficos.

ARTIGO 59

Nas *Precauções de manuseio, Sintomas de alarme e Primeiros socorros* devem constar no mínimo as seguintes informações:

1. Avisos práticos para preparação, mistura, armazenagem e eliminação de embalagens de pesticidas de uso invalidado ou excedente.

2. As precauções de segurança na manipulação do produto conforme o Anexo VII. Estas precauções devem ser escritas em letras maiusculas quando indicadas no anexo, para informar sobre a natureza do produto, manipulação e uso do concentrado e medidas a tomar caso aconteça uma contaminação.

3. Informações relacionadas com os sintomas, textos especiais e utilização de antídotos devem ser adicionados para produtos de classe I e outros quando exigidos pela autoridade de registo.

ARTIGO 60

A autoridade do registo pode exigir se assim julgar necessário, a colocação no rótulo de quaisquer outros símbolos, dizeres e avisos não contemplados neste capítulo.

ARTIGO 61

Nas embalagens em sacos ou caixas de um quilograma ou menos, será permitida a apresentação do rótulo em duas partes uma em cada face de maior superfície de embalagem, contendo uma delas os dados constantes no artigo 57 e outra os dados constantes nos artigos 58 e 59.

ARTIGO 62

Nos rótulos pequenos das embalagens de pesticidas líquidos onde seja impossível referir todas as precauções é obrigatório incluir os dados constantes no artigo 57 e a frase escrita em letras maiusculas «VER FOLHETO JUNTO». As informações do artigo 58 e 59 devem obrigatoriamente figurar no folheto anexo ou sob forma de pestana, constituindo uma extensão do rótulo.

ARTIGO 63

1. Não é permitida a propaganda de produtos de acção pesticida que possa enganar o utilizador usando expressões como: «NÃO TÓXICO», «INÓCUO», «INOFENSIVO» ou equivalente bem como termos de superioridade «O MAIS EFECTIVO», «CONTROLO MÁXIMO» e termos semelhantes.

2. Não é permitida a indicação do rótulo de pestes, culturas ou usos para os quais o produto não foi especificamente autorizado no processo de registo.

ARTIGO 64

Para os produtos experimentais as informações obrigatórias constantes no rótulo são as seguintes:

1. Marca ou código de produtos.

2. Nome de ingredientes activos, utilizando o nome comum, o código ou a denominação química, e ainda, a quantidade mínima garantida de cada ingrediente activo presente, expressa no seguinte modo:

a) Sólidos, líquidos viscosos, aerosóis e líquidos voláteis: grama por quilograma (g/kg) ou percentagem (%) por peso;

b) Outros líquidos: grama por litro (g/l) ou percentagem (%) por peso;

c) Gases: percentagem (%) por volume.

3. Símbolo correspondente à classificação toxicológica do produto.

4. Em todos os rótulos deve constar a seguinte inscrição: SOMENTE PARA USO EXPERIMENTAL; PROIBIDA A COMERCIALIZAÇÃO E VENDA.

5. *Responsável pela experimentação em Moçambique*, com indicação do nome e endereço do registante da AUEP.

6. Nome e endereço do fabricante ou do fornecedor.

7. Recomendações gerais quanto aos primeiros socorros.

8. Textos referentes aos perigos, sintomas de alarme, antídotos e tratamento.

CAPÍTULO IX

Embalagem

ARTIGO 65

Todas as substâncias com acção pesticida ou reguladoras de crescimento vegetal, para serem importadas, produzidas, comercializadas e utilizadas no País devem ter a embalagem original aprovada pela Entidade de Registo, conforme o disposto neste capítulo. Não é permitida a reembalagem de produtos importados ou produzidos localmente, sem autorização prévia da Entidade de Registo.

ARTIGO 66

Toda a embalagem deve ser constituída de material que não interfira com o produto mantendo inalteradas as propriedades físicas e químicas dos pesticidas e de seus produtos formulados. Toda a embalagem deve ser resistente a todos os choques mecânicos provenientes do transporte normal, manuseio, armazenagem, carga, descarga e empilhamento. O material de embalagem não deve ser afectado por mudanças das condições atmosféricas, como pressão, temperatura e humidade.

ARTIGO 67

As superfícies interna e externa dos recipientes devem ser constituídas ou revestidas de materiais resistentes à corrosão e reacções com o produto por um período equivalente a pelo menos o prazo de validade do conteúdo. A correspondência às características exigidas no § 1 deste artigo deve ser demostrada através de testes específicos com indicação da metodologia utilizada ou referência a métodos internacionais.

ARTIGO 68

Nenhum recipiente deve apresentar ângulos agudos ou projecções bicudas. Tanto as superfícies externas como internas da embalagem não deverão apresentar depressões capazes de reter o produto durante ou após as operações de esvaziamento. As tampas devem apresentar características de resistência mecânica e química iguais às das emba-

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ARTIGO 79

Enquadram-se como pesticidas da classe I:

1. Todos os pesticidas que apresentem a DL_{50} oral inferior a 50 mg/kg para produtos sólidos e 200 mg/kg para produtos líquidos e cuja DL_{50} dérmica seja inferior a 100 mg/kg para sólidos a 400 mg/kg para líquidos.

2. Todos os produtos que poderiam ser classificados na classe II e III, mas cuja utilização normal pode apresentar um alto risco para o homem ou animais.

ARTIGO 80

Enquadram-se como pesticidas da classe II:

1. Todos os pesticidas que apresentem uma DL_{50} oral compreendida entre 50 — 500 mg/kg para produtos sólidos e 200 — 2000 mg/kg para produtos líquidos. Todos os pesticidas cuja DL_{50} dérmica esteja compreendida entre 100 — — 1000 mg/kg para produtos sólidos e 400 — 4000 mg/kg para líquidos.

2. Todos os pesticidas que segundo a DL_{50} poderiam ser classificados na classe III, mas cuja utilização normal pode apresentar riscos moderados para o homem ou animais.

ARTIGO 81

Enquadram-se como pesticidas da classe III, todos os pesticidas cuja DL_{50} oral seja superior a 500 mg/kg para produtos sólidos e superior a 2000 mg/kg para líquidos e os cuja DL_{50} dérmica seja superior a 1000 mg/kg para produtos sólidos e 4000 mg/kg para líquidos.

ARTIGO 82

No Anexo IX encontra-se a classificação toxicológica dos produtos registados em Moçambique até ao ano de 1983.

CAPÍTULO XII

Limites máximos de resíduos tolerados em alimentos

ARTIGO 83

São aprovados os limites máximos de resíduos de substância com acção pesticida ou reguladoras do crescimento vegetal referidos no Anexo X para os alimentos contemplados no mesmo anexo. Para os alimentos não contemplados não são tolerados resíduos. São também aprovados os intervalos de segurança que devem passar entre o último tratamento e a colheita e, para os produtos alimentares armazenados, entre o último tratamento e a colocação dos produtos para consumo. Nos casos em que não é indicado o intervalo de segurança o emprego de pesticidas deve ser efectuado conforme as boas práticas agrícolas, deixando intervalos que garantam o respeito do limite máximo de tolerância.

ARTIGO 84

Os controlos executados para averiguar a observância dos limites máximos de resíduos tolerados em alimentos fixados no presente regulamento são efectuados pelos órgãos que executam a vigilância higiénico-sanitária sobre a produção e comércio dos produtos alimentares dos Ministérios da Agricultura e da Saúde, utilizando as técnicas analíticas disponíveis, capazes pela sensibilidade e especificidade de averiguar os limites de tolerância definidos. Todos os dados recolhidos no âmbito do controlo devem ser comunicados à Direcção Nacional de Saúde.

CAPÍTULO XIII

Fiscalização e penalidades

ARTIGO 85

Os autos de infracção levantados pelo pessoal técnico de Saúde e Agricultura relativos ao presente regulamento serão enviados pelas Direcções de Cidade, Distritos ou Províncias à Polícia Popular de Moçambique a fim de servirem de base à organização do respectivo processo criminal.

ARTIGO 86

A infracção ao disposto no artigo 2 e n.º 2 do artigo 23 do presente regulamento determina a imediata selagem e apreensão dos produtos e pena disposta ao abrigo da Lei n.º 8/82, de 23 de Junho.

ARTIGO 87

A abertura de estabelecimento de produção, formulação, embalagem de pesticidas e armazéns contrariando o disposto nos Capítulos IV e V deste regulamento implica o encerramento imediato do estabelecimento e pena disposta ao abrigo da Lei n.º 8/82, de 23 de Junho.

ARTIGO 88

A comercialização ou venda de pesticidas contrária ao disposto no Capítulo VI deste Regulamento implica a imediata apreensão dos produtos e multa de 10 000,00 a 100 000,00 MT.

