

AGENCY FOR INTERNATIONAL DEVELOPMENT ^{PN ABR-458}
POL./CDIE/DI REPORT PROCESSING FORM

ENTER INFORMATION ONLY IF NOT INCLUDED ON COVER OR TITLE PAGE OF DOCUMENT

1. Project / Subproject Number

693-0517

2. Contract / Grant Number

3. Publication Date

1991

4. Document Title / Translated Title

"Supplementary Environmental Assessment within the Framework of Locust/Cricket Control in Burkina Faso"

5. Author(s)

1. Bill Thomas
2. Dennis McCarthy
- 3.

6. Contributing Organization(s)

- USAID / Burkina Faso
- The Government of Burkina Faso

7. Pagination

8. Report Number

9. Sponsoring A.I.D. Office

AFR/TR/ANR/NR

10. Abstract (optional - 250 word limit)

Please use the document's Preface (Page 1) for the Abstract.

11. Subject Keywords (optional)

- | | |
|----|----|
| 1. | 4. |
| 2. | 5. |
| 3. | 6. |

12. Supplementary Notes

13. Submitting Official

Alise Laroche

14. Telephone Number

703-235-5419

15. Today's Date

5/18/94

16. DOCID

DO NOT write below this line

17. Document Disposition

DOCRD [] INV [] DUPLICATE []

SUPPLEMENTARY ENVIRONMENTAL ASSESSMENT

WITHIN THE FRAMEWORK OF LOCUST/GRASSHOPPER CONTROL IN

BURKINA FASO

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

IN COOPERATION WITH THE

GOVERNMENT OF BURKINA FASO

OUAGADOUGOU, BURKINA FASO

APRIL 1991

TABLE OF CONTENTS

PREFACE	1
LIST OF ACRONYMS AND ABBREVIATIONS	2
1.0 EXECUTIVE SUMMARY	4
2.0 PURPOSE AND PROCEDURES	4
2.1 Background	4
2.2 Scoping Procedure	5
2.3 Previous Assessments	6
2.4 Environmental Procedures	6
2.5 Pesticide Standards and Regulations	7
2.5.1 Other Environmental Regulations in Burkina Faso	8
3.0 DESCRIPTION OF PROJECT SITE	8
3.1 Description of the Physical Environment	8
3.1.1 Physical aspects and climate	8
3.1.2 Flora and Fauna	9
3.1.2.1 Birds and Fishing resources	9
3.1.2.2 Endangered species and habitat	9
3.2 Agricultural resources	11
3.2.1 General description	11
3.2.2 Agricultural Production Data	11
3.3 Locust and Grasshopper Characteristics	14
3.3.1 Distribution and Feeding habits	14
3.3.2 Level of Infestation	14
3.4 Crop loss assessment	16
3.5 Pesticide Safety and Health Care System	17
3.5.1 General Pesticide Safety Concerns	17
3.5.2 Applicator Safety Training	17
3.5.3 Public Health Care System	17
4.0 PROJECT DESCRIPTION	18
4.1 Pest Control Operations	18
4.1.1 Survey and Control Preparations	19
4.1.2 Field Operations	19
4.1.3 Thresholds of A.I.D. Assistance	20
4.1.4 Integrated Pest Management - IPM	21
4.1.5 Cultural, Biological and Traditional Control	23
4.1.6 Selection of Pesticides	24
4.1.7 Village Brigades	24
4.1.8 Ground and Aerial Operations	25
4.2 Human Health Protection	26
4.2.1 Public Awareness	26
4.2.2 Health Monitoring	27

4.3	Protection of Natural Resources	27
4.3.1	Protected areas	27
4.3.2	Buffer Zones	31
4.3.3	Pesticide Alternatives in Sensitive Areas	31
4.3.4	Environmental Monitoring	31
4.4	Pesticide Management	31
4.4.1	Pesticide Distribution and Formulation	31
4.4.2	Managing Pesticide Stocks	32
4.4.3	Pesticide Labeling	33
4.4.4	Obsolete Pesticides and Containers	33
4.4.5	Disposal of Unwanted Pesticides	34
5.0	REFERENCES	35
	BIBLIOGRAPHY	35
	APPENDIX A - LIST OF THE DRAFTING COMMITTEE AND LIST OF PEOPLE MET	38
	APPENDIX B - PEA FOR LOCUST/GRASSHOPPERS: SYNOPSIS OF ENVIRONMENTAL ASSESSMENT PRIORITIES	39
	APPENDIX C - RELEVANT DOCUMENTATION	47
	APPENDIX D - PROHIBITED PESTICIDES IN BURKINA FASO	49

LIST OF TABLES

Table I.	Threatened and Endangered Animals	10
Table II.	Cereal Production for Burkina Faso in Metric Tons, 1984-1990	13
Table III.	Protected Areas of Burkina Faso	28
Table IV.	Obsolete/Unwanted Pesticide Stocks	34

LIST OF MAPS

Map 1.	Crop Regions	12
Map 2.	Locust/Grasshopper Primary Infestation Regions	15
Map 3.	Protected Areas of Burkina Faso	30

PREFACE

This document is a supplement to the Programmatic Environmental Assessment (PEA), concerning USAID assistance in Grasshopper/Locust control programs in Africa and Asia. This Supplementary Environmental Assessment (SEA) was prepared by USAID/BURKINA, with assistance from the Government of Burkina Faso (GOBF), and with regional and local institutions. Appendix A lists members of the GOBF team, and consultants from USAID Washington, and others that assisted in the preparation of this document. This SEA reflects the best description for future USAID assistance to the Burkina Faso Crop Protection Service program for the control of locusts and grasshoppers in regard to environmental risks and advantages of control operations, training programs, environmental protection and related human health concerns.

This document is dynamic, rather than static, and is intended for active use in the planning of USAID funded pest control operations in Burkina. It should be reviewed and, if necessary, updated periodically by amendment in order to give a thorough description of the environmental consequences of assistance programs.

LIST OF ACRONYMS AND ABBREVIATIONS

CIDA	Canadian International Development Agency
AELGA	African Emergency Locust/Grasshopper Assistance USAID
AFR/TR	USAID Washington, Africa Bureau, Technical Resources
AGRHYMET	Agro-Hydro Meteorology CILSS
USAID	United States Agency for International Development, Washington, D.C.
APHIS	Animal Plant Health Inspection Service US Department of Agriculture
BSA	Bureau de la Statistique Agricole
BSPE	Bureau des Statistique, Planification et Etudes
CEFOD	Centre d'Etude et de Formation pour le Developpement
CFR	Code of Federal Regulations (U.S.)
CILSS	Permanent Interstate Committee for Drought Control in the Sahel
ChE	Cholinesterase
COPR	Overseas Control Operations Research Center; now Institute for Overseas Natural Resources Research and Development, United Kingdom
CPS	Crop Protection Services
EPA	U.S. Environment Protection Agency
FACF	Fonds d'Aide de la Cooperation Francaise
FAO	Food and Agriculture Organization
GOBF	Government of Burkina Faso
GTZ	West German Agency for Technical Cooperation
HA	Hectare
IFAD	International Fund for Agricultural Development
INSAH	Sahel Institute - a CILSS Institute

IPM	Integrated Pest Management
ITCZ	Intertropical Convergence Zone
KM	Kilometer
MLR	Maximum Limit of Residues
L/G	Locust/Grasshopper
MG/KG	Milligram/Kilogram
OCLALAV	Organisation Commune de Lutte Anti-acridienne et de Lutte Anti-aviaire
PEA	Programmatic Environmental Assessment (TAMS, 1989)
PPM	Parts per million
PRIFAS	Programme de Recherches Interdisciplinaires Francaise sur de Recherche les Acridiens du Sahel- A French Center for Research on pests, located in Montpellier, FRANCE
REDSO	Regional Office for Economic and Social Development Supplementary Environmental Assessment
SOPHYTO	Société Phytosanitaire, Bobo-Dioulasso, B.F.
UNDP	United Nations Development Programme
USAID/Burkina	AID mission in Burkina Faso, Ouagadougou.
USDA	United States Department of Agriculture.

1.0 EXECUTIVE SUMMARY

This assessment is a supplement to the Programmatic Environmental Assessment (PEA) for Locust and Grasshopper Control in Africa and Asia. It was developed to provide particular, country-specific details in Burkina Faso in order to allow A.I.D. assistance in regard to Locust and Grasshopper Control Program Management. It is therefore an extension of the PEA for Locust and Grasshopper Control and is, as such, an integral part of it.

The information contained in this document is intended for use by USAID/Burkina Faso and the Burkina Faso CPS to guide environmentally sound locust and grasshopper control program management. However, the discussions herein need not be limited to these species. Additional relevant information should be added to this SEA as needed, as this is a dynamic, rather than static document. As part of the PEA, both documents should be consulted during both planning and operational stages of implementation.

Survey and immediate treatment operations are considered foremost in preventing locust or grasshopper outbreaks. Prevention is the key to reduce crop loss and pest control operation costs. Early season intervention requires considerably less pesticide, fuel and equipment than late season emergency operations, and therefore has less impact on the environment.

Environmental awareness is emphasized. Fragile ecological areas need to be protected from pesticides, as the impact can be both dramatic and long lasting. Buffer zones of at least 2 kilometers surrounding fragile areas should be supported in any U.S.-funded control operation.

Pesticide management must be a priority in control operation programs. Because misused pesticides affect both the environment and crop production in terms of increased costs, any control program must consider possible consequences carefully. Pesticide container disposal must be conducted so as to eliminate food or water storage in used containers. In this regard, supportive legislation and regulations must be legislated and enforced to promote sound management practices.

Training should be part of any USAID assistance program. Pesticide safety and the environmental effects of pesticide use and misuse should be conveyed to both CPS personnel, and the general public through education and public awareness campaigns. Farmer training and Village Brigades can be an important part of management operations, and should be stressed.

If possible, the Burkina Faso CPS should work towards a laboratory analysis program to monitor pesticide formulation quality, and environmental residues. Analysis of blood cholinesterase testing in pesticide handlers and applicators is supported.

2.0 PURPOSE AND PROCEDURES

2.1 Background

With the latest major upsurge of the Desert Locust (*Schistocerca gregaria*) in Africa beginning in late 1986 and lasting into 1989, and extensive grasshopper (numerous species) outbreaks throughout the Sahel from 1986 through 1989, the U.S. government was called upon by concerned African nations to assist with technical expertise and needed materials in the management of these insects. In 1987, 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 waiver permitted A.I.D. to provide assistance for procurement and use of pesticides for locust/grasshopper control without full compliance with the Agency's environmental procedures. The Administrator's waiver expired on August 15, 1989.

Any future A.I.D. assistance for procurement and use of pesticides must fully comply with the Agency's environmental procedures. In 1989, a Programmatic Environmental Assessment (PEA) was completed. The PEA, and the country-specific Supplemental Environmental Assessments (SEAs) will serve as the basis for these regulatory procedures. The SEA contain specific environmental information for each of the Sahelian countries, and provide guidance on environmentally sound management procedures. Given the periodic nature of locust outbreaks, and the cyclic population fluctuations of grasshoppers, control campaigns for these insects are likely to continue indefinitely in Burkina Faso and elsewhere in the Sahel. Both locusts and grasshoppers are part of the ecology of the Sahel and Sahara, and will readily take advantage of agricultural crops. Control measures must manage problematic insects at economically reasonable levels in regard to crop loss, rather than try to achieve extermination.

