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Grasshopper Integrated Pest Management User Handbook

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Foreword

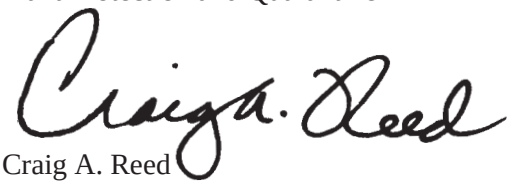
The U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) has the congressional mandate to control grasshoppers on Federal rangeland. Grasshopper infestations blanketed millions of acres of U.S. rangeland in the mid-1980's, and APHIS treated much of this land with insecticides. This demonstrated reliance on chemical control, the cyclical nature of grasshopper outbreaks, and the need to develop environmentally responsible control methods prompted the Department to look for additional control measures. Integrated pest management (IPM) was chosen as the preferred method, and in 1987 Congress provided funds for a large-scale pilot project. IPM demonstration areas in Idaho and North Dakota were chosen as representative of major western ecosystems in which grasshopper outbreaks often occur.

APHIS directed a coalition of Federal agencies that participated in the Grasshopper Integrated Pest Management Project. These agencies included USDA's Agricultural Research Service, Economic Research Service, Forest Service, and Extension Service (now known as the Cooperative State Research, Education, and Extension Service); the U.S. Department of the Interior's Bureau of Land Management, U.S. Fish and Wildlife Service, and National Park Service; and the U.S. Environmental Protection Agency's Office of Pesticide Programs. In addition, State departments of agriculture, land-grant colleges, grazing associations, and private industry joined the effort to develop new strategies for grasshopper IPM.

This Grasshopper Integrated Pest Management User Handbook summarizes the efforts of the many scientists involved in the 8-year project. As an IPM compendium, the Handbook incorporates a variety of disciplines stretching from ecology to entomology and from economics to range management. The looseleaf, three-ring binder allows a reader to lift out a section or chapter of interest. The design also allows the insertion of new information as it becomes available. Various chapters within the Handbook can be used as "standalones" to support technology transfer directly to end users, such as Federal land managers, ranchers, extension agents, and university and State department of agriculture personnel.

This Handbook will serve as an up-to-date resource for implementation of new grasshopper integrated pest management technologies before the next inevitable grasshopper epidemic.

Richard L. Dunkle
Deputy Administrator for
Plant Protection and Quarantine



Craig A. Reed
APHIS Administrator

Acknowledgments

We gratefully acknowledge the help of all scientists and managers who wrote Handbook chapters. The authors constitute only a fraction of the total workforce engaged in the preparation of this Handbook. Sincere appreciation, therefore, is also extended to those unnamed individuals who assisted the authors as technicians, clerical and administrative support personnel, students, and aides. Special recognition is also due for the leaders of each of the seven Handbook sections. Without their leadership and time-management skills, this publication would not have become a reality.

The GHIPM Management Team, who also served as the editorial board for the Handbook, deserves special recognition. Their insight and constructive criticism helped ensure that the information is appropriately written for the intended users. Editorial board members included Bob Brittingham, Nelson Foster, Keith Winks, Gary Cunningham, and Helene Wright, of USDA's Animal and Plant Health Inspection Service (APHIS); and Jerome Onsager, of the Department's Agricultural Research Service.

APHIS' Legislative and Public Affairs unit at headquarters provided editorial oversight (Janet Wintermute), layout oversight (Mary Ann Hines), and printing (Anita McGrady) services.

The Project is indebted to the U.S. Department of the Interior's Bureau of Land Management, Idaho State Office, for providing the space for office staff as well as allowing Project personnel to become a part of their organizational "family."

We believe the Grasshopper Integrated Pest Management User Handbook will be useful to scientists, land managers, and government policymakers for years to come. Late in 1999, as work on the final two sections of the Handbook was wrapping up, USDA's Agricultural Research Service (ARS) announced plans to make a CD-Rom disk containing the entire Handbook plus several other Project-related documents. This all-you-ever-wanted-to-know-about-grasshoppers disk will be available free to the public in 2000. All recipients of the hard copy of this Handbook will receive a letter explaining how to request a copy of the CD-Rom as well. We are especially proud, here at APHIS, that ARS appreciates the value of the investigations done under the GHIPM umbrella and wants to help us transfer this technology in perpetuity in the highly portable and cost-effective CD format.