ARTIGO 89

A violação do disposto no Capítulo VII é punida com multa de 10 000,00 a 50 000,00 MT, independentemente da apreensão do meio de transporte que haja dado origem à infracção, até à obtenção da competente autorização sanitária.

ARTIGO 90

A importação, produção, comercialização ou utilização de pesticidas em violação do disposto nos Capítulos VIII e IX sobre rotulagem e embalagem são punidas com a imediata apreensão dos produtos e multa igual ao triplo do valor económico dos produtos nos casos de importação e produção e multa de 10 000,00 a 100 000,00 MT nos casos de comercialização e utilização.

ARTIGO 91

A eliminação de pesticidas em violação ao disposto no Capítulo X é punida com multa de 10 000,00 a 100 000,00 MT e com pena conforme o disposto na Lei n.º 8/82, de 23 de Junho, se a eliminação for susceptível de prejudicar gravemente a área ou a Saúde das populações.

ARTIGO 92

1. Os alimentos que apresentem no controlo resíduos superiores aos limites máximos tolerados e definidos no Capítulo XII serão apreendidos, não sendo autorizada a sua comercialização. As autoridades sanitárias definirão os meios adequados para reduzir os resíduos antes da sua comercialização ou destino.

2. A comercialização de produtos contaminados com pesticidas susceptíveis de prejudicarem a Saúde do consumidor é punida conforme o disposto na Lei n.º 8/82, de 23 de Junho.

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4.10. 3. Pó solúvel:

a) Solubilidade em água.

4.10. 4. Formulações granulados:

a) Teor de pó.

4.10. 5. Pastilhas fumigantes:

a) Início e duração do desprendimento de gás, em condições determinadas

4.10. 6. Concentrado para emulsão e óleo emulsionável:

a) Densidade;
b) Estabilidade de emulsão após diluição.

4.10. 7. Solução aquosa concentrada:

a) Densidade;
b) Estabilidade e presença de depósito.

4.10. 8. Solução não aquosa concentrada (inclui preparação oleosa):

a) Densidade;
b) Estabilidade e presença de depósito;
c) Miscibilidade com veículo indicado (água ou outro).

4.10. 9. Suspensão concentrada (inclui «flowable» e suspensão microencapsulada):

a) Densidade;
b) Passagem na peneira via máquina;
c) Estabilidade da suspensão;
d) Quantidade de espuma persistente.

4.10.10. Ultrabaixo volume:

a) Densidade;
b) Viscosidade;
c) Volatilidade do solvente.

4.10.11. Óleo mineral:

a) Densidade;
b) Índice de sulfonação;
c) Viscosidade.

4.11. Métodos de análise da formulação.

5. *Características toxicológicas do ingrediente activo e produto formulado:*

Incluir dados sobre quaisquer produtos tóxicos que possam ser formados durante a decomposição do produto como resultado de diluição, armazenagem, etc.

5.1. Dados experimentais sobre toxicidade para mamíferos:

5.1.1. Dose letal 50 % aguda (DC_{50}) oral e dérmica do produto formulado, mencionando o animal usado para teste. Concentração letal inalatória (CL_{50}) para produtos cujos ingredientes activos actuam sob a forma gasosa.
5.1.2. Efeitos irritantes ou corrosivos na pele e nas mucosas.
5.1.3. Efeitos alergénicos.
5.1.4. Dados sobre toxicidade crónica e subcrónica incluindo:

a) Toxicidade oral de doses repetidas;
b) Efeitos cumulativos;
c) Efeitos neurotóxicos;
d) Efeitos sobre crescimento;
e) Alterações histológicas dos vários órgãos;
f) Efeitos sobre a composição do sangue;
g) Efeitos sobre o sistema enzimático;
h) Efeitos citotóxicos;
i) Efeitos sobre a duração da vida média;
j) Efeitos sobre reprodução, embriotoxidade, teratogenicidade;
l) Efeitos mutagénicos;
m) Efeitos cardinogénicos;
n) Efeitos sinérgicos.

5.1.5. Exaltação de toxicidade de outros produtos.

5.2. Toxicidade no homem:

5.2.1. Avaliação da dose letal.
5.2.2. Observação directa, por ex: casos clínicos.
5.2.3. Informações estatísticas de intoxicações agudas e crónicas.
5.2.4. Sintomatologia e diagnóstico das intoxicações.
5.2.5. Primeiros socorros antídoto e tratamento médico.

5.3. Toxicidade para outros organismos (ver item 7.7.):

5.3.1. Toxicidade para peixes.
5.3.2. Toxicidade para Daphnia.
5.3.3. Toxicidade para aves.
5.3.4. Toxicidade para abelhas.
5.3.5. Toxicidade para outros insectos benéficos.
5.3.6. Toxicidade para plantas aquáticas.
5.3.7. Efeitos sobre a fauna e flora do solo.
5.3.8. Efeitos sobre outras espécies de animais e plantas.

6. *Comportamento do pesticida no meio ambiente:*

6.1. Comportamento do pesticida em plantas:

6.1.1. Características de absorção foliar, resistência e recomendações.
6.1.2. Características de absorção pelas raízes ou outras partes de plantas.
6.1.3. Características de translocação.
6.1.4. Metabolismo e principais metabólitos em plantas.
6.1.5. Tempo de degradação média em condições ambientais representativas de Moçambique, intervalo de segurança.

6.2. Comportamento do pesticida em solos:

6.2.1. Características de absorção e lixiviação em diferentes tipos de solo.
6.2.2. Perdas devidas a fotodecomposição e/ou volatilização.
6.2.3. Decomposição por acção microbiana.
6.2.4. Persistência média estimada às dosagens recomendadas em condições de solo e clima representativas de Moçambique.
6.2.5. Metabólitos principais.

6.3. Comportamento do pesticida em água:

6.3.1. Absorção do pesticida na matéria orgânica do fundo em suspensão.
6.3.2. Degradação e principais metabólitos.
6.3.3. Efeitos sobre actividade de degradação bioquímica, por ex: efeitos sobre níveis de oxigénio dissolvido
6.3.4. Persistência média estimada em condições representativas.

6.4. Comportamento do pesticida em produtos armazenados: factores que afectam a acção e persistência do pesticida por ex: humidade, composição de paredes e contentores, modo de arrumação de material, armazenamento, etc.

6.5. Outros dados sobre resíduos:

6.5.1. Níveis de resíduos e degradação nas culturas e nos produtos alimentares em que é proposto usar o pesticida.
6.5.2. Efeitos de cozedura e/ou transformação industrial sobre níveis de resíduos.
6.5.3. Resíduos em produtos de origem animal.
6.5.4. Métodos de análise de resíduos indicando: especificidade, precisão e limites de detecção.

7. *Utilização proposta do produto:*

7.1. Indicação do campo de aplicação do produto.
7.2. Nome(s) científico(s) e comum(s) de praga(s) controlado(s) e grande controlo obtido *(bom, regular e fraco)*.
7.3. Duração de protecção ou controlo e influência do clima, solo, estado de desenvolvimento da cultura e praga, e outros factores (ex: no caso de iscas, grau de aceitação da isca pela praga).
7.4. Modo de acção do produto contra a(s) praga(s) por ex: contacto, sistemático, estomacal.
7.5. Incidência de resistência da (s) praga(s); cuidados necessários para evitar desenvolvimento de resistência.

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CLASSE I

CLASSE II

CLASSE III

VENENOSO QUANDO COMIDO/BEBIDO

2) O triângulo superior tem fundo amarelo, contendo uma caveira e as duas tíbias cruzadas a preto para os símbolos da classe I e II, e a cruz de Santo André a preto o símbolo da classe III.

O triângulo inferior tem fundo branco, e os avisos indicados no modelo a preto, consoante a classe toxicológica do produto.

3) A largura da orla deve ser 2/50 do lado do quadrado a preto.

4) Um traço fino deve separar os dois triângulos.