Because of the both periodic and cyclic abundance of locusts and grasshoppers, and their potential impact upon food supplies, it is likely that requests for A.I.D. technical assistance, aerial application services, commodities, equipment and/or insecticides will continue. It is likely that most of these requests will be related to the use of chemicals for control operations, either directly or indirectly. For A.I.D. to positively respond to such requests, the Environmental Procedures in Regulation 16 (22 CFR 216) must be followed. Along with the PEA, this document fulfills the requirements necessary to allow A.I.D. to provide assistance to Burkina Faso.

2.2 Scoping Procedure

A.I.D. Environmental Procedures 22 CFR 216.3(a)(4), describes the scoping process to be used in identifying issues to be addressed in an Environmental Assessment. The rationale and approach for the country-specific Supplemental Environmental Assessment [SEA] are outlined in cables 89 State 258416 (12 Aug. 1989) and 89 State 275775 (28 Aug. 1989).

A draft outline for the Supplemental Environmental Assessment (SEA) and a list of sources of information were developed by USAID/Burkina Faso and AID/W TA. The USAID/Burkina Faso Agricultural Development Office (ADO) oversaw the scoping process, wrote parts of the SEA, and organized all needed reference documentation.

USAID/Burkina Faso, with the assistance and participation of the Director of the Crop Protection Service within the Ministry of Agriculture and Livestock, worked cooperatively to facilitate the drafting of the SEA, and to ensure smooth implementation of this guidance document. The individuals members of the SEA committee, as well as those who contributed to the writing of the SEA are listed in Appendix A.

2.3 Previous Assessments

The previous assessment concerning this subject, and the primary supportive document is the Programmatic Environmental Assessment for Locust and Grasshopper Control in Africa/Asia (TAMS/CICP, 1989) (PEA). The PEA covers grasshopper and locust control operations in Africa and the Near East. This SEA is a supplement to the PEA, and should be considered an integral part of the PEA. This document concerns the country-specific environmental issues not addressed in the PEA. Other assessments in regard to l/g include:

- (1) The Africa Emergency Locust/Grasshopper Assistance Mid-term Evaluation (with specific-country case studies for Chad, Mali, Niger, Mauritania, and Cape Verde) (Appleby, Settle & Showler, 1989);
- (2) Provisional Report on the Handling of Pesticide in Anglophone West Africa. (Youdeowei, 1989, FAO Conference report, Accra, Ghana);
- (3) Provisional Report on Pesticide Management in Francophone West Africa. (Alomenu, 1989, Report to the FAO Conference at Accra, Ghana);
- (4) Report on 1989 FAO Conference on Pesticide Management, Accra, Ghana, 33 P. + Annexes;
- (5) Draft Environmental Assessment of the Tunisia Locust Control Campaign. (Potter et al, 1988);

These documents and those listed in the bibliography have been used freely in the preparation of this assessment and are often relied on without citation. Internal USAID/Burkina Faso data are used without citation.

2.4 Environmental Procedures.

It is A.I.D. policy to ensure that any negative environmental consequences of an A.I.D.-financed activity are identified prior to a final implementation decision. This document covers specific environmental consequences involved with pesticide activities, and necessary environmental safeguards and mitigative actions for any future assistance programs. Pesticide activities include all activities conducted, supported, financed, or otherwise assisted by A.I.D. for the procurement or use of pesticides, but not including pesticide research and pesticide regulatory activities. Except in emergencies, A.I.D. will discourage requests for pesticides and the use of pesticides unless they are to be used in Integrated Pest Management (IPM) crop production systems.

Although Burkina Faso does not have procedures equivalent to the National Environmental Policy Act (NEPA) or A.I.D.'s Regulation 16 requiring environmental documentation which would influence decision-making in locust and grasshopper control campaigns, Burkina Faso does have regulations governing the substance of such programs. These are covered in the following section. Procedurally, A.I.D. Environmental Regulations are likely to be controlling for the present because they are more comprehensive and more applicable to A.I.D. programs and projects.

2.5 Pesticide Standards and Regulations

To facilitate the proper and safe use of pesticides, regulatory laws are necessary. Pesticide 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. On December 5, 1986, a set of laws were adopted on the utilization of pesticides in Burkina Faso. These are listed below, and attached for reference in APPENDIX E.

1. Law No. AN VI 014/CNR/AGRI of 5/12/86, concerning the overall use and distribution of agrochemicals;
2. Decree No. AN IV 181/CNR/AGRI of 5/12/86 setup of a review committee for agrochemicals;
3. Decree No. AN IV 182/CNR/AGRI approval procedures for agrochemicals;
4. Decree No. AN IV 183/CNR/AGRI of 5/12/86 taxation and control of agrochemicals;
5. Law No. AN IV 015/CNR/AGRI collection of taxes for the control of agrochemicals in regard to regulation and approval. In 1989, the following annexes were submitted for review and approval.

Recently, a set of annexes to these laws were drafted to insure the enforcement of the pesticide regulations. In addition, a decree, dated 29/05/89 was drafted which prohibits the utilization of dangerous substances for agriculture and livestock.

- Annex 1. Committee for the approving agrochemicals, dated 29/05/89;
- Annex 2. Committee for the review of agrochemicals;
- Annex 3. Selling of agrochemicals dated 29/05/89.

It should be noted that products containing the active ingredients listed as prohibited in Appendix D are still being marketed and distributed in Burkina Faso. Specifically, these are Thioral (TMTD + heptachlor), Granox (captafol + benomyf + carbonfuran) for the treatment of seeds, Almazin 500 (Atrazin + Alachlor) and Lasso GD. It has been proposed that those products be replaced by equivalents that are less toxic to users and to environment.

If the measures discussed in this document are appropriately applied, significant reductions in the use of pesticides would be possible. The GOBF may consider imposing financial penalties to people breaking pesticide use regulatory laws. However, enforcement of these laws would require adequate infrastructure for monitoring the situation, and laboratories for analyses.

A U.S. pesticide contribution to Burkina Faso, or a U.S.- funded pesticide purchase in Burkina Faso will be controlled not only by applicable Burkinabe laws and regulations, but also by U.S. pesticide regulations and procedures, as described in the PEA. In this regard, only those pesticides listed in the PEA, or amendments thereof, are acceptable unless this SEA is amended to cover possible environmental impact which may result from the use of that particular pesticide. Pesticides used in a U.S. operation are to be

used according to label instructions only. Used pesticide containers and any unwanted pesticide resulting from a U.S.-funded operation must be disposed of properly and safely. No U.S. funds shall be used to purchase, transport, or apply any pesticide that has been banned in the United States.

2.5.1 Other Environmental Regulations in Burkina Faso

The following regulations, decrees and Codes concern Natural Resource use in Burkina Faso. While they do not specifically regulate pesticides, they do influence the use of pesticides in certain areas. The CPS and the Ministry of Agriculture consult international legal texts to make decisions accordingly. Other sources of information are available at the EEC, FAO, the World Bank and in countries such as USA and France. See appendix C for other relevant documents.

- (1) Forestry Code: The Forestry Code of the Ministry of Environment and Tourism applies in general to the protection of fish, fauna and forests. The restrictions of this code relate to intentional misuse of natural resources, such as tree cutting. Hunting animals or fish with explosives or toxic substances is specifically prohibited. While this code may be used to enforce buffer zones around protected areas, it is not specifically concerned with agricultural chemical regulation.
- (2) National Plan for Drought Control: Burkina Faso set up a national plan for drought control in 1986 with three basic objectives:
 - Environmental protection and restoration through the preservation of existing agricultural areas and forests, with emphasis on the management of existing natural resources.
 - Food self-sufficiency through improving agricultural and rangeland productivity, upgrading water resources, promoting the consumption of local produce, and diversifying agricultural production.
 - Fuel wood conservation and development of renewable energy sources.

3.0 DESCRIPTION OF PROJECT SITE

3.1 Description of the Physical Environment

3.1.1 Physical aspects and climate

The country of Burkina Faso is located in the central area of West Africa. With a 1990 population nine million people, the country covers 274,000 square km, and lies in the transitional areas between the Sahel in the north and the Sudano-Guinean zone in the south. Average precipitation ranges from less than 300 mm in the north to 1200 mm in the south. Climatic factors determine four major seasons with differences in length from north to south: 1) Dry and cool - November to March, 2) Dry and hot - March to June, 3) Wet - June to October, 4) Hot and humid - October to November.

The topography of Burkina is mostly flat and eroded, with a 300 m altitude change cut by the Comoe and Mouhoun valleys, the cliffs of Banfora and the western plateau. The natural soil fertility is poor, with continued cultivation degrading the soils to an even greater extent, with increasing populations numbers not allowing fallow periods. The major river basins are the Mouhoun (west), the Comoe (south-west), the Mouhoun, Nakambe, Nazinon (center). The flood plains of the upper Banifing create wide floodplains covering over 10,000 ha.

Considered one of the poorest countries in the world, the people of this landlocked Sahelian country are engaged primarily in agriculture. Burkina Faso has experienced the effects of consecutive droughts and dry periods over the last 30 years. Population movement, compounded by the drought has caused increased desertification, and vegetation loss. Animal poaching and drought have caused some animal species, such as elephants, to be on the verge of disappearing from Burkina Faso. Because of the drought, the already fragile ecosystems are much more vulnerable, especially those in the vicinity of water and wetlands. Overgrazing and increasing human populations are additional stress factors on ecologically fragile areas.

It has been estimated that over 50% of Burkina is still covered with natural vegetation, which ranges from grass savannah in the north, to gallery forests in the south. About 14% of the country has been designated as National Forest, Reserve, or Parks. The southwestern part of the country had long remained sparsely populated because of onchocerciasis and trypanosomiasis. With the virtual elimination of these diseases, this area is a target for migration. This population influx is not without impact on the areas natural resources.

3.1.2 Flora and Fauna

3.1.2.1 Birds and Fishing resources

Burkina Faso has a considerable diversity of natural resources. There is also diversity in the vegetation and fauna. In this regard, any pesticide use will likely have impact on such resources. Birds are especially susceptible to toxins such as pesticides, and may be affected in ways difficult to discern. Fish will also be affected, especially when wet lands are sprayed or equipment is washed at or near a river or lake. Since fishing is a very real resource for the people of Burkina Faso, it is important to consider potential impact in the planing and implementation phases of a U.S.-funded pesticide operation.

3.1.2.2 Endangered species and habitat

Birds and aquatic invertebrates are most sensitive to the pesticide use and pest management practices (Keith 1989). Burkina Faso has a number of rare and endangered animal and bird species (Table 1). It is critical to consider the importance of these habitats, and the direct vulnerability of non-target organisms to pesticide toxicity.

Table 1. Threatened and Endangered Animals

MAMMALS

Cephalophus syviculor	Cephalophus rufilatus
Cephalophus monticola	Damaliscus korrigum
Gazella dama	Gazella rufifrons
Gazella dorcas	Hippopotamus amphibius
Potamochoerus porcus	

Loxodonata africana

Felis caracal	Felis aurata
Acinonyx jubata	Panthera pardus
Mellivora capeusis	

Orycteropus afer

Colobus polykomos	Pan satyrus verus
-------------------	-------------------

Crocodylus niloticus	Crocodylus cataphractus
----------------------	-------------------------

BIRDS

Struthionidae
 Sturthio camelus

Ardeidae	
A dea goliath	Bubulcus ibis
Egretta alba	

Ciconiidae	
Anastomus lamelligerus	Ciconia ciconia
Ciconia nigra	Ciconia episcopus
Ibis ibis	Leptoptilos crumeniferus
Ephippiorhynchus senegalensis	

Threskiornithidae	
Hagesashia hagedash	Platalea falcinellus
Threskiornis aethiopicus	Platalea alba

Accipitridae	
Gyps africanus	Gyps ruppellii
Aegyptius tracheliotus	Neophron monachus
Neophron percnopterus	Trigonoceps occipitalis

Sagittariidae
 Sagittarius serpentarius

3.2 Agricultural resources

3.2.1 General description

Burkina Faso is an agricultural country with a large rural population involved both subsistence and market crop production. The total area in cultivation is estimated to be 2,900,000 hectares (for the 1989-1990 campaign). Agricultural areas and farms are found throughout the 30 administrative provinces of Burkina Faso (see map 1). Most farming is dependent on rainfall, and is carried out during the late summer and fall.