Gary L. Cunningham and
Mike W. Sampson,
Technical Coordinators

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Introduction

During the last major outbreak of grasshoppers in the mid-1980's on Western United States' rangelands, Federal and State governments saw the need to develop new and better ways of grasshopper management. From that need, Congress created the Grasshopper Integrated Pest Management Project. (APHIS file photo.)

Introduction

Gary L. Cunningham, Director (1990–94)
Grasshopper Integrated Pest Management Project

Historical Background

In the 1930's, grasshopper infestations covered millions of acres of federally and privately controlled land in 17 Western States. Failed attempts at local control efforts proved that grasshopper outbreaks could be dealt with only on a regional scale. As a result, in 1934 Congress charged the U.S. Department of Agriculture (USDA) with controlling grasshoppers on Federal rangeland. This responsibility is part of the duties of the USDA's Animal and Plant Health Inspection Service (APHIS).

APHIS provided direct supervision and leadership for large-scale grasshopper management programs. Cooperators included other Federal agencies, State departments of agriculture, and private ranchers. The agency's activities complied with National Environmental Policy Act requirements and were authorized by the Incipient and Emergency Control of Pests Act (1937), the Organic Act of the Department of Agriculture (1944), the Cooperation With State Agencies in the Administration and Enforcement of Certain Laws Act (1962), and the Food Security Act (1985). Management strategies are presented in the "1987 Rangeland Grasshopper Cooperative Management Program: Final Environmental Impact Statement."

Cooperative control programs for rangeland grasshoppers are undertaken almost every year in affected parts of the Great Plains and Intermountain West. These programs were most visible in the mid-1980's. In 1985, there were 55 million acres of western rangelands heavily infested with grasshoppers, and APHIS treated 14 million acres with chemicals. Liquid insecticides were aerially applied to blocks of 10,000 acres or more. The chemicals used were chosen for their minimal or negligible impact on the environment. However, treatments of this magnitude did raise concern about the possible effects of insecticides on nontarget organisms, the environment, and the ecosystem.

Grasshopper Integrated Pest Management

In response to the grasshopper epidemic of the mid-1980's, USDA, APHIS, specified in a programmatic environmental impact statement (EIS) that integrated pest management (IPM) be the preferred approach for cooperative programs to control grasshoppers on rangeland. IPM is defined as the coordinated use of pest and environmental information along with available pest control methods (including cultural, biological, genetic, and chemical) to prevent unacceptable levels of pest damage by the most economical means and with the least possible hazard to people, property, and the environment. This approach is often sustainable and complements USDA initiatives in range management, water quality, and food safety. When available, IPM is preferred by Federal and State agencies that manage public lands.

In 1987, APHIS initiated the Grasshopper Integrated Pest Management (GHIPM) Project to develop and demonstrate new IPM technologies and to provide the results to managers of public and private rangelands. The overall purpose of the Project was to develop tools that would help in predicting outbreaks and to develop a combination of preventive tactics that would reduce reliance upon chemical insecticides for control.

The Project's stated objectives were to

- Refine an existing grasshopper phenology (growth and development) model to maximize the efficiency of management activities;
- Demonstrate that early sampling can detect and help classify developing infestations that could be responsive to management with tactics alternative to chemical controls;
- Develop economic thresholds and prescribe treatments to reduce infestations to noneconomic levels with minimal effects on nontarget species;
- Quantify current-season and long-term grasshopper population changes after each different control tactic in order to support a model of population dynamics;
- Develop new biological control methods for grasshopper management, including grasshopper viruses, fungal pathogens, and parasites;

- Provide coordinated research on economics, range management, and ecology as components of a systems approach to grasshopper management; and

- Integrate pertinent data into an expert system that can be used by APHIS and the private sector upon completion of the Project.

Two 1-million-acre demonstration sites were chosen as representative grassland ecosystems. One was in northwestern North Dakota, partially within the USDA, Forest Service's Little Missouri National Grassland, with other large areas managed by the McKenzie County Grazing Association. The second, in south-central Idaho, was managed by the U.S. Department of the Interior, Bureau of Land Management's Shoshone District. Lack of high grasshopper populations in Idaho since 1988 made the Shoshone District site less suitable than the North Dakota site for demonstrating new IPM control technologies.