5) As dimensões dos símbolos toxicológicos no rótulo devem ser conforme o peso líquido do produto segundo o seguinte quadro:

Peso/volume líquido do produto	Dimensão do lado do quadrado dos símbolos toxicológicos
g ou cm³	cm
1000	2,5
1000–5000	3,5
5000	10,0

ANEXO V

Lista de tipos de formulações de pesticidas e sistema de código internacional (GIFAP)

AB Isca de grãos.
AE Bomba de aerosol.
AI Ingrediente activo/substância.
AL Outros líquidos para aplicação directa.
BB Isca em blocos.
BR Bloco.
CB Isca concentrada.
CG Granulado encapsulado.
CS Suspensão de capsulado.
DP Pó.
DS Pó para tratamento de sementes a seco.
EC Concentrado para emulsão.
ED Líquido para pulverização electroestática.
EO Emulsão (água em óleo).
EW Emulsão (óleo em água).
FD Pastilha fumigadora.
FG Granulado fino (tamanho de partículas: 300 — 2500 mm).
FK Vela fumigadora.
FP Cartucho fumigador.
FR Filamento fumigador.
FS Concentrado fluido para tratamento de sementes.
FT Tablete fumigadora.
FU Produto fumigador.
FW Grânulo fumigador.
GA Gás (em embalagem pressurizada).
GB Isca granulada.
GE Produto gerador de gás.
GG Macrogranulado (tamanho de partículas: 2000 — 6000 mm).
GP Polvilho fino (para estufas).
GR Granulado.
GS Pasta oleosa.
HN Concentrado para nebulização a quente (hot fogging).
KN Concentrado para nebulização a frio.
LA Laca.
LS Solução para tratamento de sementes.
MG Microgranulado (tamanho de partículas: 100 — 600 um).
OF Concentrado fluido miscível em óleo.
OL Solução miscível em óleo.
OP Pó molhável em óleo (*não* — organophosphorous compunds).
PA Pasta.
PB Isca em pires.
PO Solução para molhar (a pele dos animais: *pour-on*).
PR Filamento vegetal (plant rodlet)
PS Semente tratada com pesticida.
RB Isca pronta para usar.
SA Solução para aplicação local (spot aplication-a pele dos animais).
SB Isca em aparas.
SC Suspensão concentrada (= flowable).
SG Granulado solúvel em água.
SL Concentrado solúvel em água
SO Óleo para formar película (camada superficial) nas águas.
SP Pó solúvel (em água).
SS Pó solúvel para tratamento de sementes.
SU Suspensão para aplicação em ultra baixo volume (ULV).
TB Tablete.
TC Produto técnico.
TP Pó para despistagem (rodenticida de contacto).
UL Líquido homogénio para aplicação em ultra baixo volume (ULV).
VP Produto produtor de vapor.
WG Granulado para dispersão em água.
WP Pó molhável.
WS Pó para preparação de *slurry* (mistura aquosa).
XX Outros.

ANEXO VI

Directivas para uso

Texto *A:*

1. Este pesticida envenena através da pele.
2. Evite qualquer contacto do produto. Use equipamento de protecção como fato-macaco/luvas/máscara.
3. Não beber, comer ou fumar durante a utilização deste produto.
4. Perigoso para animais e peixes.
5. Guarde todos os pesticidas separados de outros produtos, num armazém próprio fechado à chave.
6. Nunca utilize as embalagens vazias para guardar água ou alimentos.

Texto *B:*

Proteje as mãos e use luvas de borracha.

Texto *C:*

As plantas e produtos tratados com este pesticida são *venenosos* durante X dias depois do tratamento. *Não entre* na machamba durante este período.

Texto *D:*

Mantenha a embalagem *longe do fogo* e na sombra.

Para produtos altamente inflamáveis as palavras «CUIDADO: PEGA FOGO FACILMENTE» e o símbolo de inflamabilidade de tamanho mínimo equivalente a 0,5 % da área total do rótulo.

Para produtos inflamáveis as palavras «CUIDADO NA ARMAZENAGEM: ARDE FACILMENTE» e o símbolo do inflamabilidade de tamanho mínimo equivalente a 0,5 % da área total do rótulo.

Texto *E:*

Evite respirar os produtos pulverizados.

Texto *F:*

Não aplique contra o vento.

Texto *G:*

Este produto liberta gás venenoso em contacto com ácidos e água. ESTE GÁS PODE MATAR.

Texto *H:*

Este produto IRRITA a pele e os olhos.

Texto *I:*

Use uma máscara própria de protecção com filtros novos/Não produto em culturas ou alimentos.

Texto *J:*

Use óculos protectores/Nunca trabalhe sozinho com este produto.

Use uma máscara própria de protecção com filtros novos/Não deixe entrar ninguém no lugar tratado/Feche durante X dias, depois ventile bem o ambiente.

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ANEXO IX

Classificação toxicológica dos produtos registados

Classe I — Produtos altamente tóxicos

Produtos técnicos	Produtos formulados
Azinfós etílico.	— Azinfós etílico (FW).
BHC.	— Azinfós etílico (CE).
Brometo de metilo.	— Dibrometo de etileno (L).
Canfecloro.	— Paraquat (CE).
Carbofurão.	— Paratião (QFC).
Clorfenvinfós.	
Dibrometo de etileno.	
Dieldrin.	
Dissulfotão.	
Fenamifós.	
Fosfamidão.	
Fosfina e fosfeto de alumínio.	
Acetato de fenil-mercúrio.	
Monocrotofós.	
Paraquat.	
Paratião.	
Aldrin.	— Aldrin > 2 % (P).
Cumacloro.	— Aldrin > 2 % (Gr).
Cumatetralil.	— Aldrin (PM) (CE).
Diclorvos.	— BHC (PM).
Fentião.	— Cumacloro > 0,05 % (P).
Heptenofós.	— Cumatetralil 0,05 % (Gr).
2, 4, 5-T.	— Cumatetralil (P).
	— Diclorvos (CE).
	— Endossulfão > 40 % (CE).
	— Fentião > 16,5 % (CE).

Classe II — Produtos moderadamente tóxicos

Produtos técnicos	Produtos formulados
Alacloro.	— Alacloro > 60 % (CE).
Bronopol.	— Aldrin < 2 % (P) (Gr).
Carbaril.	— Bronopol > 4 % (P).
Cianazina.	— Canfecloro (QFC).
Cipermetrina.	— Carbaril > 15 % (PM).
Clorobenzilato.	— Cianazina > 10 % (SC).
2, 4-D.	— Cipermetrina (CE) (UBV).
Dazomet.	— Clorobenzilato ≤ 25 % (CE).
DDT.	— Cumacloro ≤ 0,05 % (Gr).
Deltametrina.	— Cumatetralil ≤ 0,05 % (Gr).
Diazinão.	— DDT > 5 % (PM).
Dimetoato.	— Deltametrina (UBV).
Dioxacarb.	— Diazinão > 60 % (Gr).
Diquat.	— Diazinão > 15 % (CE).
Endossulfão.	— Dimetoato > 7,5 % (CE).
Fenitrotião.	— Dinacarp > 50 % (PM).
Foxim.	— Endossulfão 4-40 % (CE).
Ioxinil.	— Fentião ≤ 16,5 % (CE).
Lindano.	— Lindano < 5 % (CE).
Propoxur.	— Propoxur 5 a 50 % (PM).
Tiazaflurão.	— Tiazaflurão > 14 % (PM).
Triadimefão.	— Triadimefão ≥ 18,5 % (PM).
Triadimenol.	
Mancozeb.	— Nitralina.
MCPA.	— Prometrina (PW).
Metalaxil.	— Propanil (CE).
MSMA.	— Propoxur ≤ 5 % (PM).
Metobromurão.	— Triazaflurão ≤ 14 % (PM).
Metolacloro.	— Triadimefão > 18,5 % (PM).
Metribuzina.	— Triclorfão ≤ 25 % (PS).
Nitralina.	— Trifluralina (CE).
Oxadiazona.	
Oxicloreto de cobre.	
Permetrina.	
Pendimetalina.	
Pirimifós metílico.	
Prometrina.	
Propanil.	
Propineb.	
Quinometionato.	
Simazina.	
Temefós.	
Terbutrina.	
Tetrametrina.	
Tiofanato metílico	
Tiram.	
Triclorfão.	
Trifluralina.	

Classe III — Produtos ligeiramente tóxicos

Produtos técnicos	Produtos formulados
Ácido giberélico.	— Ametrina (FW).
Ácido 1-naftil-acético.	— Atrazina (PM).
Ametrina.	— Benomil (PM).
Asulam.	— Bromopropilato (CE).
Atrazina.	— Bronopol ≤ 40 % (P).
Benomil.	— Captafol (FW).
Bromacil.	— Carbaril ≤ 15 % (PM).
Bromopropilato.	— Cianazina ≤ 10 % (SC).
Butacloro.	— DDT ≤ 5 % (PM).
Captafol.	— Diazinão ≤ 60 % (Gr).
Captan.	— Diazinão ≤ 15 % (CE).
Cloridazão.	— Dimetoato ≤ 7,5 % (CE).
Clorometiurão.	— Dinocap ≤ 50 % (PM).
Clortal dimetílico.	— Endossulfão ≤ 4 % (CE).
Difenacum.	— Etidimurão (Gr).
Dipropetrina.	— Etidimurão (PM).
Diurão.	— Fenitrotião (P).
Enxofre.	— Fenitrotião ≤ 25 % (CE).
Etidimurão.	— Lindano ≤ 5 % (CE).
Floumeturão.	— Malatião (PM).
Flourodifen.	— Mancozeb (PM).
Glifosato.	— Metobromurão (CE).
Iodofenfós.	— Metolacloro (CE).
Malatião.	— Metribuzina (PM).