The majority of the people in Burkina Faso are either directly or indirectly involved in agricultural production. The average density of the population is 29 inhabitants per square kilometer, with the highest concentration in the central plateau at 47 inhabitants per square kilometer. The total production of crop in Burkina Faso varies from one year to another, with 1,951,671 metric tons produced during the 1989 - 1990 campaign. In years when production is lower, food needs may not be met.

The important crops in the Sahel area of Burkina Faso are Millet and Sorghum. The important crops in the Central Plateau are Sorghum and Millet. Apart from a portion of the Sahel, sorghum is grown everywhere in Burkina Faso.

Other crops are grown in lesser quantities - rice, fonio, voandzou, niébé, potatoes, vegetables, sesame and groundnuts. Corn is grown in all parts of Burkina Faso except the northern regions of Soum, Oudalan, and Seno. Rice is grown in the southwestern regions of Sourou, Kossi, Mouhoun, Kenedougou, Houet, Bougouriba, Comoe, and Poni. Potatoes, onions, and yams are grown in the south central regions of Bougouriba, Poni, Sissili, and Nahouri. The geographic distribution of crops is dependent upon climatic zones and yearly rainfall, with the growing period from June through October. See Table 1 for 1985 - 1990 Cereal Production figures.

Cotton is grown in the regions of Kossi, Mouhoun, and Houet, with 1989 - 1990 production at 179,000 metric tons. In addition, there are about 16,029,000 animals in Burkina Faso, including cattle, sheep and goats.

3.2.2 Agricultural Production Data

In order to thoroughly understand whether or not a locust or grasshopper control operation is necessary, it is essential to have reliable data on what the impact of damage will be on yield. In this light, agricultural production data, crop loss assessment information, and intervention thresholds are important factors to consider in management decision making. Available data on production in Burkina Faso is extremely variable, and may not be reliable. It is important for both the GOBF and donors to work toward a reliable data infrastructure in Burkina Faso. The recent A.I.D. sponsored Crop Loss Assessment conference in Ouagadougou (March 18 - 22, 1991) is an important step in this direction.

Map 1. Crop Regions

Map 1. Crop Regions

Table II. Cereal Production for Burkina Faso in Metric Tons, 1984-1990

<u>YEAR</u>	<u>SORGHUM</u>	<u>MILLET</u>	<u>MAIZE</u>	<u>RICE</u>	<u>TOTAL</u>
1984	587700	319100	81100	29800	1017700
1985	815700	585600	137900	37400	1576600
1986	928000	613100	155200	34300	1730600
1987	699000	583900	132300	36800	1452000
1988	981200	776500	227000	40600	2025300
1989	989200	653800	256900	40900	1965600
1990	750500	449000	257900	47800	1505200
AVE.	821614	568714	178329	38229	

(source: USAID/Burkina Faso, FEWS)

3.3 Locust and Grasshopper Characteristics

3.3.1 Distribution and Feeding habits

The insects considered in this document are grasshoppers and locusts. Locusts and Grasshoppers can impact most of Burkina Faso agricultural regions, with the northern and central regions effected most intensely. These include the Oudalan, Soum, Seno, Yatenga, Bam, Sanmatenga, Namentenga, Gnagna, Sourou, Passore, Gourma, Mouhoun, Sanguie, and Boulkiemde regions (map 2).

There are numerous species of grasshopper which are considered pests in Burkina Faso, principal are the species Oedaleus senegalensis, and Zonocerus variegatus. However, there are several other grasshoppers which can become serious pests depending on environmental conditions. In regard to locusts, the primary pest species are the Desert Locust (Schistocera gregaria), and, to a lesser extent the African Migratory Locust (Locusta migratoria).

While locusts can breed in northern Burkina Faso, they generally do not. However, these insects will migrate into Burkina and throughout the Sahelian and Saharan Zones. Locusts are a periodic problem, with migrating gregarious swarms moving into Burkina Faso on a very erratic basis. Several years of intense locust infestation activity may be followed by ten to fifteen years of virtually no locust sighting at all. Conversely, grasshoppers will be found in Burkina Faso at varying levels of infestation intensity every year. Grasshoppers will be found throughout the northern regions, and to a lesser extent in the southern areas.

The main grasshopper outbreak areas in Burkina extends through the Sahel zone comprising the Bam, Namentenga, Sanmatenga, Yatenga, Seno, Soum and Oudalan provinces. The Mouhoun zone comprising the Sourou, Mouhoun and Kossi provinces. The desert locust (Schistocera gregaria) can reproduce in the northern areas of Burkina, and will migrate into the Sahel zone. The African migratory locust can reproduce in more humid zones.

3.3.2 Level of Infestation

Grasshoppers and locusts vary over a range of population levels in their natural habitat, depending upon rainfall and other environmental conditions. A migrating infestation of locusts can, depending upon wind conditions and movement patterns, have a significant impact on agriculture. For grasshoppers, crop infestation levels depend upon the numeric density and life stage of the insect. In Burkina Faso, grasshoppers in the northern regions will be a problem every year to some degree. Locusts, however, are widely periodic and will fluctuate greatly over time periods of ten to twenty years.

For management planning purposes, impact on ultimate crop yield has been divided into four infestation levels. Note that 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. This concept is discussed in more detail in section 4.1.4 of this document.

Level 0 describes a "normal" density of grasshoppers. Locusts are not considered at this level. In this regard, grasshopper density levels will below the intervention threshold level for a given species. Crop losses from this level of infestation are minor and localized. The Crop Protection Service should be able to carry out any needed spot treatment programs without donor assistance. However, some material or training assistance may be needed to assure this.

Map 2.

Locust/Grasshopper Primary Infestation Regions

Source: FAO, 2004. <http://www.fao.org/docrep/010/a0401e/a0401e01.htm>

Level I describes a situation with locust or grasshopper populations at levels which will require additional donor assistance to avoid crop loss. In this case, pest densities will be at or slightly above the intervention threshold levels. The CPS will likely need assistance to cover additional costs, including materials and equipment needed to reduce population levels.

Level II describes high locust or grasshopper densities with large numbers in both crops and pasture lands. Here, l/g densities will exceed the intervention threshold level. Significant crop loss is probable without additional donor assistance and possibly intervention.

Level III describes a situation involving very high locust or grasshopper populations extending over a large area. Again, densities exceed the intervention threshold. This situation will require considerable donor assistance and intervention to avoid l/g outbreaks and substantial crop loss.

Because of the complex effects of crop loss, investments by donors at each of the four intervention levels may be justified. At each level, assistance which builds sustainable infrastructure would be most appropriate.

3.4 Crop loss assessment

Despite regional variation and the unreliability of data, assessment at national level is possible. Estimates of loss rate vary from 1.5 % (the lowest by FAO and PEA which is comparable with level 0 in this SEA) to the high figure of 20 % (Appleby and al. 1989). No sound inquiry about crop loss has been conducted in Burkina Faso. However, the CPS believes that grasshoppers are the cause of about 5 to 10 % of total loss of potential production. These data vary from one region to another and from one year to another. Range losses are more difficult to assess in the absence of data since the effects on cattle are indirect.

In light of regional data variability and possible uncertainty concerning the reliability of data, both regional and national l/g damage level estimations can often be problematic. AID/W is currently supporting extensive research in Mali and Chad, as well as collaborative work with other donors and regional research organizations. Results are expected to improve l/g management considerably.

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 extreme north, may experience high losses. Costs of grain transport over long distances may be more prohibitively expensive than those of a locust/grasshopper control program. Losses in grasslands are more difficult to assess than in crop lands, because the impacts are on wandering grazing animals, and thus indirect.

3.5 Pesticide Safety and Health Care System

3.5.1 General Pesticide Safety Concerns

Because of the role pesticides can play in potentially increasing agricultural productivity, the Government of Burkina Faso regards these chemicals a useful part of agriculture. Unfortunately, pesticides can be misused by both farmers and CPS agents, presenting hazards to the human environment and the natural ecology. Some pesticides in Burkina Faso are marketed illegally and fraudulently. Pesticides intended for agricultural or public health purposes may be misused for fishing, hunting, and general household insect control.

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.

3.5.2 Applicator Safety Training

A.I.D. has supported CPS pesticide safety training in the past in Burkina Faso, and will likely continue this form of assistance. It is important that well trained CPS agents are available to work with any U.S.-funded pesticide donation.

The incorporation of hands-on pesticide safety and application training courses into the academic course in agronomy and other agricultural degrees is essential. This approach will allow trained individuals to interact with the actual users of pesticides.

Properly trained CPS agents and agricultural extension agents are encouraged to work with farmers and Village Brigades 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. This type of training is strongly encouraged by A.I.D..

3.5.3 Public Health Care System

The Health care system of Burkina is well-structured, although the ratio of health personnel to population numbers is far below W.H.O. standards. The structure of these services varies according to the levels, i.e. national level, provincial level, district level and village level.

The Health Pyramid

Village: Visiting pharmacy and health personnel (hygienist, first aid agents, traditional midwife) While this serves the village adequately, it may not be able to address serious pesticide poisonings. The visiting personnel can participate in social awareness campaigns concerning pesticide safety.

- District:** A Health Center is administered by a trained nurse who is trained to recognize and treat pesticide poisonings, and give first aid before evacuation to an appropriate center. There are 400 Centre de Sante et de Promotion Sociale (CSPS) in Burkina Faso, and can be found in most of the larger villages.
- Province:** This is a Hospital with a dispensary and maternity section administered by a doctor. Pesticide poisonings can be recognized and treated effectively. These are found in each provincial capital, and in highly populated areas. There are 55 of these Centre Medical (CM) institutions nationwide.
- National:** There are two big hospitals in Burkina Faso, one in Ouagadougou and the other in Bobo-Diulasso. These hospitals can handle any level of pesticide poisoning situation, and are fully trained and equipped to assist in an emergency.

At all levels, the following measures need to be taken:

- Training in all aspects of pesticide use and safety;
- Providing Health Centers with the medicine necessary for pesticide poisoning treatment.
- Technical participation by medical staff with the CPS in the preparation of pesticide use operations and safety-related trainings.
- Participation in human health monitoring in order to detect possible pesticide poisoning in pesticide handlers and applicators.

4.0 PROJECT DESCRIPTION

4.1 Pest Control Operations

The Burkina Faso Crop Protection Service (CPS) is capable of carrying out insect management and crop protection activities when locust or grasshopper population levels are low (level 0, section 3.2.2). Through the development of a yearly action plan, the CPS can have materials and equipment prepared and ready for early season survey and control operations. Although assistance programs may be provided to the CPS at this level, particularly in the form of training, the goals of any such assistance is to increase the sustainability of the CPS infrastructure. With vigilant survey and management programs, locusts, and grasshoppers in particular, can be maintained at low population levels.