A major component of the GHIPM Project (1987–94) was a comprehensive research and development program. The Project's technical work group, comprised of representatives from nine Federal agencies, provided oversight for research funding. Under USDA cooperative agreements, more than 50 scientists from Federal and State research institutions were involved in developing new IPM technologies during the life of the Project. Disciplines included agricultural engineering, entomology, plant pathology, ecology, range management, agricultural economics, hydrology, plant physiology, computer science, and wildlife management.

GHIPM User Handbook

This Handbook consolidates extensive information developed over the 8 years of the Project on IPM for grasshoppers. The Handbook is written for anyone who needs practical information, and the intended audience includes Federal and State land managers; USDA, APHIS, Plant Protection and Quarantine (PPQ) officials; State department of agriculture personnel; extension agents working for USDA's Cooperative State Research, Education, and Extension Service at the county level; IPM specialists and researchers; and farmers and ranchers. The Handbook supplements, but does not replace, the APHIS, PPQ, Grasshopper Program Manual (the document that governs PPQ employees in their operational work on grasshopper problems). The Handbook's three-ring binder permits future additions and revisions so it can be kept up to date as a reference tool. The contents are written in a nonscientific format from the perspective of putting new research findings into practical use.

Handbook Format

Seven sections of the GHIPM User Handbook organize and identify the major components developed during the project.

Section I, Biological Control, provides an overview of grasshopper biological control agents and discusses their potential as management tools. Included are protozoa, fungi, bacteria, viruses, insect predators and parasites, mites, nematodes, birds, and wildlife.

Section II, Chemical Control, identifies available chemical insecticides, application methods, and rationale for selecting certain insecticides for grasshopper control. It also discusses new techniques and equipment designed to reduce pesticide load in the environment while retaining cost effectiveness.

Section III, Environmental Monitoring and Evaluation, examines the effects of grasshopper treatments on nontarget organisms and the environment. The section also includes techniques for monitoring and reducing environmental effects of grasshopper treatment programs.

Section IV, Modeling and Population Dynamics, provides an overview of computerized modeling of grasshopper populations and the dynamics associated with grasshopper population development, survival, and buildup. Modeling allows land managers to make more accurate predictions of future outbreaks, based on data bases of past grasshopper populations.

Section V, Rangeland Management, explains how various range-management techniques can affect grasshopper populations and why grazing systems are a factor in grasshopper management. The section includes specific examples for Idaho and for portions of the upper Great Plains.

Section VI, Decision Support Tools, describes and provides "hands-on" management and grasshopper identification tools, including the Hopper decision support software, an expert system that helps in making management decisions. Economic considerations and survey sampling procedures also are discussed. Hopper Helper is a grasshopper identification key included in the Handbook. A much more comprehensive work, Robert Pfadt's "Field Guide to Common Western Grasshoppers," was developed during the GHIPM Project. Section VI includes an example of the guide's contents, which are individual species factsheets. (Recipients of the printed version of this Handbook have also been sent two separate mailouts of Dr. Pfadt's factsheets, which cover some 75 grasshopper species of economic importance.)

Section VII, Future Directions, presents an overview of key trends in and components of grasshopper IPM that need further study and development. These trends and components include new materials for chemical and biological control, environmental studies, the possible effects of grasshopper treatment programs on recreational activities, discussions of grasshopper population and habitat manipulation, and the important role geographic information systems will play in the future.

Within each section, individual chapters have their own bibliographies so readers can seek out more detailed information on the science behind the GHIPM Project's recommendations.

Updating the Handbook

Recipients of the original Handbook will be kept on a mailing list so APHIS can send them new or revised grasshopper materials in the future. New or replacement pages will be punched and labeled, ready for insertion into specified sections in the Handbook.

How To Obtain Copies

Single free copies of the Grasshopper IPM User Handbook may be obtained from USDA, APHIS, PPQ, Operational Support Staff, 4700 River Road, Riverdale, MD 20737. You may request a copy by telephone as well (301–734–8247).

References Cited

U.S. Department of Agriculture, Animal and Plant Health Inspection Service. 1987. Rangeland Grasshopper Cooperative Management Program: final environmental impact statement. Washington, DC: U.S. Department of Agriculture, Animal and Plant Health Inspection Service. 221 p.

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