ANEXO X

Limites máximos de resíduos tolerados em alimentos

Pesticida	Alimento	Limite máximo de resíduos (mg/kg)		Intervalo de Segurança (dias)
Ácido giberélico (*Giberalic acid*)	Batata	0,05	100	20
Alacloro (*Alachlor*)	Semente de algodão	0,05	T	—
	Cana-de-açúcar	0,01	T	—
	Batata, couves e tomate	N.E.,000		—
	Feijão, Milho e Soja	0,02	T	—
Ametrina (*Ametryn*)	Semente de algodão e cana-de-açúcar	N.E.		30
	Ananás	0,2	T	30
Asulam (*Asulam*)	Cana-de-açúcar	0,01	T	7
Atrazina (*Atrazine*)	Ananás e cana-de-açúcar	0,2	T	—
	Milho e sorgo	0,2	T	—
Azinfós-etílico (*Azinphos-ethyl*)	Batata	0,5	T	30
BHC (*HCH*)	Cajú e milho	N.E.		—
	Carne (na gordura)	0,2 LRE(0000)	T	—
	Leite e produtos lácteos	0,1 LRE	T	—
	Ovos (na gema)	0,2 LRE	T	—
Bromacil (*Bromacil*)	Ananás e citrinos	0,1	T	—
Brometo de metilo (*Methyl bromide*)	Grãos armazenados	50		—
Bronopol (*Bronopol*)	Semente de algodão	N.E.		—
Butacloro (*Butachlor*)	Milho	0,1	T	—
Confecloro (*Camphechlor*)	Carne (na gordura)	7	T	—
Captan (*Captan*)	Algodão e milho	N.E.		15

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Observações:

(X)T = Limite de resíduo temporário pelo facto de não ter Ingestão Diária Aceitável (IDA) estabelecida ou a IDA ser estabelecida por um período de tempo limitado.

(XXX)N. E. = Valores não estabelecidos por falta de dados sobre resíduos.

(XXX)LRE = Limite de resíduo estranho.

(*a*) Os limites incluem a soma dos resíduos de Endossulfão A, Endossulfão B e de sulfato de endossulfão.

(*b*) Os limites incluem a soma dos resíduos dos isómeros *cis e trans* e de seus derivados des-etilados.

(*c*) Os resíduos são determinados e expressos em C_2S.

(*d*) Estes dados (ETU) referem-se ao resíduo de etileno-tio-uréia.

(*e*) Os resíduos referem-se à soma isómeros *cis e trans*.

Preço — 18,00 MT

IMPRENSA NACIONAL DE MOÇAMBIQUE

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Appendix D. Up-date on A.I.D.-approved list of pesticides for locust'grasshopper control 3'93

OUTGOING TELEGRAM

AGENCY FOR INT'L DEV. TELECOMMUNICATIONS CENTER

PAGE 01 STATE 118760 192313Z 8622 024879 AID2306
ORIGIN AID-00

ORIGIN OFFICE AFDV-06
INFO AFEA-04 AFSA-03 AFSW-06 AFCW-04 AFFE-02 ASTR-03 AFAR-05
OL-01 FAPB-02 POSP-01 GC-01 GCAF-02 RDAA-01 STAG-02
STFN-02 SECP-01 SERP-01 SE'S-02 AMAD-01 OUT-01 FABP-02
AFFW-02 POCE-01 LAV-01 REG-01 /058 A8 30/8434Z

INFO LOG-00 AF-00 OIG-04 /886R

DRAFTED BY: AID/AFR/ONI/TPPI:YBELAYNEH:YB
APPROVED BY: AID/AFR/ONI/TPPI:ZWAHN
AID/AFR/ONI/TPPI:VDREYER (DRAFT) AID/AFR/ONI/TPPI:ASHOWLER (DRAFT)
AID/NE:GJACKSON (DRAFT) AID/POL:JHESTER (DRAFT)
AID/AFR/ARTS:JGAUDET (DRAFT) AID/AFR/FHA/OFDA:GNUDEN (DRAFT)
AID/OC/AFR:ESPRIGGS (DRAFT) AID/ASIA/DR/TR:MKUX (DRAFT)

85293E 192314Z /36
R 192313Z APR 93
FM SECSTATE WASHDC
TO USAID MISSIONS IN AFRICA

UNCLAS STATE 118760

AIDAC NAIROBI FOR REDSO/ESA; ABIDJAN FOR REDSO/WCA, N/ENA
E.O. 12356: N/A
TAGS:
SUBJECT: UPDATE ON A.I.D.-APPROVED LIST OF PESTICIDES FOR LOCUST/GRASSHOPPER CONTROL

1. SUMMARY: AID/AFR/ONI IS IN THE PROCESS OF REFINING THE LIST OF PREFERRED PESTICIDES PRESENTED IN THE 1989 PROGRAMMATIC ENVIRONMENTAL ASSESSMENT (PEA) FOR LOCUST AND GRASSHOPPER CONTROL IN AFRICA AND ASIA. THE INFORMATION IN THIS CABLE UPDATES SIMILAR TABULAR DATA IN THE PEA, AND SUPERCEDES SIMILAR DATA IN A.I.D.'S 'REVIEW OF ENVIRONMENTAL CONCERNS IN A.I.D. PROGRAMS FOR LOCUST AND

GRASSHOPPER CONTROL, PUBL. SERIES NO. 81-7'. THE INFORMATION ON PESTICIDES IN THIS CABLE SHOULD BE CONSIDERED TO BE AN AMENDMENT TO THE PEA. THE TABLE LISTING PESTICIDES IN THE ENVIRONMENTAL CONCERNS DOCUMENT WAS ONLY MEANT TO INDICATE PESTICIDES THAT CAN BE PURCHASED WITH A.I.D. FUNDS, BUT IT SHOULD NOT BE CONSIDERED AS GUIDANCE FOR PESTICIDE SELECTION, END SUMMARY.

2. WITH MORE AND MORE INFORMATION ON PESTICIDES BEING GENERATED, AID/AFR FINDS IT NECESSARY TO REFINE ITS LIST OF A.I.D.-APPROVED ANTI-LOCUST/GRASSHOPPER PESTICIDES. THE FOLLOWING IS AN ALPHABETICAL LISTING OF THE PESTICIDES

APPROVED IN THE PEA. THE LIST INCLUDES RELEVANT INFORMATION ON TOXICITY, BIO-ACCUMULATION AND SIGNAL WORDS (TO INDICATE THE RELATIVE TOXICITY OF EACH INSECTICIDE). THIS INFORMATION PROVIDES A SKETCH OF PROPERTIES OF THE A.I.D.-APPROVED ANTI-LOCUST/GRASSHOPPER PESTICIDES. ALL OF THE CHEMICALS LISTED BELOW ARE CURRENTLY REGISTERED EITHER BY THE U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) OR ITS EQUIVALENT IN OTHER COUNTRIES FOR LOCUST AND GRASSHOPPER CONTROL.

	TOXICITY TO						
	FISH	INVER	BIRD	MAMML	BIOAC	PERS	SIGNV
1. ACEPHATE	L	L	L	M	L	L	C
2. BENDIOCARB	M	M	M	M	M	M	W
3. CARBARYL	L	L	L	L	L-M	L	C
4. CHLORPYRIFOS	M	M	M	M	M	L	C-W
5. DIAZINON	M	M	M-H	L	M	M	C-W
6. FENITROTHION	L	M	M	L	M	L	W
7. LAMBDA-CYHALOTHRIN	H	H	L	H	H	M	D
8. MALATHION	L	L	M	L-M	L	L	C
9. TRALOMETHRIN	H	H	L	L	H	M	D

LEGEND:

NON-TARGET ORGANISMS: FISH, INVERTEBRATES (INCLUDING HONEYBEES), BIRDS, MAMMALS

BIOAC = BIO-ACCUMULATION, PERS = PERSISTENCE,

L = LOW; M = MODERATE; H = HIGH (APPLY TO TOXICITY LEVELS TO NON-TARGET ORGANISMS, BIO-ACCUMULATION AND PERSISTENCE; RELATIVE TOXICITY IS ALSO A FUNCTION OF FORMULATION AND ACTIVE INGREDIENT CONCENTRATION)

SIGNV = SIGNAL WORD: C = CAUTION; W = WARNING; D = DANGER (POISON); (APPLIES TO THE RELATIVE TOXICITY OF PESTICIDES IN ASCENDING ORDER; RELATIVE TOXICITY IS ALSO A FUNCTION OF FORMULATION AND ACTIVE INGREDIENT CONCENTRATION)

SPECIFIC DOSAGES MUST BE WORKED OUT BY HIGHLY EXPERIENCED PERSONNEL FAMILIAR WITH THE APPLICATION EQUIPMENT, PESTICIDE FORMULATION, ETC., TO BE USED. FOR ELABORATION ON THE PROPERTIES OF A.I.D.-APPROVED ANTI-LOCUST/GRASSHOPPER PESTICIDES, CONSULT THE PEA AND COUNTRY-SPECIFIC SUPPLEMENTARY ENVIRONMENTAL ASSESSMENTS (SEAS).