The philosophy of vigorous survey and early season management will save valuable funds and resources over the long-term, compared with costs of short-term emergency operations. Additional donor assistance may be required if high infestation I/g levels exceed the capacity of the CPS. In regard to U.S.-funded assistance involving pesticides, the information, recommendations, and regulations discussed in this SEA and the PEA must be observed and reckoned with in project design and implementation.

By developing a strong base of trained personal and a well maintained fleet of sturdy vehicles and equipment, the CPS will be able hold impending grasshopper outbreaks, and invading locust swarms to a

minimum. This will result in considerably less pesticides being used than if these pests are 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 of pesticide use. Any assistance A.I.D. can offer to build such a institution, with full participation and involvement of the Burkina Fasoian CPS, will be a far greater investment than the immense amounts which have been spent on past emergency operations (with little effect on sustainable infrastructure).

4.1.1 Survey and Control Preparations

In order to keep locust and grasshopper population numbers below levels where crop loss is imminent, it is important to survey early in the season, and to implement control activities immediately. The main elements to be included in locust or grasshopper survey programs are:

- The physical and temporal distribution of 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.
- The availability of pest management support resources to be mobilized for control: pesticides, application equipment, as well as logistical and technical support.
- The importance of the agricultural productions threatened by those species;
- The availability of the pest management means to be implemented in order to control pests, including human resources, equipment, pesticides, materials, etc..

4.1.2 Field Operations

Ideally, information from survey teams is compiled at regional CPS bases, and then sent to Ouagadougou for analysis and appraisal at national level. Periodic reports are then prepared concerning infestation levels and control operations. However, there is currently a serious shortage of qualified pest management officers in Burkina. Survey, application, and laboratory equipment is insufficient, thus slowing crop protection related activities. Involved in the national pest management system, are:

- (a) Control Operation Units, which are provided with light equipment and minimal quantity of pesticides for intervention in small, localized, infested areas. Intervention decisions are made directly by the extension agent.

- (b) Control Operation Teams are located in crop growing areas with a likelihood of g/l outbreaks, and supervised by the Control Operation bases. Logistics for ground interventions are limited to areas not exceeding 100 hectares. The team leader makes decisions regarding operations. According needs, the team conduct missions in the operational zone, and provides advice to the intervention teams and farmers.
- (c) Control Operation Bases are located in all regional capitals, where the bases are decentralized units of the CPS. All pesticides and application equipment for pest control operations are stored and managed at the bases.
- (d) The National Crop Protection Service Center supplies the Operational Bases, Teams, and Units with equipment, materials, pesticides, and personnel. The NCPS monitors activities in each region, and assists when infestations overwhelm the regional Bases. Requests for donor assistance are carried out at the national level, based on the importance of the threatened crop, stage of growth, density and stage of the pest, availability of pesticides, etc.

4.1.3 Thresholds of A.I.D. Assistance

The CPS 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 use of cultural, biological and traditional means of control. In decisions on assistance to the CPS for locust or grasshopper management activities, A.I.D. will examine both the pest situation and the capabilities of the CPS. Decisions will be made in such a way as to minimize the amount of pesticide used.

If A.I.D. does choose to participate in an assistance program, it is important that support be coordinated with other donors and the GOBF to achieve a reasonable and balanced program. Assistance for such a program should emphasize the principles of IPM (as discussed in section 4.1.3), in that all available management resources should be considered.

While probable crop loss will be a criterion for A.I.D. involvement in control efforts, sustainable infrastructure development and cost/benefit ratio will also be considered. Participation by A.I.D. 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. Because the use of pesticides in Africa has increased over the last few years, A.I.D. will assist primarily with a pro ram emphasizing good survey and use of non-chemical control methods.

The level of USAID/Burkina Faso participation in a I/g management program should not only be related to the extent and severity of the problem, but also to the extent such assistance will the CPS more sustainable. Section 3.2.2 describes different possible levels of infestation and intervention. The actual level of intervention assistance will depend upon a number of variables, including insect density, crop conditions, CPS capacity, and environmental conditions.

Prior to the implementation of I/g assistance, a through analysis of needs is necessary. In evaluating areas of assistance, USAID/Burkina Faso should be responsive not only to the requests of the

GOBF, but must further ascertain what materials the CPS already has, and what other donor supported programs are planned or implemented. Supplying the CPS with an overburden of pesticides, unneeded materials, or poorly planned training will not assist in managing locusts or grasshoppers. In addition, an independent verification of pest identity, density, and potential impact should be made by a qualified technician prior to fund committal and allocation.

4.1.4 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 over 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. The following steps illustrate the development of an IPM program.

Step 1: Identify the Major Pests, and Establish Intervention Thresholds.

Dozens of potentially harmful species may infest a crop. However, only a few pest species cause substantial crop loss. The pests which recur at intolerable levels on a regular basis are known as primary pests, and are the focus of IPM programs.

The criterion that determines whether taking action to control a harmful species is profitable is called the intervention threshold (or economic injury level). The intervention threshold is the point above which control actions should be taken, and below which no actions are necessary. The economic injury level may be expressed in different ways depending upon the crop and the pest.

Examples of injury level indicators could be:

- Numbers of insects per plant.
- Percentage of fruit damaged by a given pest.
- Numbers of weeds per square meter.

Several factors will influence the intervention threshold for a specific pest: crop variety and stage of development, value of the crop, presence of natural enemies, cost of control measures, as well as external costs to health and the environment. The intervention threshold depends on the relationship between the pest intensity and the yield loss, and the economics of reducing the damage. It will therefore change as these variables change. The intervention threshold developed in one area will not likely be appropriate for use in another area.

Research is needed to determine the initial intervention threshold. This should be thoroughly tested in actual field conditions to verify effectiveness. The level can be refined as more information becomes available, and as it is used in the field.

Step 2: Select the Best Mix of Control Techniques.

All pest management methods and practices should be considered for an IPM program.

First consideration should be given to use of preventive measures:

- Resistant crop varieties.
- Biological control (conservation or augmentation of natural enemies already present or introduced)
- Cultural control (cultivation, crop rotation, use of pest-free seed and planting stock, fertilizer management, and intercropping).

Farmers will likely already be using one or more of these preventive measures. It is therefore important to talk to the farmers before determining which measures are needed.

Pesticides should be used only if no practical, effective, and economic nonchemical control methods are available. Once the pesticide has been carefully chosen, it should be applied only to keep the pest below the intervention threshold. Pesticides will impact other organisms besides the pest, and may cause harm to humans, livestock, honey bees, natural enemies, and the natural environment.

Step 3: Monitor the Fields Regularly.

The growth of pest populations usually is related closely to the stage of crop growth and weather conditions. However, it is difficult to predict the severity of pest problems in advance. The crops must be inspected regularly to determine the levels of pests and natural enemies, and crop damage.

CPS survey personnel and agricultural extension agents can assist with field inspections. They can train farmers to separate pests from non-pests and natural enemies and to determine when crop protection measures, perhaps including pesticides, are necessary.

Step 4: Use All Control Methods Correctly and Safely.

Each pest control method has both advantages and disadvantages. CPS and Extension agents should learn as much as possible about each control method. Education programs should be developed to teach farmers how to use the available control methods safely and correctly.

Step 5: Develop Education, Training, and Demonstration Programs for Extension Workers.

Implementation of IPM depends heavily on education, training, and demonstration to help farmers and extension workers develop and evaluate the IPM methods. Hands-on training conducted in farmers' fields (as opposed to a classroom) is a must. Special training for

extension workers and educational programs for government officials and the public are also important.

4.1.5 Cultural, Biological and Traditional Control

Numerous non-chemical methods exist for pest management in general, and have been used against locust and 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. Sorghum, for example, is more resistant to attack by grasshoppers than millet. Other cultural methods, such as trap cropping, residue burning, trench digging in front of locust larval path, and intercropping 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 (George, 1989).

Farmer experience with traditional or innovative control methods should be encouraged and incorporated into the overall I/g management program. If villagers can be recruited as participants in control efforts, such as a Village Brigade, a field can be protected with a minimum of pesticide use and expense.

Research on field use of microbial agents in locust and grasshopper control is currently being implemented by A.I.D. and other international organizations. The microsporidian *Nosema locustae* has been tested in the US and in parts of Africa for its control potential. Preliminary results from Mali indicate that *Nosema* may be an unlikely candidate for use in an emergency situation, but could be part of an overall bio-intensive program. Additional work will be needed to determine its specific usefulness in an IPM context for longer-term maintenance.

In working with microbial pest control agents, attention must be given to handling and application techniques. *Nosema*, for example, has a short shelf life and must be used soon after production. In addition, the field climatic and environmental conditions will impact the microbial control agent.

Another research recommendation is the search for local and possibly more species-specific pathogens. Large population explosions of locusts/grasshoppers might be conducive to the development of epidemics of endemic pathogens. At the time of population collapses a search for more effective pathogens would be appropriate. Such a search should be done in collaboration with laboratories familiar with pathogen isolation.

Using Neem tree extract as an antifeedant has potential for being a component of IPM and may be appropriate for the northern regions of Burkina Faso, where there are large numbers of Neem trees. Additional research on Neem is needed, especially in its use against locusts and grasshoppers.

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

4.1.6 Selection of Pesticides

There are many methods of g/l control, and the most commonly used is chemical pesticides. While pesticides kill these pests, they also affect other living organisms in the ecosystems in and around cropping areas. In addition, misuse or overuse of pesticides results in higher overall operational costs. This is not only because of the direct cost of the pesticide, but also because of reduction in natural enemies in the crop ecosystem.

Twenty-two approved pesticides are in current use in Burkina Faso and a further six, which may be in use, should be retested for efficacy. All pesticide testing in Burkina Faso is carried out by the Institute for Agronomic Research (IRA). The authority that currently exists for the control of imported pesticides must be enforced so only approved materials will be available in Burkina Faso.

To use a pesticide in a specific area at specific time, it is necessary to have detailed knowledge of the physical and chemical attributes of the product, the ecology of the area to be treated, and the biology of the pest to be treated. Pesticide selection for locust/grasshopper control requires the following concerning the pesticide itself:

- Effectiveness at low application rates;
- Minimal effects on nontarget organisms, including people and animals, and specifically predators and parasites of locusts and grasshoppers;
- Minimum persistence of residues on and in native fauna and flora, water, soil, and crops;
- Low toxicity and ease of handling;
- Good storage capacity;
- Compatibility with existing application equipment.

Although a number of pesticides have been used in Burkina Faso against locusts and grasshoppers in the past (See Table 4), any pesticide involved in an operation funded by the USG must be approved for use in the United States by the EPA. These chemicals are listed in the PEA, and should be referred to during both the planning and implementation of phases of I/g control management. In addition, regulations governing the use of a particular pesticide, as set forth on the label, must be followed.

4.1.7 Village Brigades

Farmers can play a major role in a control campaign--reporting population levels, destroying egg-pods, protecting crops from larval infestations. However, farmer and village training efforts must be made. Both A.I.D. and FAO have a high degree of success in this area with "Train the Trainer" programs. These have been implemented on a large scale basis since 1987 in areas where locust or grasshopper infestations are endemic. This has been applied successfully in Burkina Faso, and is encouraged to continue by the USAID.

Each Village Brigade typically includes 10 interested and enthusiastic villagers. The participants will receive 3 days of intensive training (covering the identification and biology of both local pest and beneficial insect species, the fundamentals of good survey techniques, and the safe handling and use of pesticides); and are then given a small quantity of pesticide, a set of protective clothing, and necessary application equipment. Village Brigade members are responsible for locust or grasshopper control at the village level and are supported by the CPS. An entire village may be trained during the year by members of a Village Brigade.

The continuing support of the CPS is essential in this to the Village Brigade. Once formed, the Brigade members must receive needed materials and technical support within a reasonable time frame to achieve crop protection. While a trained group may in theory be able to creatively defend crops against pests without resources, in reality, they will lose both enthusiasm and expertise without support.

4.1.8 Ground and Aerial Operations

The use of spray aircraft should be considered a last resort in a U.S.-funded locust or grasshopper management program. With an attentive survey program, combined with rapid deployment ground pesticide application teams, it is possible to conduct a management campaign without the use of spray aircraft. A.I.D. fully supports this concept, and needed training programs for survey and ground teams. In addition to the basics of survey techniques, pesticide safety and application, such training must encompass a thorough background knowledge on pest species that require control.

While aircraft are management tools, and may be justifiably needed during locust or grasshopper outbreaks, they should be used with caution. This is because: 1) aircraft carry and spray larger quantities of pesticide than ground equipment, and therefore are more likely to have an environmental impact; 2) They are expensive to run and maintain, and are unlikely to be sustainable without a high level of outside input; 3) Assumed use or use support by donors will result in less attention by the CPS to maintenance of a good survey and ground control system.

The Burkina Faso CPS has been provided with a variety of fixed-wing aircraft (Cessna, Turbo Thrush, DC3) and helicopters (Allouette, Bell 206) by various donors for its aerial spray operations. According to the CPS, aerial control operations in Burkina Faso have produced the following conclusions:

- large infested areas can be treated in a short time;
- inaccessible areas are more easily treated;
- aircraft logistical support is expensive, and large amounts of pesticides are required;
- pesticide drift is difficult to control;
- Landing strips for fixed-wing aircraft require frequent and expensive maintenance.

In light of these limitations concerning aerial control operations, the CPS policy is to use preventive ground control operations whenever possible. The components of ground operations are:

- training and equipping farmers and Village Brigades;
- early season egg pod surveys and localized destruction;
- increased survey and ground application teams.

4.2 Human Health Protection

4.2.1 Public Awareness

In conjunction with A.I.D. assistance regarding locust and grasshopper efforts, it is important that the Government of Burkina Faso 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. Application of a pesticide in a given area should be preceded by public awareness and extension activities and education of the users. The Burkina public must be informed that pesticides are dangerous and that empty pesticide containers should not be used for food or water storage. A good public information program can 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.

Pesticide educational programs can 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 might 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 Burkina Faso. This will allow potential buyers and users to know what pesticides should be accepted and what should be refused.

4.2.2 Health Monitoring

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.

The GOBF should have the capability to monitor both behavioral symptoms of pesticide poisoning, and such blood-chemistry manifestations such as acetylcholinesterase (ACHE) inhibition. Testing for ACHE inhibition is fairly simple and inexpensive, 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. Measurement of residue levels in the environment can also be a valuable source of information for assessing exposure and determining if modifications to treatment operations are needed.

4.3 Protection of Natural Resources

4.3.1 Protected areas

Because of the vulnerability of ecosystems to the toxicological impact of pesticides used in pest management, fragile areas of the environment must be protected. An appropriate form of protection is the demarcation of zones not to be treated with pesticides. In addition to restricting pesticide use in ecologically fragile areas, it is recommended that a buffer zone of pesticide restriction of 500 meters surround the area. Priority should be placed on the use of non-chemical control methods in areas around fragile areas. The types of zone which should be protected are: Populated areas, Nature reserves, National parks, and Wet areas such as lakes, wells, river systems.

In Burkina Faso, such natural resource protected areas consist of National Parks, Forest Reserves and Protected Areas. There are five main National Parks, covering over one million hectares. Some 54 Forest Reserves cover over 3.5 million hectares, consisting of 12.6% of the total area of Burkina. There are three reserves devoted solely to the regeneration of natural resources: Nyangoloko, La Mare aux Hypos and Massif du Kou. These areas have seen great success in replacing and preserving the natural fauna and flora of Burkina. In addition, there are ten Protected areas, which are reserves of unique or endangered plants and animals. Map 3 shows the general location of most of these areas, and Table 3 gives a listing of names, provincial location, and area of each of the protected areas.

Despite an overall lack of natural resource management, especially in regard to forestry, the Naziono and Nazinga forestry management areas in the southern provinces of Sissili and Nahouri have proven workable and sustainable. However, most natural resources protection areas are not supervised adequately. In many cases, both vegetation and animals are taken with out restriction. In any U.S.-funded pesticide use operation, it is important that both the CPS and USAID/Burkina Faso ensure that pesticides will not be used in a designated protected area.

Table III. Protected Areas of Burkina Faso**1. Eastern Regions**

<u>TYPE</u>	<u>NAME</u>	<u>REGION</u>	<u>AREA</u>
National Park:	"W"	Tapoa	350,000 ha
	Arly	Tapoa	206,000 ha
Protected Area:	Kourtiagou	Tapoa	51,000 ha
	Pama	Gourma	223,700 ha
	Radjoa	Gourma	17,000 ha
Forest Reserve:	Singor	Gourma	192,000 ha

2. Western Regions

<u>TYPE</u>	<u>NAME</u>	<u>REGION</u>	<u>AREA</u>
National Park:	Deux Bale	Mouhoun	-
Forest Reserve:	Twesse	Central	490 ha
	Niouma	Central	735 ha
	Tiogo	Sangue	37,600 ha
	Sa	Mouhoun	5,400 ha
	Kalio	Sangue	12,000 ha
	Tisse	Mouhoun	21,500 ha
	Tuy	Houet	47,000 ha
	Sourou	Sourou	14,000 ha
	Sorobouli	Mouhoun	12,300 ha
	Ouara	Mouhoun	14,000 ha
	Dibon	Comoe	24,000 ha
	Bonou	Mouhoun	17,000 ha
	Pa	Mouhoun	15,625 ha
	Peni	Houet	1,200 ha
	Bansie	Houet	500 ha
	Bahon	Houet	980 ha
	Massif du Kou	Houet	2,060 ha
	Mare aux Hyppos	Houet	11,200 ha
	Koa	Houet	350 ha
	Dinderess	Houet	8,500 ha
	Maro	Houet	50,000 ha
	Koulima	Houet	2,150 ha

Table III. Protected Areas of Burkina Faso (continued)

3. Central Regions

<u>TYPE</u>	<u>NAME</u>	<u>REGION</u>	<u>AREA</u>
National Park:	Tambi	Nahouri	155,500 ha
Protected Area:	Nazinga	Nahouri	28,300 ha
Forest Reserve:	Barrage	Kadiogo	240 ha
	Pic Naouri	Nahouri	836 ha
	Bissiga	Oubritenga	4,100 ha
	Gonse	Oubritenga	5,500 ha
	Sitenga	Kouritenga	840 ha
	Yakala	Boulougou	600 ha
	Ouillingore	Boulougou	6,850 ha
	Tougouri	Namenlenga	40 ha
	Nakabe	Sammatenga	2,000 ha
	Yabo	Sammatenga	1,000 ha
	Dom	Sammatenga	350 ha
	Sissili	Sissili	32,700 ha

4. Southwestern Regions

<u>TYPE</u>	<u>NAME</u>	<u>REGION</u>	<u>AREA</u>
National Park:	Komoe-Leraba	Comoe	145,000 ha
Protected Area:	Bontioli	Bougouriba	12,700 ha
	Nabere	-	29,500 ha
	Biophere	Houet	119,200 ha
Forest Reserve:	Bounoma	Comoe	1,300 ha
	Beregadougou	Comoe	5,000 ha
	Toumousseni	Comoe	2,500 ha
	Nyangoloko	Comoe	6,650 ha
	Baldolo	Comoe	500 ha
	Dioufoula	Comoe	85,000 ha
	Yende:e	Comoe	700 ha
	Koflande	Comoe	30,000 ha
	Tere	Houet	4,300 ha
	Source Mauhoun	Comoe	9,500 ha
	Boulon	Comoe	12,000 ha
	Kongoko	Comoe	27,000 ha
	Dida	Comoe	75,000 ha
	Longniegue	Comoe	23,000 ha
	Koulbi	Poni	40,000 ha
	Naore	Comoe	6,400 ha
	Gouabougou	Comoe	12,000 ha
	Bougouriba	Bougouriba	8,500 ha

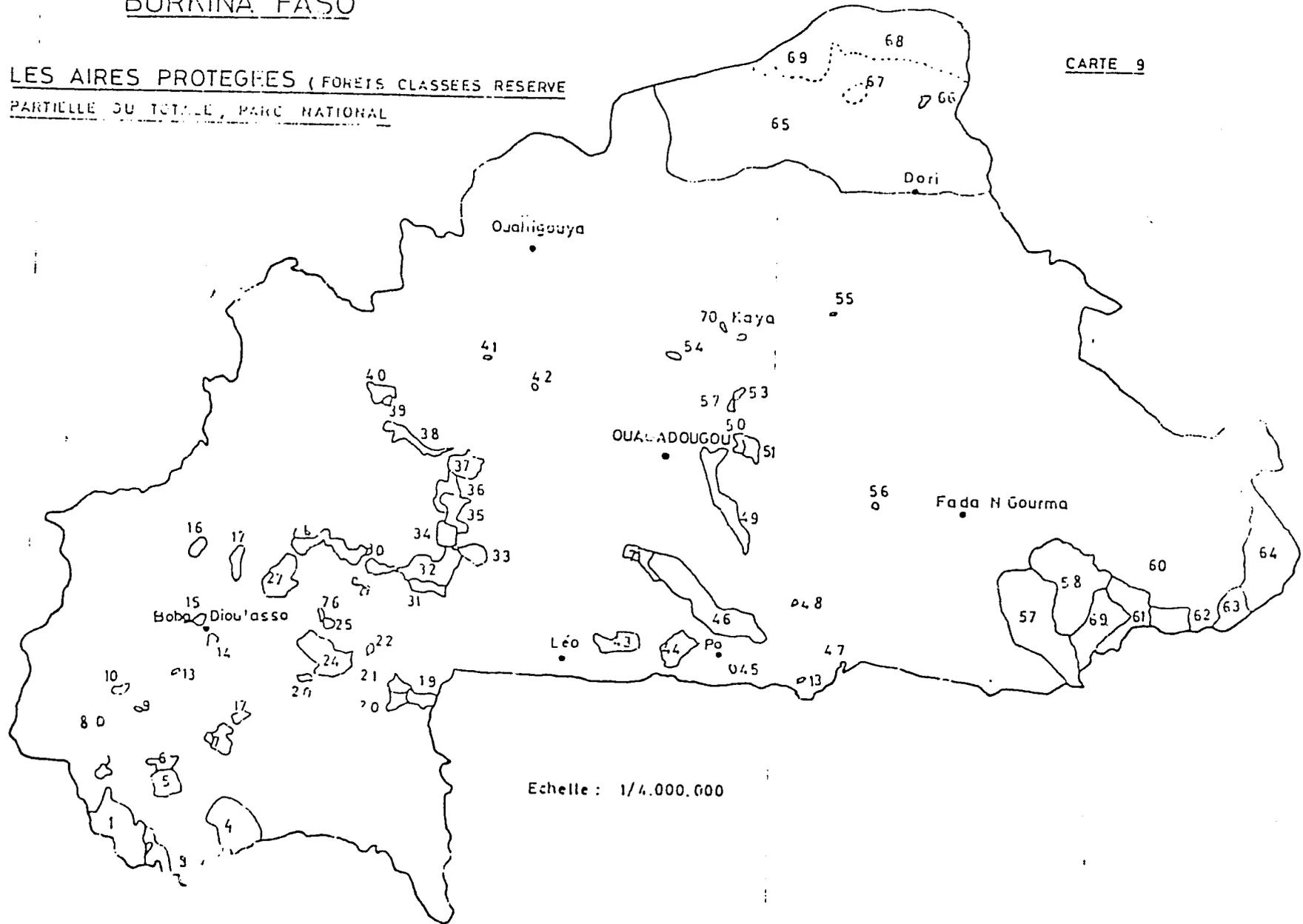
Map 3.