3. IT IS IMPORTANT THAT ALL PRECAUTIONS INDICATED ON THE PESTICIDE LABELS, E.G., APPLICATION DOSAGES, SAFETY MEASURES, INSTRUCTIONS ON HANDLING AND STORAGE PROCEDURES, DISPOSAL OPTIONS, ENTRY BY UNPROTECTED PERSONS INTO TREATED AREAS, EMERGENCY GUIDELINES, ETC., BE CAREFULLY OBSERVED, AS OUTLINED IN THE COUNTRY-SPECIFIC SEAS.

4. AID/W WILL KEEP MISSIONS INFORMED OF FUTURE UPDATES ON THE LIST OF A.I.D.-APPROVED ANTI-LOCUST/GRASSHOPPER PESTICIDES.
CHRISTOPHER

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Appendix E. List of Pesticides Registered in Mozambique

LIST OF PESTICIDES REGISTERED

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TRADE NAME	ACTIVE INGREDIENT	AGENT	REGISTRATION NUMBER	VALIDITY
Actellic 2% Dust	Pirimiphos - Methyl	ICI	IN12/20DP-A	19.09.94
Actellic 50% EC	Pirimiphos - Methyl	ICI	IN12/500EC-A	19.09.94
Aerosol Dragon	Permethrin + Pynamin forte + Tetramethrin	ICI	IN13+14+15/SOAE-A	31.12.94
Alachlor 48% EC	Alachlor	Quimigal	HE7/480EC-B	26.03.95
Alachlor Sentrachem	Alachlor	Sentrachem	HE7/384EC-C	30.05.95
Astra 25% ED	Profenophos	ICI	IN6/250ED-A	30.08.96
Atrazine Sentrachem	Atrazine	Sentrachem	HE4/500FM-A	07.04.94
Azodrin 25% ULV	Monocrotophos	Shell	IN30/250ULV - A	30.08.96
Bac Atrazine 80% PM	Atrazine	S.M.P.A.	HE4/800FM-A	31.07.93
Bac oil	Oil mineral	S.M.P.A.	IN-AC25/8535EC-A	29.06.96
Basagran 480 SL	Bentazon	Basf	HE26/480SL-A	25.04.96
Basudine 60% EC	Diazinon	Ciba - Geigy	IN21/600EC-A	30.05.95
Basvitin 50% SC	Carbendazim	Basf	FU14/500SC - A	30.08.96
Baythroid 050 EC	Cyflutryn	S.M.P.A.	IN4/50EC -A	30.08.96
Baythroid 1,2% EC	Cyfluthrin	S.M.P.A.	IN4/12UBV-A	27.02.93
Benlate 50% WP	Benomil	ICI	FU9/500WP - B	30.07.95
Benomil 50% WP	Benomil	Quimigal	FU9/500WP-A	26.03.95
Bladex Plus	Atrazine + Cyanazine	Shell	HE4+15/500SC-A	31.05.94
Bromoxynil + MCPA	Bromoxynil + MCPA	Quimigal	HE25+18/400EC-A	14.12.95
Bronocot 12% DS	Bronopol	ICI	BAC1/120DS-A	26.03.95
Bronocot c 42% DS	Bronopol + Captan	ICI	FU3+4/420DS-A	20.07.93
Butachlor Sentrachem	Butachlor	Sentrachem	HE6/600EC-B	30.03.95
Carbaryl 50% WP	Carbaryl	Quimigal	IN17/500WP-A	26.03.95
Carbofuran 10% Gr	Carbofuran	Quimigal	IN16/100GR-B	15.04.95
Cotogard 500 SC	Fluometuron + Prometrin	Ciba - Geigy	HE12+13/500SC-A	02.05.94
Curacron Ulvair 250	Profenofos	Ciba + Geigy	IN25/250UBV-A	07.04.94
Curacron Ulvair 375	Profenofos	Ciba - Geigy	IN6/375UBV-A	19.10.93
Curaterr 10% Gr	Carbofuran	S.M.P.A.	IN16/100GR-A	15.01.95
Cymbush 6% ED	Cypermethrin	ICI	IN3/60ED-A	27.02.93
Cypermethrin 20% EC	Cypermethrin	Quimigal	IN3/200EC-B	26.03.95
Cypermethrin 2,5% UBV	Cypermethrin	Quimigal	IN3/25UBV-B	26.03.95
Decis 0,5% UBV	Deltametrin	Quimigal	IN11/5UBV-A	15.09.94
Decis 2,5% EC	Deltametrin	Quimigal	IN11/25EC-A	25.09.94
Diazinon 60% EC	Diazinon	Mitsui	IN21/600EC-B	07.12.95
Dimecron 25% UBV	Phosphamidon	Ciba - Geigy	IN1/250UBV-A	30.03.92
Dimecron 50% Sol	Phosphamidon	Ciba - Geigy	IN1/500SOL-A	30.06.93
Dimepax 500 EC	Dimethoate	Ciba - Geigy	HE9/500EC-A	20.02.94
Dipterex 95% SP	Trichlorfon	S.M.P.A.	IN22/950SP-A	30.05.95
Dithane M 45% WP	Mancozeb	S.M.P.A.	FU7/800WP-A	28.06.96
Dithane M - 45	Mancozeb	Mitsui	FU7/450WP-A	07.12.95
Dual 960 EC	Metolachlor	Ciba - Geigy	HE5/960EC-A	07.04.94
Duplosan super	Mecoprob-p + Dichlorprop- p + MCPA	Basf	HE27+28+18/690SL-A	25.04.96
Dursban 24% ULV	Chlorpirifos	Sentrachem	IN26/240ULV-A	31.07.96
Dursban 4% EC	Chlorpirifos	Sentrachem	IN26/40EC-A	31.07.96
Endosulfan 25% UBV	Endosulfan	Quimigal	IN7/250UBV-A	11.02.94
Fastac 0,6% UBV	Cypermethrin	Shell	IN3/6UBV-A	30.08.92
Focus ultra	Cloloxidim	Basf	HE24/200SLV-A	25.04.96
Fortrol 5% EC	Cyanazine	Shell	HE15/50EC - A	30.06.96
Fusilad s 12,5% EC	Fluazifop - p - Butyl	ICI	HE8/125EC-A	17.02.93