Protected Areas of Burkina Faso

BURKINA FASO

LES AIRES PROTEGES (FORETS CLASSEES RESERVE
PARTIELLE OU TOTALE, PARC NATIONAL

CARTE 9



30

4.3.2 Buffer Zones

Protected areas should be surrounded by a buffer zones at least 2.5 km wide. These are needed to avoid accidental pesticide application and possible spray drift, and to will help to minimize indirect effects of pesticide use. Within buffer zones, a higher priority should be given to the use of alternatives to chemical pesticides, and a monitoring program so that non-chemical alternatives can be applied successfully. As the capacity of the CPS to provide training in non-chemical alternatives increases, the width of the buffer zones can be increased.

4.3.3 Pesticide Alternatives 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 use chemical pesticides. These farmers should be encouraged to use traditional methods and should be informed as to how pesticides are dangerous to both humans and the environment. Farmers in such areas should be given individual attention, time to ask questions, and opportunity for discussion. CPS trainers should have a basic knowledge concerning food chains and the indirect effects of pesticides.

4.3.4 Environmental Monitoring

Part of the overall pest management system is monitoring treated areas for potential environmental effects of pesticides. Monitoring can indicate negative impacts on flora and fauna, as well as detect improper application methods which can impact human health and increase operations cost. Measuring pesticide residues in the environment is an excellent way of monitoring, and will require a residue analysis laboratory for full implementation. Any donor which supports the use of pesticides should incorporate residue analysis into their project plans, and GOBF should begin qualitative behavioral observations of non-target organisms near any pesticide target areas. Applicators must be trained to note unusual behavior among fauna of the area.

4.4 Pesticide Management

4.4.1 Pesticide Distribution and Formulation

The majority of pesticides used in Burkina Faso are imported from other countries. Points of origin include Nigeria, Cote d'Ivoire, Senegal, Europe and the United States. Once a pesticide arrives in Burkina Faso, it is distributed to the end-user through merchants and commercial operations. Import and in-country distribution is controlled by several governmental agencies, including the CPS. While a regulatory structure exists, it is not always followed by the distributors involved.

In 1989, a pesticide formulation plant (SOPHYTO) was created to support the pesticide needs of the cotton industry. This company, located in Bobo Dioulasso, imports active ingredients, and fabricates formulated products. While this company primarily serves the cotton growing industry, it will also sell pesticide to other parties.

4.4.2 Managing Pesticide Stocks

A well maintained and secure pesticide storage facility is required for a U.S. pesticide donation. With a good pesticide management system in place, both donated and purchased pesticides can be controlled and utilized as needed. A good storage area should have a fenced and covered area for the pesticides. A pesticide storage warehouse should:

- (1) be isolated from dwellings in order to avoid fire, leakage, and water contamination;
- (2) be applied with water in order to clean spills and fight fire;
- (3) be aerated to avoid toxic fume concentration;
- (4) have a current inventory of pesticide stocks;
- (5) have protection gear such as suits, boots, gloves, goggles and breathing masks;
- (6) have a first aid kit with antidotes;
- (7) be staffed with trained personnel who are familiar with measures to take in cases of 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 and grasshopper campaigns depends on availability of pesticides in the areas which need treatment. Pesticides should be placed in safe and secure storage area as close as possible to agricultural areas which will likely need treatment. In Burkina Faso, pesticide storage areas are associated with the CPS Operations Bases and Field Posts. At the CPS Operations Bases, a monthly inventory of products and materials should be made and sent to the Crop Protection Service in Ouagadougou. 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 in villages before the rainy season.

For the most part, the storage facilities in Burkina Faso are good. Most of the CPS warehouses have been constructed within the last five years. However 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 may be a result of a lack of training in the managerial aspects of pesticide storage.

In addition to management of the pesticides themselves, the CPS Field Bases must adequately manage pesticide application equipment. Due to inconsistent donor contributions, Burkina Faso 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 CPS Field Base must work to maintain what equipment it does have, and ensure that it is clean and in good working order.

4.4.3 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. Part of the labeling process is pesticide registration by host countries. Both registration and proper labeling require good solid legislation at the national level. It is important that the GOBF draft legislation on Approval and Control of Pesticides, including a legal framework that will require pesticide labeling and registration in Burkina Faso. A strong licensing and labeling program by the GOBF 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.

Pesticide labeling in Burkina Faso tends to be quite variable. In general, pesticides in the original container carry a label with adequate information for application. Some labels, though not all, contained some information on first-aid or disposal. Unfortunately, much of the CPS stocked pesticide containers have either lost what labels did exist, or were rendered illegible through handling and exposure.

While labeling must be specific to local needs and the social environment of Burkina Faso, the FAO has prepared a global set of guidelines which can assist a labeling program. In addition to enacting legislation, the GOBF should insist that donated pesticides be labeled in comprehensive language as required by donor country law, and be in French and English.

4.4.4 Obsolete Pesticides and Containers

Once the pesticide has been used, the management operation is left with an empty container. This container can be either reused or destroyed. If reused it should be only be used for the same pesticide or to store fuel. In addition, it can be flattened for use in construction. It should never, repeat never, be used to store water or food. Even though the pesticide is gone, enough is left to cause mild poisoning cases, especially in the very young or old. Further, small quantities of pesticides will make the human body more susceptible to other diseases.

While the CPS has an overall well managed pesticide stock system, most Field Bases have some storage problems, usually due to the accumulation of pesticide stocks which were not used in the prescribed season, or chemicals which have been banned and cannot be used. In many cases, containers are deteriorating, and pesticides has leaked into the environment, necessitating either repacking or disposal. The general lack of a good pesticide purchasing and distribution policy has also contributed to the buildup of unused stocks.

4.4.5 Disposal of Unwanted Pesticides

When a pesticide is no longer needed, or is degraded chemically due to heat or time, it will need to be disposed of. Several alternatives exist for disposal of old pesticides. 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 neighboring countries (such as Nigeria) may be used for disposal operations. Because of the current research in this area, and the potential for political ramifications, USAID/Burkina Faso should consult AID/W prior to any pesticide disposal assistance program.

There are numerous empty drums at most Bases, and with most needing to be disposed of. It is important to dispose of used drums immediately, as farmers will often convert pesticide containers into water barrels and food containers. The pesticide residues remaining in the drums will then contaminate the stored material.

The system of crop protection in Burkina Faso, in which all pesticides are the property of the state, should theoretically result in effective management and disposal of empty drums. All containers belong to the government and should be removed from the field when empty. The Department of Agriculture is ultimately in charge of drum disposal. However, the reality of the situation indicates that training in this area could be useful. An assessment should be conducted in order to determine the quantity of unusable outdated stocks in Burkina.

Table IV. Obsolete/Unwanted Pesticide Stocks

- Dieldrin ULV	20,000 liters
- Thioral	50 tons
- DDT	unknown quantity
- Fenitrothion	40,000 liters

5.0 REFERENCES

BIBLIOGRAPHY

- Alomenu, H.S. 1989. Provisional Report on Pesticide Management in Francophone West Africa. Food & Agriculture Organization, Accra, Ghana. 58 pp.
- Appleby, G., W. Settle and A. Showler. 1989. The Africa Emergency Locust/Grasshopper Assistance Mid-term Evaluation, Tropical Research & Development, Inc., Gainesville, Florida. 146 pp.
- Babcock, C., C. Castleton, P.W. Orr, J. Klump, N. Pyers and D. Herman. 1986. Locust Grasshopper Control Campaign Republic of Chad. A.I.D., Washington, DC. 43 pp.
- Boberschmidt, L., S. Saari, J. Sassaman and L. Skinner. 1989. Pesticide Background Statements, Volume IV, Insecticides. Agriculture Handbook No. 685, U.S. Forest Service, Washington, DC. 578 pp.
- Bottrell, D., B. Mann, P. Matteson, M. Shenk, A. Steinhauer, and P. Teng. 1991. How to Prepare Environmental Assessments of Pesticide Use in A.I.D. Projects. CICP, College Park, Maryland. 54 pp.
- Cavin, G. 1989. Trip Report - Grasshoppers in Sénégal, USAID, Bamako. 10 pp.
- de Visscher, M., J. Duranton, M. Launois and G. Garcia. 1988. Effets directs et indirects, immédiats et différés de la lutte antiacridienne sur l'environnement, démarches préliminaires. Doc. D. 308, PRIFAS, Montpellier. 32 pp.
- Dieme, S. 1981. Some insect pests on the main crops in Senegal, West Africa. MS Thesis, Oklahoma State University, Stillwater, Oklahoma, USA. 60 pp.
- DNSP. 1989. Plan de dévolution du Plan du Programme de Surveillance et de Lutte contre l'Onchocercose, la Trypanosomiase et les Maladies négligées. Direction Nationale de la Santé Publique, Bamako.
- Doumbia, Y.O., Bonzi S.M. 1989. Les insectes du mil et du sorgho au Mali, distribution et dégâts. Agronomie Tropicale (in press).
- DYNAMAC. 1988a. Results of the Mali Pesticide Testing Trial Against the Senegalese Grasshopper. Dynamac Corporation, Rockville, Maryland, USA. 111 pp + Appendices.
- DYNAMAC. 1988b. Results of the Locust Pesticide Testing Trials in Sudan. Dynamac Corporation, Rockville, Maryland, USA. 84 pp. + Appendices.
- DYNAMAC. 1988c. Progress Report on the Results of Mali-Sudan Pesticides Testing Project, AELGA. USAID Contract # AFR- 0517-C-00-7035-00. Arlington, Virginia.
- Everts, J.W., Elsen A.C., Doumbia Y.O., Koeman J.H. 1981. L'impact sur l'environnement de la région du Sahel de la lutte intégrée contre les ennemis des principales Cultures Vivrières. Rapport de mission.

- Edité par la Section de Toxicologie, Université Agronomique de Wageningen Pays Bas. FAO. 1971. Manuel sur l'Utilisation des Normes FAO pour les Produits Phytopharmaceutiques. Rome.
- FAO. 1986. Code International de conduite pour la distribution et l'utilisation des pesticides. FAO, Rome. 2E pp.
- Fischer, A., and C. Murphy. 1987. Crop loss assessment on millet Chad. Oregon State University, Corvallis. 19 pp.
- George, D. 1989. Agricultural Development in Drought Zones. PIE Report for July to October 1989. CARE, Macina. 24 pp.
- GIFAP. 1988. Directives des Pesticides sur l'Utilisation, le Stockage. 62 pp.
- Halter, Faith. 1989a. General Suggestions for Project of the Government of the Republic of Mali to Review All Laws Pertaining to the Environment. Report to USAID/Bamako. 11 pp.
- Halter, Faith. 1989b. Implementing the Law Banning Toxic Waste Imports. Comments prepared for USAID/Bamako, Mali. 6 pp.
- IAPSCCCTA. 1964. Mémoire sur les Méthodes de Protection Phytosanitaire Applicables en Afrique. Interafrican Phytosanitary Council. Publ. no. 82.
- I.U.C.N. 1989. Projet de Conservation de l'Environnement dans le Cercle de Youvarou, Mali. Union Internationale pour la Conservation de la Nature et de ses Ressources. 53 pp.
- Kane, A., B. Taal, P. Wit, J. Bellot, R. Rochette and H. Eger. 1987. Plan national de lutte contre la desertification. Republique du Tchad, Unite Travail Progres. CILSS. 117 pp.
- Keith, J.O. 1989. Environmental Effects of Insecticides used in Locust Control. Pilot Study in Senegal. Trip Report. Denver Wildlife Research Center, Denver. 7 pp.
- Jensen, J.K. 1987. Trip Report and Observations Made on Pesticide Disposal Survey Team, Sudan, Ethiopia, Kenya and Somalia. CACP, College Park, Maryland, USA.
- Jensen, J.K. 1990. Alternative methods for disposal of obsolete pesticides. USAID Pesticide Disposal Conference, Niamey, Niger. January, 1990. 13 pp.
- MASI. 1986. La lutte contre les acridiens et les oiseaux granivores au Mali. Rapport présenté à l'OFDA. 119 pp.
- MASI, Development Services Division. 1986. Locust, Grasshopper and Grain Eating Bird Control In Mali. Report presented to OFDA. 111 pages.
- Ministère de la Santé Publique et des Affaires Sociales. 1988. Direction Nationale de la Planification et de la Formation Socio-Sanitaire, Annuaire Statistique 1988.

- Morgan, D. P. 1989. Recognition and Management of Pesticide Poisonings. 4th Edition. EPA-450/9-88-001. Environmental Protection Agency, Washington, DC. 207 pp.
- Popov, G.B. 1989. Joint Nosema, Insect Growth Regulator and Insecticide Trials Project in Mali. Report of Consultant to Ciba-Geigy, FAO, and SPV. 25 pp.
- Potter, C.S., M.G. Rutanen-Whaley, H. Khoury and A. Messer. 1988. Draft Environmental Assessment of the Tunisia Locust Control Campaign. Agency for International Development, Tunis, Tunisia. 48 pp.
- Price Williams & Associates. 1987. Grasshoppers/Locusts. Looking back at 1986. Famine Early Warning System Special Report, A.I.D., Washington, DC. 26 pp.
- Shannon, M., et al. 1987. Rangeland Grasshopper Cooperative Management Program, Final Environmental Impact Statement. Animal and Plant Health Inspection Service, U.S. Department of Agriculture, Washington, DC. 251 pp + Appendices.
- Steedman, A.(ed.). 1988. Locust Handbook. 2nd edition. Overseas Development Natural Resources Institute, London, England. 180 pp.
- Strzok, P.P., E.B. Radcliff, H. Larew, R. Swanson and G. Ouedraogo. 1989. Design of a Neem Kernel Extract Project for Crop Protection in Mali. Agency to Facilitate the Growth of Rural Organizations, Minneapolis. 39 pp.
- TAMS. 1983. Les Ressources Terrestres au Mali. Vol. II. Rapport Technique. Tippetts-Abbett-McCarthy-Stratton Consultants, Inc., NY.
- TAMS. 1989. Locust and Grasshopper Control in Africa/Asia, A. Programmatic Environmental Assessment. TAMS Consultants, Inc., Arlington, Virginia, USA. 305 pp + Appendices.
- United Nations. 1983. Formulation of Pesticides in Developing Countries. United Nations, New York, USA.
- USAID. 1988. Grasshopper/Locust Workshop Report and References. Harper's Ferry, West Virginia, USA. 309 pp.
- USAID. 1989a. Locust/Grasshopper Management Guidebook. Office of Foreign Disaster Assistance, Agency for International Development, Washington, DC.
- USAID/Niger. 1989b. Implementation Plan for Government of Niger to Reduce Hazard of Surplus and Unusable Insecticides Acquired for Use in the Locust/Grasshopper Program. Agency for International Development, Washington, DC.
- WHO, O.C.P./G.V.A/85.1A Dix années de Lutte contre l'Onchocercose en Afrique de l'Ouest, 1986-87.
- World Environment Center. 1987. Pesticide Disposal in East Africa. New York, USA.

APPENDIX A - LIST OF THE DRAFTING COMMITTEE AND LIST OF PEOPLE MET

Government of Burkina Faso

Ministry of Agriculture and Livestock (CPS)

Combary, Abdoulaye: Director of Crop Protection Service

Traore, Adama: Department Chief, Crop Protection Service

Ministry of Environment and Tourism

Sawadogo, Prosper: Director of Training

Zeba, Souleymane: Director of Fauna and Flora

USAID/Burkina

Dennis McCarthy: Agricultural Development Officer

Ousseini Edos Yeye: Assistant Agricultural Program Officer

USAID/Washington

Stanley Ronald: AID/AFR/TR, Advisor in Environmental Management.

Thomas, Bill: AID/AFR/TR/ANR/NR, Entomologist

APPENDIX B - PEA FOR LOCUST/GRASSHOPPERS: SYNOPSIS OF ENVIRONMENTAL ASSESSMENT PRIORITIES

BASIC PRE-CONDITION OF PROGRAM

Recommendation 1. It is recommended that A.I.D. continue its involvement in Locust and Grasshopper control. Operationally, the approach to be adopted should evolve toward one of Integrated Pest Management (IPM).

This recommendation should be applied in the context of the specific needs of Burkina Faso. USAID/Burkina Faso supports IPM in the management of locusts and grasshoppers, as well as other insect pests.

INVENTORY AND MAPPING PROCEDURES

Recommendation 2. It is recommended that an inventory and mapping program be started to determine the extent and boundaries of environmentally fragile areas.

This recommendation can be part of future USAID/Burkina Faso involvement with assistance efforts. Maps should include specific areas to be protected, some with a total ban on pesticides for grasshopper or locust control and some with a high priority for restricted use of pesticides. Areas which may have potential for the testing of pesticide alternatives should also be included.

Recommendation 3. It is recommended that a system for dynamic inventory of pesticide chemical stocks be developed.

Because of past poor management practices in Burkina Faso, large stocks of pesticide have been allowed to accumulate and degrade. In addition, stored pesticides are not always handled carefully or tracked to insure correct use and disposal. Improvements in the system for managing pesticide stocks must be implemented to protect human health and the environment and to minimize chances of pesticide.

PRODUCTS BECOMING OBSOLETE

Recommendation 4. It is recommended that A.I.D. take an active role in assisting host countries in identifying alternate use or disposal of pesticide stocks.

A plan for managing obsolete stocks has been drafted with the support of A.I.D. Washington. This should include the periodic testing of stored pesticide stocks to insure that the material is usable. Unwanted stocks in Burkina Faso should be disposed of only with technology that best fits the local situation. High priority should be placed on minimizing the future accumulation of any unwanted pesticide.

Recommendation 5. It is recommended that FAO, as lead agency for migratory pest control, be requested to establish a system for the inventory of manpower, procedures and equipment.

This SEA supports that recommendation as an AID/W-coordinated activity, but considers it low priority as a direct USAID/Burkina Faso activity.

MITIGATION OF NON-TARGET PESTICIDE EFFECTS

Recommendation 6. It is recommended that there be no pesticide application in environmentally fragile areas and human settlements.

Any future spray operations or pesticide donations for use in Burkina Faso should be accompanied by a requirement prohibiting use in some areas and limiting use in others and requiring appropriate buffer zones. The areas of total prohibition are designated wetlands, national parks, national forests, and fragile areas. Buffer zones and other reserves should restrict pesticide use, and encourage traditional and non-chemical methods. Villages, towns, cities, or any other human settlement will not be sprayed.

Recommendation 7. It is recommended that pesticides used should be those with the minimum impact on non-target species.

Pesticide recommendations in the PEA should be followed until research results indicate that more environmentally safe pesticides are available for use. Investigation of traditional and cultural methods of control are also strongly encouraged as a USAID/Burkina Faso activity. This SEA does not contain a list of pesticides because it accepts the pesticide selection in the PEA.

Recommendation 8. It is recommended that pre- and post-treatment monitoring and sampling of sentinel organisms and water and/or soils be carried out as an integral part of each control campaign.

This recommendation should be implemented to some extent if possible, but may be difficult to fully implement in Burkina Faso, due to both the expense and a lack of supportive infrastructure. A program of research monitoring is important both as a basis for design of operational monitoring and as a means of establishing statistically verifiable base line data. In addition, periodic sampling observations of target and non-target mortality, population numbers, and behavior should be made at locations involved in pesticides use.

APPLICATION OF INSECTICIDES

Recommendation 9. It is recommended that one of the criteria to be utilized in the selection of control techniques should be the minimization of the area to be sprayed.

A number of operational procedures should be followed to minimize the area to be sprayed: (1) Emphasis should be on an early and vigorous surveillance program, thus allowing early treatment operations and reducing the amount of pesticide used; (2) Crop protection operations should utilize economic thresholds to the extent possible; (3) A program of identifying non-treatment areas and minimum treatment areas should be adopted; (4) Training of all decision-making individuals should emphasize the importance of restraint in use of pesticides; (5) Farmers and villagers should be included in training and subsequent survey and application operations.

Recommendation 10. It is recommended that helicopters should be used primarily for survey to support ground and air control units. When aerial treatment is indicated, it should only be when very accurate spraying is necessary, such as close to environmentally fragile areas or for localized treatment.

The treatment program in Burkina Faso should emphasize early season ground application. However, during rainy season treatment operations, road conditions may necessitate the use of aircraft. In addition, many areas of Burkina Faso are inaccessible except by helicopter. The AID/W (Forest Service) Aerial Application Guidelines should be followed in any such operation.

Recommendation 11. It is recommended that, 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.

This SEA supports this recommendation. However, large aircraft may be needed in Burkina Faso to spray areas far from supportive infrastructure.

Recommendation 12. It is recommended that any USG-funded locust/grasshopper control actions which provide pesticides and other commodities, or aerial or ground application services, include technical assistance and environmental assessment expertise as an integral component of the assistance package.

This SEA agrees with this recommendation. In addition, this SEA strongly supports both long- and short-term training to be integrated with USAID-provided technical assistance.

Recommendation 13. It is recommended that all pesticide containers be appropriately labeled.

This SEA agrees with the recommendation and urges the GOBF to give high priority to pesticide legislation and implementation of laws requiring a good clear label. It is suggested that the GOBF follow the FAO pesticide label guidelines.

DISPOSAL OF PESTICIDES

Recommendation 14. It is recommended that A.I.D. provide assistance to host governments in disposing of empty pesticide containers and pesticides that are obsolete or no longer usable for the purpose intended.

A.I.D. Washington is currently developing guidance on disposal programs for unwanted pesticides and empty containers. In addition, several pilot disposal projects are being implemented. USAID/Burkina Faso should follow such disposal guidance when available, and should continue to assist with proper pesticide management. Proper disposal of empty barrels is especially important.

PUBLIC HEALTH AWARENESS

Recommendation 15. A.I.D. 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 pesticides, environmental awareness, pest management techniques of locusts and grasshoppers, and the potential hazards of pesticides. The goal would be to enable policy makers and local populations to recognize and avoid potential health problems related to pesticide applications.