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Galex 500 EC	Metolachlor + Metobromuron	Ciba - Geigy	HE5+8/500EC-A	07.04.94
Gesagard 500 SC	Promethrin	Ciba - Geigy	HE13/500SC-B	30.05.95
Gesaprin 50% SC	Atrazine	Ciba - Geigy	HE4/500SC-A	19.06.93
Gesaprin 80% PM	Atrazine	Ciba - Geigy	HE4A/800PM-B	19.05.94
Gramoxon Blue 20% Sol	Paraquat	ICI	HE2/200SOL-A	30.08.92
Gramuron Blue 40% SC	Paraquat + Diuron	ICI	HE2A/400SC-A	30.08.92
Guardian 90% EC	Acetochlor	S.M.P.A.	HE20/900EC-B	10.04.95
Harness 810 EC	Acetochlor	S.M.P.A.	HE20/810EC-A	10.04.95
Hyvar dupont 80% WP	Bromacil	ICI	HE30/800WP-A	25.04.96
Icon 10% WP	Lambdacyhalothrin	ICI	IN10/100WP-A	19.01.95
Icon 2,5% EC	Lambdacyhalothrin	ICI	IN10/100WP-A	19.01.95
Igran 500 SC	Terbuthrin	Ciba - Geigy	HE14/500SC-A	02.05.94
Igran Combi 500 EC	Terbuthrin + Metolachlor	Ciba - Geigy	HE5+14/500EC-A	02.05.94
Karate 0,8% UBV	Cyhalothrin	ICI	IN10/8UBV-A	28.06.94
Karate 3% ED	Lambdacyhalothrin	ICI	IN10/30ED-A	10.07.94
Karate 5% EC	Lambdacyhalothrin	ICI	IN10/50EC-A	25.08.94
Karate c 1,6% ULV	Cyhalothrin	ICI	IN19/16ULV-A	10.03.95
Klerat (granulado)	Brodifacoum	ICI	RO3/0,5GR - A	05.09.96
Larvin (R) 175 ULV	Thiodicarb	Sapec	IN27/175ULV-A	31.07.96
Larvin (R) 375 SC	Thiodicarb	Sapec	IN27/375SC-A	31.07.96
Lasso 38,4% EC	Alachlor	Shell	HE7/384EC-D	30.05.95
Lasso 38,4% EC	Alachlor	S.M.P.A.	HE7/384EC-A	16.03.94
Lexone du pont 75% WG	Metrebuzin	ICI	HE11/750WG-A	30.04.95
Machete 60% EC	Butachlor	S.M.P.A.	HE6/600EC-A	15.09.93
Malathion 50% EC	Malathion	Quimigal	IN18/500EC-A	26.03.95
Mancozeb 80% PM	Mancozeb	Quimigal	FU7/800PM-A	26.03.95
MCPA 400 EC	MCPA	S.M.P.A.	HE18/400EC-C	29.06.96
MCPA 40% CSA	MCPA	Quimigal	HE18/400SL-A	26.03.95
MCPA Sentrachem	MCPA	Sentrachem	HE18/400EC-A	15.06.95
Metribuzin Sentrachem	Metribuzin	Sentrachem	HE11/480EC-A	07.04.94
Miral 10% Gr	Isazophos	Ciba - Geigy	IN8/100GR-A	19.05.94
Milraz 76% WP	Propineb + Cymoxanil	Ciba - Geigy	FU5+6/760WP-A	20.10.93
Monceren combi	Pencycuron + Captan	S.M.P.A.	FU12+13/700DS-A	29.06.96
Neoron 500 EC	Bromopropilate	Ciba - Geigy	AC9/500EC-A	07.06.94
Oftanol 50% EC	Isofenphos	S.M.P.A.	IN20/500EC-A	22.05.95
Ordram 6 - E	Molinate	ICI	HE21/60EC-A	15.05.92
Patafol	Ofurace + Mancozeb	Quimigal	FU7+8/700PM-A	07.04.94
Phostoxin Tablets	Aluminium Phosphorete	S.M.P.A.	IN29/560FT - A	30.08.96
Pirimor 12,5% ED	Pirimicarb	ICI	IN31/125ED-A	30.08.96
Pix 0,5% SL	Mepiquatchloride	Basf	HE29/5SL-A	25.04.96
Polytrin 025 ULV	Cipermetrina	Ciba - Geigy	IN3/25ULV-B	08.12.94
Polytrin 200 EC	Cypermethrin	Ciba - Geigy	IN3/200EC-A	07.04.94
Polytrin c 220 UBV	Profenofos + Cypermethrin	Ciba - Geigy	IN3+6/220UBV-A	06.04.94
Polytrin Ulvair 24	Cypermethrin	Ciba - Geigy	IN3/240UBV-C	08.12.94
Pree 40% EC	Metolachlor	Basf	HE5/400EC-A	25.04.96
Primagran 50% SC	Metolachlor + Atrazine	Ciba - Geigy	HE5+4/500SC-B	30.06.93
Primextra 50% SC	Metolachlor + Atrazine	Ciba - Geigy	HE5+4/500SC-A	30.06.93
Promethrin 50% SC	Promethrin	Quimigal	HE13/500SC-A	26.03.95
Propanil 36% EC	Propanil	Quimigal	HE17360EC-D	15.04.95
Propanil Sentrachem	Propanil	Sentrachem	HE17/360EC-C	30.03.95
Propanin CNDA	Propanil	C.J.F.S.	HE17/360EC-B	25.01.95
Racumin Rat Bait Block	Coumatetralil	S.M.P.A.	RO2/3,33BB - A	30.08.96
Ridomil Combi 50% PM	Metalaxyl + Fosfet	Ciba - Geigy	FU1+2/500PM-A	30.07.93

Ronstar 25% EC	Oxadiazon	Quimigal	HE16/250EC-A	25.09.94
Roundup	Glyphosate	S.M.P.A.	HE10/480SCL-A	20.02.94
Satunil 60% EC	Thiobencarb + Propanil	S.M.P.A.	HE31+17/600EC-A	29.06.96
Saturn 50% EC	Thiobencarb	S.M.P.A.	HE31/500EC-A	29.06.96
Selecron 500 EC	Profenofos	Ciba - Geigy	IN6/500EC-A	30.05.95
Sencor 70% PM	Metribuzin	S.M.P.A.	HE11/700PM-A	15.01.95
Stam - F - 34	Propanil	Nitsui	HE17/340EC-D	07.12.95
Sting 18% SL	Glifosate	S.M.P.A.	HE18/180SL - A	30.08.96
Stomp 50% EC	Pendimethalin	S.M.P.A.	HE1/500EC-A	30.08.92
Sumi - Alpha 1% ULV	Esfenvalerate	Sumitomo	IN28/10ULV-A	05.07.96
Sumicidin 20% EC	Fenvalerate	Sumitomo	IN2/200EC-A	30.06.93
Sumicidin 3% UBV	Fenvalerate	Sumitomo	IN2/30UBV-A	30.08.92
Sumicidin 4% ULV	Fenvalerate	Sumitomo	IN2/40ULV-A	22.06.96
Sumithion 100% EC	Fenitrothion	Sumitomo	IN5/1000EC-B	18.10.93
Sumithion 2% Dust	Fenitrothion	Sumitomo	IN5/20DP-A	18.10.93
Sumithion 50% EC	Fenitrothion	Sumitomo	IN5/500EC-A	18.10.93
Supkur 80% PM	Sulphur	Quimigal	FU10/800PM-A	26.03.95
Supona 30% EC	Chlorfenvinphos	Shell	CA1/300EC -A	31.07.96
Surcopur 36% EC	Propanil	S.M.P.A.	HE17/360EC-A	18.10.94
Tamaron 58,5% SL	Metamidophos	S.M.P.A.	IN-AC24/585SL-A	30.07.96
Terbuthrin 50% SC	Terbuthrin	Quimigal	HE14/500SC-B	26.03.95
Trichlorfon 80% SP	Trichlorfon	Quimigal	IN22/800SP-A	14.12.95
Trichlorfon 80% SP	Trichlorfon	Quimigal	IN17/500HP -A	26.03.95
Ustilan 10% Gr	Ethidimuron	S.M.P.A.	HE19/100GR-A	10.04.95
Velpar du pont 90% SP	Hexazione	ICI	HE22/900SP-A	30.04.95

Jose Kumpebo
(Pesticides register)

Bernardino do Rosario
(Head of pesticide sector)