Collaboration between the PPS and other ministries, begun with the writing of this SEA, should continue with the development of public and applicator education on pesticide safety, pesticide poisoning recognition, avoidance, and treatment. In addition to receiving information on general pesticide awareness, the public should be made aware of the need to protect environmentally sensitive areas from pesticide misuse. Radio is an extremely effective medium in this regard, and should be utilized to its fullest.

Recommendation 16. It is recommended that training courses be designed and developed for health personnel in areas where pesticides are used frequently.

This SEA supports this recommendation and advocates inter- governmental collaboration in training programs.

Recommendation 17. It is recommended that each health center and dispensary located in an area where pesticides are used be provided with posters describing diagnosis and treatment of pesticide poisonings, as well as medicines and antidotes required for treatment of poisoning cases.

This SEA supports this recommendation, and advocates collaboration between CPS and the Ministry of Health in appropriate implementation.

Recommendation 18. It is recommended that presently available tests for monitoring human exposure to pesticides should be implemented in the field. This includes measurement of cholinesterase levels in blood as a screening and indicator test for pesticide handlers and applicators.

This SEA supports the need to monitor the health of pesticide applicators and handlers during control operations. It is especially feasible to monitor blood cholinesterase in individuals working with organophosphate pesticides. This should be implemented on a regular basis with pesticide handlers and applicators. In addition, this SEA favors behavioral monitoring for symptoms of pesticide exposure.

PESTICIDE FORMULATION AND MANAGEMENT

Recommendation 19. It is recommended that the specifications for A.I.D. purchase of locust/grasshopper insecticides be adapted for all insecticides.

This is an AID/W activity that should be implemented through a revision of A.I.D.'s Pest Management Guidelines, currently underway. No Burkina Faso-specific recommendation is included in this SEA as it is a central and regional activity.

Recommendation 20. It is recommended that pesticide container specifications be developed.

This is an AID/W activity that should be implemented through a revision of A.I.D.'s Pest Management Guidelines. A.I.D. is working with the EPA Pesticide Disposal Workgroup to achieve state-of-the-art pesticide container specifications.

BIOLOGICAL CONTROL

Recommendation 21. It is recommended that Nosema and other biological agents such as Neem be field tested under African and Asian conditions in priority countries.

AID/W is currently supporting research bio-pesticides in Africa. The need for carefully controlled studies in the area of biological control is stressed by this SEA. Other areas of research should be pursued, especially in regard to native populations of parasites, diseases and predators. USAID/Burkina Faso may wish to support training and local research in this subject area.

TRAINING

Recommendation 22. It is recommended that a comprehensive training program be developed for A.I.D. Mission personnel who have responsibility for control operations. This will involve a review of existing materials and those under development, in order to save resources.

This SEA supports that recommendation for Burkina Faso. The L/G Operations Handbook (A.I.D., 1989a) fills this need in part, as does the PEA and this SEA. Other materials include regional meetings and workshops, and short-term technical assistance.

Recommendation 23. It is recommended that local programs of training be instituted for pesticide storage management, environmental monitoring and public health (see Recommendation 16).

This SEA supports this recommendation, and recommends that the high priority be given to training on the safe and appropriate application of pesticides. Training can take the form of courses, as well having as individuals work with outside technical expertise. "Train the trainer" programs are especially effective in passing information with minimal expense.

Recommendation 24. It is recommended that when technical assistance teams are provided they be given short-term intensive technical training (including language if necessary) and some background in the use and availability of training aids.

This SEA supports that recommendation as an AID/W activity. The overall preference is to have technical assistance teams with the needed technical expertise and sufficient language fluency for the tasks to be performed.

ECONOMICS

Recommendation 25. It is recommended that field research be carried out to generate badly needed economic data on a country- by-country basis.

This SEA supports this recommendation. Implementation in Burkina Faso might consist of an agricultural productivity analysis along with an annual agricultural database program. This should include a research study on crop loss analysis.

Recommendation 26. It is recommended that no pesticide be applied unless the provisional economic threshold of locusts or grasshoppers is exceeded.

Due to the erratic nature of these insects, along with potential for social impact, a valid economic threshold will require both the long-term collection of quantitative data, and research to determine the extent to which agricultural productivity is threatened. In this light, it is important that intervention decisions, especially those involving pesticides, 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.

ENVIRONMENTAL POLICY

Recommendation 27. It is recommended that A.I.D. provide assistance to host countries in drawing up regulations on registration and management of pesticides and the drafting of environmental policy.

This SEA supports that recommendation. AID/W and EPA are developing an assistance program to assist with pesticide regulations and policies, including human safety, environmental impact, and use, storage, and disposal. Implementation should include improvement of pesticide labeling, including clear precautionary statements, specific use directions, and appropriate instructions for disposal of empty containers. In addition, policy must include an environmental monitoring program, with results used in the planning of future pesticide use operations, as well as detection of possible misuse or unexpected adverse results.

PESTICIDE USE POLICY

Recommendation 28. It is recommended that a pesticide use inventory covering all treatments in both agricultural and health programs be developed, on a country-by-country basis.

This SEA supports that recommendation, and considers this to be a topic appropriate for GOBF action. Such a pesticide inventory program, done in conjunction with good storage management, can prevent the build-up of obsolete stocks, and thereby reduce overall operations and storage costs.

PESTICIDE HANDBOOK

Recommendation 29. It is recommended the A.I.D. produce a regularly updated pesticide handbook for use by its staff.

This SEA supports that recommendation as an AID/W or REDSO activity. Among the relevant activities in this area are A.I.D. policies concerning pesticide use, efficacy and agricultural productivity, environmental impacts and health effects, and safety and mitigative measures. The Handbook should contain health, safety, and environmental assessments of pesticides that are likely to be used in Burkina Faso.

SUPPORT AND TRAINING

Recommendation 30. It is recommended that technical assistance, education and training, and equipment be provided crop protection services of host countries with a view to making the services eventually self-sustaining.

This SEA supports this recommendation, but only with a through analysis of actual needs, existing supportive infrastructure, and the ability of the PPS to manage a sustainable program.

STORAGE

Recommendation 31. It is recommended that more pesticide storage facilities be built. Until that occurs, emergency supplies should be pre-positioned in the United States.

This SEA supports this recommendation, and considers this a valid activity for Burkina Faso. Due to the inadequate storage facilities that currently exist in Burkina Faso, support is for the Pesticide Bank concept. A thorough evaluation of storage facilities should be completed prior to project assistance.

FORECASTING

Recommendation 32. It is recommended that A.I.D. make the decision whether to continue funding forecasting and remote sensing or to use FAO's early warning program.

This SEA is in favor of continuing and improving forecasting as an AID/W or FAO activity.

PUBLIC HEALTH MONITORING AND STUDY

Recommendation 33. It is recommended that a series of epidemiological case-control studies, within the countries involved in locust and grasshopper control, should be implemented in areas of heavy human exposure to pesticides.

Although this is a valid activity for Burkina Faso, a lack of supportive infrastructure would require that such a research program be accomplished with outside expertise and facilities.

RESEARCH

Recommendation 34. It is recommended that applied research be carried out on the efficacy of various pesticides and insect growth retardants and their application.

This SEA supports this recommendation, including the search for other microbial pathogens of locust and grasshopper species as a longer term priority.

Recommendation 35. It is recommended that applied research be carried out on the use of Neem as an antifeedant.

Neem may be one of the most promising new bio-pesticides, and thus deserves additional field research. As additional funds are available, the most promising options should be pursued. If Neem extract shows promise, research efforts should continue.

Recommendation 36. It is recommended that research be carried out to determine the best techniques for assessing the impacts of organophosphates used for locust and grasshopper control in relation to the use of these and other chemicals for other pest control programs.

This SEA considers such comparative impact research an appropriate AID/W activity. A major international research effort has been launched in Senegal on the ecotoxicological effects of locust insecticides.

ENHANCING AND ACCELERATING IMPLEMENTATION

Recommendation 37. It is recommended that A.I.D., on the basis of the previous recommendations, develop a plan of action with practical procedures to provide guidance in locust/grasshopper control to missions in the field.

This SEA supports this recommendation. AID/W has a general plan of action that includes the development of Supplementary Environmental Assessments in the countries that are most critical for locust and grasshopper control. These countries include Burkina Faso, Burkina Faso, Chad, Mali, Mauritania, Niger, Senegal, and Sudan. These Supplementary EAs will, in turn, contain commitments for future actions. Country-specific plans of action will be developed to implement those commitments when needed. Such a plan for Burkina Faso has been developed by the PPS. The country-specific plans of action will be the backbone for guidance of locust/grasshopper control activities.

Recommendation 38. It is recommended that detailed guidelines be developed for A.I.D. to promote common approaches to locust and grasshopper control and safe pesticide use among UN Agencies and donor nations. Coordination of efforts is becoming increasingly important because of the increasing number and magnitude of multilateral agreements and follow up efforts in subsequent years by various donors.

This SEA supports this recommendation. Coordination must occur both at the AID/W level and the OAR/Burkina Faso level. In Burkina Faso, the PPS is the major coordinating body, but donors also discuss specific plans with each other. These efforts should be improved for the future.

In order to carry out the proposed recommendations cited above, significant additional AID/W regional funding allocations would be required by OAR/Burkina.

APPENDIX C - RELEVANT DOCUMENTATION

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.

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 and grasshopper control on the environment. (D. 308) T. 3. PRIFAS - Dec. 1988.
- (e) Locust and Grasshopper 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 and grasshopper 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 and grasshopper 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, DC 20460 USA

APPENDIX D - PROHIBITED PESTICIDES IN BURKINA FASO

- 1 - Acetate of Dinosebe
- 2 - Dichloro - Diphenyl - Trichloro ethan (DDT)
- 3 - Dichloro - Diphenyl Dichloro ethan (DDD or TDE)
- 4 - Diquat
- 5 - Captafol
- 6 - Chloramphenicol
- 7 - Cyhexatine
- 8 - Dinosebe
- 9 - Alachlore
- 10 - Bromo - methyl-benzen (DBBT)
- 11 - Di-u-oxo-di-n-buty estanniohydroxyborane (BBB)
- 12 - Hexachloro-cyclohexane (HCH and its sulphurated derivations less gamma isomere or lindane)
- 13 - Hexachloro-hexahydro-diendromethylen-naphtalen (Dieldrin and Endrin)
- 14 - Hexachlorophen
- 15 - Chloral Hydrate
- 16 - Heptachloro-methano-tetrahydro-indane (Heptachlor)
- 17 - Octachloro-methani-tetrahydro-indane (Chlordane)
- 18 - Paraquat
- 19 - Toxaphen and Polychlorocamphans
- 20 - Trichloro-acetate of Sodium (TCA)
- 21 - Ugilec 121 : Chloro (dichlorophenyl) methyl benzen
- 22 - Ugilec 141 : Dichloro (dichlorophenyl) methyl mehyl-benzen.

APPENDIX E - LAWS AND REGULATIONS OF BURKINA FASO CONCERNING PESTICIDES

**AGENCY FOR INTERNATIONAL DEVELOPMENT
BUREAU FOR AFRICA**

**Office of Analysis, Research and Technical Services/
Office of Operations and New Initiatives
AFR/ARTS-ONI**

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

FINAL ACTION FORM

COUNTRY: BURKINA FASO

DATE: August 1990

ACTION TAKEN:

Approved: Date 8/1/90

Disapproval: Date _____

Bureau Environmental Officer: J. G. G. G.

K:\DATA\NR\SEA\ACTIONFO.BRK