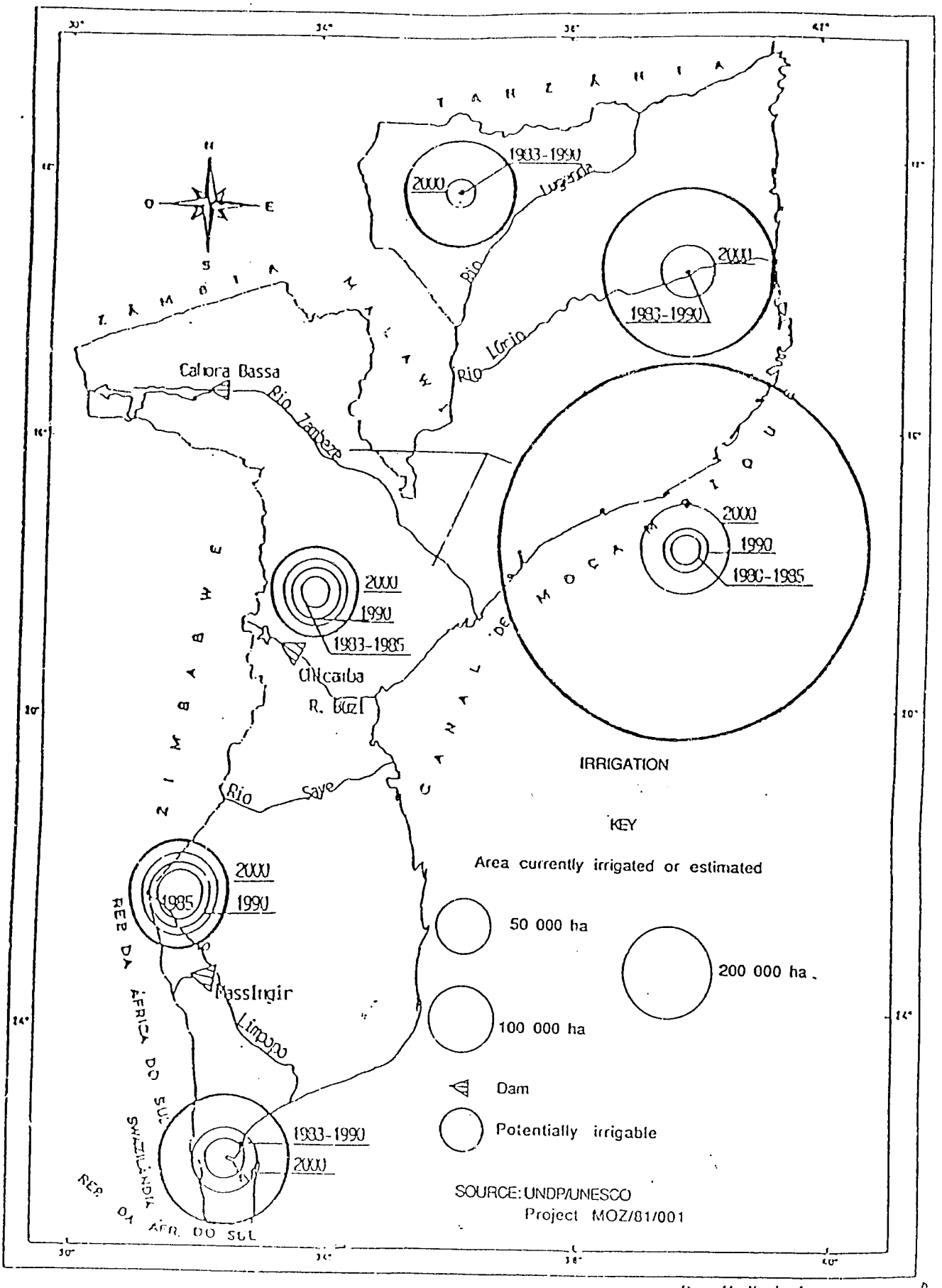
Mozambique August 30, 1991

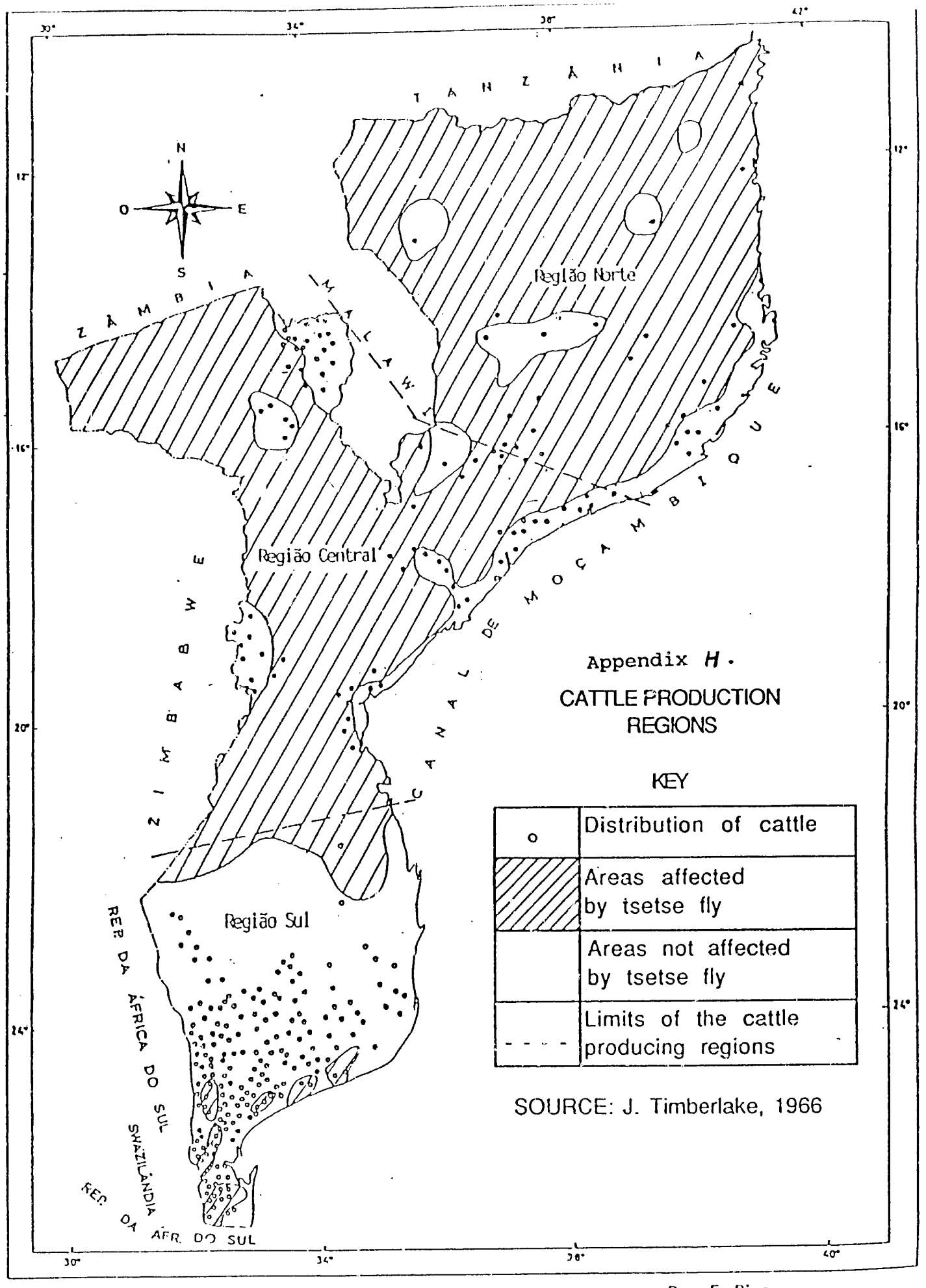
Appendix F. Agricultural Production by Sector, 1984/85-1986/87

Crop	1984 - 1985 (%)				1985 - 1986 (%)				1986 - 1987 (%)			
	State	Coop	Priv	Fam	State	Coop	Priv	Fam	State	Coop	Priv	Fam
Maize	45	3	9	43	39	4	22	35	32	4	26	38
Rice	75	2	12	12	61	2	23	13	60	2	17	21
Cassa-va	43	2	20	34	16	5	20	58	2	4	22	72
Pea-nuts	4	3	7	86	7	3	19	70	2	–	3	94
Sun-flower	6	–	5	88	9	2	23	65	9	–	43	48
Sorg-hum	22	2	11	65	14	3	11	72	10	7	13	70
Cashew	–	–	–	100	–	–	–	100	–	–	–	100
Sisal	31	–	70	–	100	–	–	–	100	–	–	–
Copra	40	–	29	31	32	–	23	45	22	–	26	52

Source: Informacao Estatistica 1987, National Planning Commission, National Statistics Directorate, 1988

Appendix G. Irrigated or Irrigable Land - Potential for Pesticide use and Pest Proliferation





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Des: E. Dias

Appendix I. Protected Fauna of Mozambique (partially translated from "Lista dos animais protegidos" - List of protected animals).

1. Mamiferos (Mammals):

Cabrito das pedras (Stone kid)
Caracal (Karakul)
Chacal dorso preto (Black back jackal)
Chacal listrado (Stripped jackal)
Chango da montanha
Chita * (Cheetah)
Civeta (Civet cat)
Dugongo *
Doninha nuca branca
Gato bravo (Wild cat)
Gato cerval (cerval cat)
Genetas ou simbas
Girafa * (Giraffe)
Hiena catanha (Brown hyena
Hiena malhada (Spotted hyena
Jagras (Jaguar)
Lontras (Otters)
Mabeco (Wild dog)
Macaco de cara preta ou azul (Blue or Black face monkey)
Macaco Simango (Simango monkey)
Mangucos (Mongoose)
Maritacaca (skunk)
Matagaiça *
M'zanze *
Pangolim (Pangolin, a mammal)
Protelo
Raposa orelhuda (Big-ear fox)
Ratel
Rincoceronte de lábio preensil * (Prehensile lip rhinoceros)
Rinoceronte de lábio quadrado * (Quadrate lip rhinoceros)
Sitatunga *
Elefante * (Elephants)

2. Aves (Birds):

Rapina/diurnas e nocturnas) (Diurnal and nocturnal Robin)
Abetrada gigante (Giant Albatross)
Abutres (Vultures)
Avestruz * (Ostriches)
Calau do solo
Cegonhas
Flamingos (Flamingos)
Gaviotas e gaivanhas (Sea Gulls)
Graças
Marabu (Marabou)
Pelicanos (Pelicans)
Serpentário

3. Répteis (Reptiles):

Tartarugas marinhas (Sea turtles)
Lagartass varanaus (Lizards)
Pitão ou gibóia (Pythons)

* On the verge of extinction

Appendix J. Overview of Insecticides used by the Crop Protection Service, through BOROR for 1989/90 and 1990/91

CAMPANHA 1989/90 A 90/91

Anexo 1 PRODUTOS ENCOMENDADOS E DISTRIBUIDOS

PRODUTOS AGRO-QUIMICOS	UN. MD.	DISTRIBUICAO POR ZONAS ZONA SUL	Z.CENTRO	Z.NORTE	TOTAL
1. ADUBOS					
Sulfato de Amonio	Ton	500	0	0	500
Ureia 46%	Ton	2500	0	2000	4500
N-P-K- 12:24:12	Ton	0	0	1500	1500
2.PESTICIDAS					
2.1.FUNGICIDAS					
Mancozeb 80 WP	Kg.	17100	3100	0	20200
Ridomil 58-MZ	Kg.	4400	0	0	4400
Benomyl 50 WP	Kg.	0	3000	0	3000
2.2.HERBECIDAS					
Atrazina 80 WP	Kg.	0	1200	1200	2400
Dual 960 EC	Lt.	2800	2500	1600	6900
Roundup	Lt.	2100	2100	0	4200
2.3.INSECTECIDAS					
Basudin 60 EC	Lt.	2000	5300	600	7900
Cipermetrina 20 EC	Lt.	10600	400	0	11000
Malathion 50 EC	Lt.	4200	400	0	4600
Neoron 500 EC	Lt.	3676	0	0	3676
Sumicidin 3% ULV	Lt.	0	0	50000	50000
Actellic 2% Po	Kg.	10000	0	0	10000
Actellic 50 EC	Lt.	5000	0	0	5000
Oftanol 500 EC	Lt.	1500	0	0	1500

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Appendix K. Pesticides Stocked by BOROR in the Southern, Central and Norther Regions.

NOMES DOS PRODUTOS		UN.	SUL		CENTRO	NORTE			TOTAL
COMERCIAL	TECNICO (m.a)	MD.	MATOLA	CHOKWE	BEIRA	NAMPULA	NACALA	PEMBA	
FUNGICIDAS	FUNGICIDAS								
Benlate 50 WP	Benomyl 500 Gr./Kg.	Kg.	0	625	3000	0	0	0	3625
Thiuram 80 WP	Thiram 800 Gr/Kg.	Kg.	0	0	25	0	0	0	25
Tiabendazol 45 EC	Thiabendazol 450 Gr/Lt.	Lt.	0	0	1600	60	0	500	2160
Cobre 80 WP	Oxicloreto de Cobre 800 Gr/Kg.	Kg.	0	0	0	0	0	0	0
Ridomil MZ58 WP	Metolaxyl + Mancozeb(180+400)	Kg.	0	0	0	21600	80	0	21680
Enxofre 80 WP	Enxofre 800 Gr/Kg.	Kg.	0	0	0	0	0	2000	2000
HERBICIDAS	HERBICIDAS								
Gesaprim 50 WP	Atrazina 800 Gr/Kg.	Kg.	475	400	5000	0	0	0	5875
Amine 2,4D	2,4D 720 Gr/Lt.	Lt.	0	0	8200	0	0	0	8200
Gesapax Plus	Atrazina+Cianazina (338+164)	Lt.	0	0	1000	0	0	0	1000
Basagran 25 WP	Bentazona 720 Gr/Kg.	Kg.	0	0	14800	0	0	0	14800
Gesapax Duo EC	Metobromurao+Metolac.(250+250)	Lt.	0	0	3500	0	0	4000	7500
Gesatop 80 WP	Simazina 800 Gr/Kg.	Kg.	0	0	1000	0	0	0	1000
Gesapax Plus	Metobromurao+Metolac.(250+250)	Lt.	0	0	150	0	2700	0	2850
Sencor 70 WP	Metribuzin 700 Gr/Kg.	Kg.	250	0	0	0	175	400	825
Erecal 36 EC	Propanil 360 Gr/Lt.	Lt.	0	0	3600	0	0	0	3600
Primagram 500 FW	Metolacloro+Atrazina(250+250)	Lt.	1400	75	0	0	0	0	1475
Butacloro	Butacloro	Lt.	1900	0	0	0	0	0	1900
Dual 960 EC	Metolacloro 960 Gr/Lt.	Lt.	50	0	0	0	0	400	450
INSECTICIDAS	INSECTICIDAS								
Actellic 50 EC	Pirimifosmetyl 20 Gr/Kg.	Kg.	800	3000	0	0	0	0	3800
Actellic 50 EC	Pirimifosmetyl 500 Gr/Lt.	Lt.	6000	25	2500	57	900	0	9282
Basudin 60 EC	Diazinon 600 Gr/Lt.	Lt.	0	700	3400	139	0	1500	5739
Baythroid 5% UWV	Cyfluthrin 50 Gr/Lt.	Lt.	0	0	3000	25	4300	0	7325
Baythroid 50 EC	Cyflutrin 500 Gr/Lt.	Lt.	0	0	0	0	0	0	0
Cypermethrine 5,5 ULV	Cypermethrine 25 Gr/Lt.	Lt.	34800	1000	0	0	0	0	35800
Dimetoato 40 EC	Dimetoato 400 Gr/Lt.	Lt.	0	0	0	0	0	0	0
Evolution 30 ULV	Resmethrine+Propoxur(260+40)Gr/Lt.	Lt.	3475	0	3700	0	4500	0	11675
Folidol 50 EC	Isofenfos 500 Gr/Lt.	Lt.	0	0	0	1900	0	0	1900
Nexagone 500 EC	Bromopropilato 500 Gr/Lt.	Lt.	0	6500	250	0	0	0	6750
Sevin	Carbaryl 800 Gr/Lt.	Lt.	0	0	0	0	38000	0	38000

APPENDIX L . Documentation that can be consulted on safety measures, transport, distribution, handling, use, application, and disposal of Pesticides.

FAO Pesticide Management Documents:

a) International Code of Conduct for Distribution and Utilization of Pesticides.

b) Guidelines for safe pesticide distribution, storage, and handling.

c) Guidelines for pesticide disposal and container disposal.

d) List of FAO approved pesticides.

e) Pesticide storage and packaging guidelines.

f) Guidelines for pesticide approval and management.

g) Ecotoxicological guidelines.

h) Ground and aerial application guidelines.

i) Insecticide poisoning: prevention, diagnosis and treatment.

j) Guidelines for effective labeling.

k) Efficacy requirements for pesticide approval.

l) Guidelines on environmental criteria for the registration of pesticides

m) Mozambique's Pesticide Regulation

n) A Draft Legislation of Association of Agrochemical Importers of Mozambique

Other Documents on Pesticides and Locust/Grasshopper Control:

a) Guidelines for selection, procurement, and use of pesticides in World Bank-financed projects.

b) Crop Protection Service Organization (D.310) T. 1. PRIFAS. Dec. 1988.

c) Effectiveness of localized pesticide treatment. (D.309) T. 2. PRIFAS - Dec. 1988.

d) Effects of locust/grasshopper and control on the environment. (D. 308) T. 3. PRIFAS - Dec. 1988.

e) Locust/Grasshopper and Control - Interministerial Instruction No. 3 related to protection of man and environment. Algérien doc.- March 1989.

f) First aid in cases of poisoning by locust/ grasshopper and control products. CIBA-GEIGY.

USEPA Pesticide Fact Sheets:

Acephate	# 140	October	1987
Bendiocarb	# 195	June	1987
Carbaryl	# 21	March	1984
Cholpyrophos	# 37	September	1984
Diazinon	# 96.1	December	1988
Fenitrothion	# 142	July	1987
Malathion	# 152	January	1987
Lindane	# 73	September	1985

These are among the many Pesticide Fact Sheets issued by the U.S. Environmental Protection Agency, selected for relevance to locust/grasshopper and control. They summarize data known to EPA at the time of preparation of the Fact Sheet. They generally include information on acute and chronic toxicity to humans and other non-target organisms, handling precautions, and other instructions for use. They may be requested from:

Office of Pesticide Programs
US Environmental Protection Agency
401 M Street, SW
Washington, D.C. 20460 USA

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AGENCY FOR INTERNATIONAL DEVELOPMENT
BUREAU FOR AFRICA
Disaster Response Coordination Office
AFR/AA/DRCO

COUNTRY SPECIFIC SUPPLEMENTARY ENVIRONMENTAL ASSESSMENT (SEA) TO THE PROGRAMMATIC ENVIRONMENTAL ASSESSMENT (PEA) FOR LOCUST/GRASSHOPPER CONTROL IN AFRICA AND ASIA

FINAL ACTION FORM

COUNTRY: MOZAMBIQUE

DATE: September 1993

Recommendation:_____

ACTION TAKEN:

Approved: ✓ Date 1/31/94

Disapproval: _____ Date _____

Bureau Environmental Officer, John Gaudet: _____